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New-Indy Catawba LLC P.O. Box 7 5300 Cureton Ferry Road Catawba, SC 29704 T 803-981-8000 New-indycb.com

March 23, 2023

Ms. Katharine Buckner South Carolina Department of Health and Environmental Control Bureau of Air Quality - Air Permitting Division 2600 Bull Street Columbia, South Carolina 29201

#### Re: New-Indy Catawba LLC Consent Order to Correct Undesirable Levels of Air Contaminants Construction Permit Application

Ms. Buckner,

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill) and currently operates under Title V Operating Permit No. TV-2440-0005 (Title V Operating Permit or TV-2440-0005).

New-Indy Catawba has prepared this construction permit application as required by the South Carolina Department of Health and Environmental Control (SCDHEC) Consent Order to Correct Undesirable Levels of Air Contaminants, signed November 23, 2022 (Consent Order).

The attached document represents the construction permit application for this Project (Application). Appendix A of the application contains the required completed SCDHEC construction permit application forms. Appendix B of the application provides Project-related emissions calculations and supporting information. The Project-related emissions information has been refined since the previous submittal of the draft calculations on March 15, 2023. Comments received from SCDHEC regarding the Project-related emissions submitted on March 15 will be addressed by March 31, 2023. Appendix C of the application includes a description of air dispersion modeling performed for SCDHEC toxic air pollutants. The supporting air dispersion modeling files will be made available to the SCDHEC Air Modeling Section in electronic format.

If you have any additional questions regarding the attached construction permit application, please contact Bob Tourville at (803) 981 – 8009 or by e-mail at bob.tourville@new-indycb.com.

Sincerely,

Charles Cleveland Technical Manager

attachment

cc: Sheryl Watkins, P.E. - ALL4 Steven Moore - ALL4 Environmental File 200-air-205-air\_permits



# New Condensate Stripper

# **CONSTRUCTION PERMIT APPLICATION**

# NEW-INDY CATAWBA LLC – CATAWBA, SC MILL

MARCH 2023

Submitted by:



New-Indy Catawba LLC – Catawba, SC Mill 5300 Cureton Ferry Road Catawba, SC 29704



Submitted to:

SC Department of Health and Environmental Control Bureau of Air Quality – Division of Air Permitting 2600 Bull Street Columbia, SC 29201



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### 1. INTRODUCTION AND APPLICATION OVERVIEW

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill or the Mill) and currently operates under Title V Operating Permit No. TV-2440-005 (TVOP or TV-2440-0005), effective on July 1, 2019.

New-Indy Catawba has prepared this construction permit application as required by the Consent Order to Correct Undesirable Levels of Air Contaminants ("Consent Order"), issued on November 23, 2022, by the South Carolina Department of Health and Environmental Control (SCDHEC)<sup>1</sup>. For compliance with the provisions of the Consent Order, New-Indy Catawba is proposing a modification to their current foul condensate treatment system (condensate treatment system) to install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper [existing steam stripper (ID 9801)] strictly to backup operation during periods of downtime experienced by the new steam stripper (Project). The Project also includes the installation of a stripper feed tank, methanol storage tank, and hot water tank to serve the new steam stripper. The stripper feed tank and methanol storage tank will be controlled in the LVHC system. The hot water tank is not expected to be a source of emissions. The Project will also satisfy the requirements of Item I.a. of Appendix A of Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (EPA Consent Decree). This document represents the construction permit application for this Project (Application).

<sup>&</sup>lt;sup>1</sup> The November 23, 2022, Consent Order amends and replaces the Order to Correct Undesirable Level of Air Contaminants issued by SCDHEC on May 7, 2021.

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### 2. PROCESS AND PROJECT DESCRIPTION

New-Indy Catawba is comprised of seven distinct process areas that include the following: the woodyard area, the kraft pulp mill area, the paper mill area, the chemical recovery area, the utilities area, the waste treatment area, and a miscellaneous area. A simplified process flow diagram for these process areas is included as Figure 2-1. A description of the process areas is presented below, with more detail provided in the areas that are impacted by the Project.

Southern pine logs and chips are received at the woodyard. Logs are debarked, chipped, and the chips are screened prior to storage for use within the pulping process. Likewise, purchased wood chips received are screened, and processed as needed, prior to use within the pulping processes.

The kraft (sulfate) process area is used to produce pulp. Pulp from the kraft process is produced from "cooking" wood chips in the continuous digester in a caustic solution at an elevated temperature and pressure. The pulp slurry from the continuous digester is sent to the blow tank, then to one of two parallel pulping lines, each consisting of an enclosed deshive refiner and a three-stage drum displacement washer system and associated filtrate tanks. Weak black liquor from the washer filtrate tanks is stored before being recycled to chemical recovery. Rejects from the refiners are sent to the screw presses, with the filtrate being screened and stored before being recycled to chemical recovery. Washed pulp is stored and then sent to the paper mill area. With the exception of the pulp storage tanks after pulp washing, the kraft pulp mill sources are currently collected and routed to the high volume low concentration (HVLC) or low volume, high concentration (LVHC) systems, and emissions are controlled through combustion in the Nos. 1 or 2 Combination Boilers.

Linerboard (the outside layer of a corrugated container) is produced in the paper mill area on one state-of-the-art paper machine. Unbleached market pulp is produced on one pulp dryer. A second paper machine at the Mill is currently idled.

Weak black liquor is concentrated in the Nos. 1-3 Evaporator Sets and is then fired in the recovery furnaces (chemical recovery area) that burn the organics extracted from the chips and recover cooking chemicals. The causticizing area utilizes the chemicals recovered by the recovery furnaces, and after adding lime, provides the cooking chemicals for the kraft process.

Emissions from the Evaporator Sets and Turpentine Recovery System are collected in the LVHC gas collection system and combusted in the Nos. 1 or 2 Combination Boilers. Several weak black liquor tanks are collected in the HVLC system and combusted in the Nos. 1 or 2 Combination Boilers. Evaporator condensates are segregated, with the combined condensates being recycled to the Brownstock washer system or sewered. The foul condensates are treated in a dual control device configuration: foul condensates are preferentially treated in the existing



condensate steam stripper system, with the remaining flow being directed to the aerated stabilization basin (ASB) via the Hardpipe (ID 9802).

Steam and electricity are produced for facility-wide use by two combination boilers. The recovery furnaces also generate steam.

A waste treatment area receives wastewater and mill waste (solid waste) from the various previously mentioned areas of the facility. Wastewater undergoes biological treatment to remove the dissolved organic wastes prior to discharge into the receiving stream. Mill solid waste is deposited in an on-site landfill.

The miscellaneous areas include everything that is not captured in one of the aforementioned process operating areas, such as facility roads and the pulp storage tanks.





#### Figure 2-1 Simplified Mill Flow Diagram



This document represents the construction permit application for this Project in accordance with the DHEC Consent Order. The Project consists of the following new equipment and proposed changes to the existing treatment scenarios:

- 1. Construct and operate a new low-pressure steam foul condensate stripper system that will process the pulping process condensates (foul condensate) for compliance with 40 CFR Part 63, Subpart S. The resultant stripped methanol will be condensed into a liquid [called stripper rectified liquid (SRL)] and combusted in the Nos. 2 and 3 Recovery Furnaces (ID Nos. 2505 and 5105). The methanol will be added to the black liquor at a maximum amount of 1% by volume. This methanol addition limit is required for safely operating the recovery furnaces. There are no anticipated changes in black liquor firing as a result of the project. The LVHC gases from the SRL condenser system, stripper feed tank, and SRL methanol tank will be combusted in the No. 3 Recovery Furnace. The LVHC system will include a 1.0 mmBtu/hr natural gas ignitor for combustion of the LVHC gases when black liquor firing is less than 50% of capacity. The existing Nos. 1 and 2 Combination Boilers (ID Nos. 2605 and 3705) will serve as back-up control for the new Stripper's LVHC gases when the SRL condenser system is not in operation. Stripped condensates will be recycled to the Brownstock washers (ID 5230), as needed;
- 2. Operate the existing steam stripper (ID 9801) as a backup to the new low-pressure steam stripper. The existing steam stripper will be operated to process the foul condensate and remove 98% of the total reduced sulfur (TRS) compounds; although with reduced methanol removal efficiency. Further methanol treatment through biological destruction will be accomplished by routing the stripped condensates to the existing Hardpipe system that discharges the foul condensates below the liquid surface of the existing ASB; and
- 3. Modify the No. 3 Recovery Furnace to combust gases collected in the LVHC system. The Nos. 1 and 2 Combination Boilers will serve as backup control for the LVHC gases following the Project. When these LVHC gases are combusted in the combination boilers, a caustic scrubber will be operated to provide 50% removal of the sulfur prior to combustion.

Figure 2-2 presents a simplified process flow with the possible operating scenarios for treatment of the foul condensates and the associated control scenarios for the new and existing steam stripper vent gases. Section 3.2.2.3 presents the prevention of significant deterioration (PSD) analysis that details the basis for the projected actual emissions (PAE) calculations for the proposed future operating scenarios.





#### **Figure 2-2 Stripper Operating Scenarios**



### 3. **REGULATORY REVIEW**

This section summarizes Federal and State air quality regulations that potentially apply to the Project. Discussions pertaining to applicable regulatory requirements are separated into three categories:

- Federal Air Quality Regulations
- South Carolina Air Quality Regulations
- Provisions of the SCDHEC Consent Order and EPA Consent Decree

#### 3.1 FEDERAL AIR QUALITY REGULATIONS

For the purpose of this Application, potentially applicable Federal regulations consist of:

- Standards of Performance for New Stationary Sources (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- New Source Review (NSR) and PSD
- Compliance Assurance Monitoring (CAM)
- Requirements for Preparation, Adoption, and Submittal of Implementation Plans
- Title V Operating Permits

A discussion of each specific Federal air quality regulation is provided in the following subsections.

#### 3.1.1 Standards of Performance for New Stationary Sources

U.S. EPA has promulgated NSPS at 40 CFR Part 60. NSPS requirements are promulgated under 40 CFR 60 pursuant to Section 111 of the Clean Air Act.

# 3.1.1.1 40 CFR Part 60, Subparts BB and BBa – Standards of Performance for Kraft Pulp Mills

40 CFR Part 60, Subpart BB – Standards of Performance for Kraft Pulp Mills applies to TRS emissions from digesters, brownstock washers, multiple-effect evaporators, recovery furnaces, smelt dissolving tanks, lime kilns, and condensate strippers that commenced construction, reconstruction, or modification after September 24, 1976, and on or before May 23, 2013. Subpart BBa applies to the same sources that commence construction, reconstruction, or modification after May 23, 2013.



The existing condensate stripper system and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators are currently subject to 40 CFR 60, Subpart BB for TRS (Standards of Performance for Kraft Pulp Mills). Compliance with the TRS standard at 60.283a(a)(1) is currently demonstrated by combusting the stripper off-gases and evaporator vent gases in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii) [combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds]. As there are no physical modifications to the existing condensate stripper and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators, the Mill will continue to combust the existing stripper off-gases in the Nos. 1 and 2 Combination Boilers; however, following the Project, the vent gases from the Nos. 1-3 Multi-effect Evaporator Sets with Concentrators will be combusted in the No. 3 Recovery Furnace per §60.283(a)(1)(ii) [gases are combusted in a recovery furnace subject to §60.283(a)(2)] or in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii).

Upon completion of the Project, the new condensate stripper system will be subject to 40 CFR Part 60, Subpart BBa for TRS (Standards of Performance for Kraft Pulp Mill Affected Sources for Which Construction, Reconstruction, or Modification Commenced After May 23, 2013). Compliance with the TRS standard at 60.283a(a)(1) will be demonstrated through collection of the stripper off-gases (SOG) in the existing SOG collection system and SRL gases in the existing low volume high concentration (LVHC) closed-vent collection system meeting the requirements of §63.450. The SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The LVHC collection system gases will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(ii) or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). Emissions from the stripper feed tank will also be collected in the LVHC collection system. The Mill will continuously monitor the incineration of SOG and LVHC gases in the No. 3 recovery furnace, each combination boiler, and venting of the SOG and LVHC closed-vent systems as required by §60.284a(d)(3)(iii) and currently utilized for monitoring compliance with Subpart BB.

New-Indy Catawba will maintain records of excess emissions and malfunctions for the new stripper as required by §60.287a(b)(7) and (c), respectively. The Mill will report periods of excess emissions and malfunctions as required by §60.288a(a) and (d), respectively. As defined in §60.284a(e)(1)(vi), periods of excess emissions from the LVHC closed-vent system (condensate stripper system) that are less than one percent (1%) of operating time during a semi-annual period are not a violation of §60.283a(a)(1)(iii).

The stripper feed tank, methanol tank, hot water tank, Hardpipe, and ASB are not included in the definition of condensate stripper system under §60.281 or §60.281a and are not affected sources under Subparts BB or BBa.



3.1.1.2 40 CFR Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

The Project includes a new stripper feed tank, new methanol tank, and a new hot water tank. 40 CFR Part 60, Subpart Kb includes standards of performance for new storage tanks. However, per 60.111b, the definition of storage tank does not include process tanks (tanks that collect material from one part of a process before sending it to another part of the process). Therefore, the new tanks are not subject to Subpart Kb.

#### 3.1.2 National Emission Standards for Hazardous Air Pollutants

NESHAP found in 40 CFR Part 61 apply to specific compounds emitted from certain listed processes. 40 CFR Part 61 subparts do not apply to the Mill, and there are no Part 61 subparts that apply to the proposed Project. Applicability of Part 63 NESHAP is discussed below.

# 3.1.2.1 40 CFR Part 63, Subpart S – National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry

New-Indy Catawba is subject to 40 CFR Part 63, Subpart S, also referred to as Maximum Achievable Control Technology (MACT) I for the pulp and paper industry. This standard regulates hazardous air pollutant (HAP) emissions from pulping and bleaching systems. The affected source under this standard is the total of all HAP emission points in the pulping and bleaching systems. The Mill does not produce bleached pulp and is therefore not subject to the requirements of §63.445.

The Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine Recovery System were constructed prior to 1993 and are existing affected sources, while the existing condensate stripper was constructed after 1993, making it a new source under 40 CFR Part 63, Subpart S. Compliance is currently demonstrated by collecting the gases in the existing LVHC closed-vent system meeting the requirements of 63.450 and combustion of the SOG and LVHC system gases in the Nos. 1 and 2 Combination Boilers per 63.443(d)(4)(i) (introduce the HAP emission stream with the primary fuel or into the flame zone). The Mill currently complies with the pulping condensates collection requirements in 63.446(c)(1) [collect all named pulping process condensate streams listed in 40 CFR § 63.446(b)(1-5)] and the treatment requirements in 63.446(c)(4) [treat a minimum of 6.6 lb HAP per ton oven dried ton of pulp (ODTP)]. The Mill has utilized concurrent use of the existing steam stripper and Hardpipe for compliance with 863.446(c)(4).



Subpart S requires collection of LVHC gases from steam stripper systems, defined to include the stripper column, associated feed tanks, condensers, and any methanol rectification process. The new condensate stripper, stripper feed tank, methanol condenser, and methanol tank will be subject to this rule upon startup.

Following the completion of the proposed Project, SOG from the existing condensate stripper and vent gases from the existing Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine system will continue to be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and §63.453(k)(1-6). The existing SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). However, the vent gases from the LVHC collection system will be combusted in the No. 3 Recovery Furnace or in the Nos. 1 and 2 Combination Boilers (as backup) per §63.443(d)(4)(i). The Mill will update the leak detection and repair (LDAR) site inspection plan as appropriate per §63.454(b).

The Mill plans to demonstrate compliance with the pulping condensates collection requirements in §63.446(c)(3) [collect the pulping process condensates from equipment systems listed in §63.446(b)(1) through (b)(5) that in total contain 7.2 lb HAP/ODTP] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill will utilize the new condensate stripper for compliance with §63.446(e)(4) and will operate a continuous monitoring system for the parameters in §63.453(g)(1-3). Vents from the new condensate stripper (including the stripper feed tank, SRL condenser, and SRL methanol tank) will be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and combusted in the No. 3 Recovery Furnace or Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). The Mill will update the LDAR site inspection plan as appropriate per §63.454(b) and will perform the required inspection and monitoring requirements per §63.453(k)(1-6). The new stripper will be included in semi-annual excess emission reports under §63.455. Per §63.446(g), periods of excess emissions reported under §63.455 are not considered a violation of §63.446(e)(4) provided that the time of excess emissions divided by the total process operating time in a semi-annual reporting period does not exceed 10 percent.

At the request of SCDHEC, the Mill is providing additional information regarding plans to demonstrate continuous compliance with the pulping condensate collection and treatment in the new steam stripper. These are as follows:

- Pulping condensate collection emissions limit of 7.2 lb HAP/ODTP:
  - HAP will be measured "as methanol" per 63.457(f)(2);
  - Daily sampling of foul condensates for methanol concentration representative of the inlet to the new stripper;



- Continuous measurement of new steam stripper inlet foul condensate feed flow (gpm);
- Daily measurement of pulp production (ODTP); and
- Daily calculation of a 15-day rolling average collection (lbs methanol/ODTP) [Note: The Mill may use historical and/or collect future foul condensate sampling data to support a longer averaging period].
- Pulping condensate treatment in the new steam stripper to remove 6.6 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2); and
  - Daily sampling of stripped condensates for methanol concentration representative of the outlet of the new stripper.
  - Continuous measurement of:
    - New steam stripper inlet foul condensate feed flow (gpm);
    - New steam stripper steam feed flow (lbs/hr);
    - Foul condensate to new steam stripper feed temperature (°F); and
    - New steam stripper stripped condensate flow (gpm).
  - Daily measurement of pulp production (ODTP).
  - o Daily calculation of the percent methanol removed in the steam stripper .
  - Daily calculation of the treatment in the new steam stripper [15-day (or other averaging period, as justified) rolling average methanol collected (lbs methanol/ODTP) multiplied by the calculated daily methanol percent removal in the new stripper].

Please note that the Mill may choose to establish a methanol concentration factor in lieu of daily methanol sampling at the inlet to the new steam stripper once sufficient data has been collected demonstrating consistency in the foul condensate methanol concentration. In addition, the Mill may choose to establish an effective steam to feed ratio (ESFR) curve for the new stripper system to be used to establish the methanol removal efficiency across the stripper in lieu of the method described above. The compliance approach will be delineated in the Notification of Compliance Status (NOCS) that will be submitted with the results of the initial compliance demonstration to be conducted within 180 days of startup of the new stripper system.

#### 3.1.2.2 40 CFR Part 63, Subpart MM National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills

New-Indy Catawba is subject to 40 CFR Part 63, Subpart MM, also referred to as MACT II for the pulp and paper industry. This standard regulates particulate matter (PM) emissions from existing recovery boilers, smelt tanks, and lime kilns when processing black liquor or calcium oxide. The Nos. 2 and 3 Recovery Furnaces are currently subject to the existing source requirements of this regulation. The proposed Project will modify the LVHC collection system



that delivers the LVHC gases to the No. 3 Recovery Furnace for combustion, but no changes in black liquor firing are expected for the recovery furnaces and PM emissions from black liquor combustion are not expected to increase. The Mill will continue to meet the existing PM emission limits under Subpart MM after completion of the Project.

# 3.1.2.3 40 CFR Part 63, Subpart EEEE – National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (non-Gasoline)

Subpart EEEE applies to organic liquids distribution (OLD) operations at major sources of HAP. The Project includes installation of a new methanol tank and a new hot water tank. However, these new tanks are not subject to this rule because they are part of the Mill's pulping system as defined under Subpart S. EPA confirmed that tanks in pulp and paper mills that are part of the pulping or bleaching systems are not subject to Subpart EEEE in a December 2004 determination (ADI Control Number M050008).

# 3.1.2.4 40 CFR Part 63, Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.

New-Indy Catawba is subject to 40 CFR Part 63, Subpart DDDDD, also referred to as Boiler MACT. Boiler MACT sets forth emissions limits and work practice standards; testing and fuel analyses requirements; and monitoring, recordkeeping, notification, and reporting requirements that apply to boilers and process heaters located at major sources of HAP. The Nos. 1 and 2 Combination Boilers are subject to the requirements of 40 CFR Part 63, Subpart DDDDD. The Nos. 2 and 3 Recovery Furnaces are not subject to the rule per §63.7491(b). The Project will not affect the regulatory applicability of 40 CFR Part 63, Subpart DDDDD, for either combination boiler and will not affect compliance with the applicable emissions limits. The Mill will continue to comply with the currently applicable provisions of 40 CFR Part 63, Subpart DDDDD, in the same manner after completion of the Project.

#### 3.1.3 New Source Review

The Mill is located in York County which is classified as in attainment of or unclassifiable for the National Ambient Air Quality Standards (NAAQS) for regulated NSR pollutants. Therefore, Nonattainment New Source Review (NNSR) regulations do not apply to this Project and the Project is analyzed for applicability as it relates to the PSD requirements. Implementation of the PSD regulations (i.e., 40 CFR §51.166) has been delegated in full to the State of South Carolina. Refer to Section 3.2.2.3 for a discussion of PSD applicability.



#### 3.1.4 Compliance Assurance Monitoring

U.S. EPA developed the CAM rule at 40 CFR Part 64 as a means for providing reasonable assurance that continuous compliance with applicable requirements is achieved for certain emissions units located at major stationary sources subject to Title V permitting. CAM applies to pollutant-specific emissions units (PSEUs) that (1) are subject to an emissions limit or standard (2) use a control device to achieve compliance with that emissions limit or standard, and (3) have potential pre-control device emissions in the amount required to classify the unit as a major source under Part 70 of the Clean Air Act (CAA). Part 64 does not apply to emissions limitations or standards proposed after November 15, 1990 pursuant to Section 111 or 112 of the Clean Air Act (e.g., post-1990 NSPS or NESHAP). The proposed Project is not subject to CAM requirements because the new steam stripper is subject to 40 CFR Part 60, Subpart BBa and 40 CFR Part 63, Subpart S, which are standards proposed after November 15, 1990.

# 3.1.5 Requirements for Preparation, Adoption, and Submittal of Implementation Plans

U.S. EPA requires air agencies to develop and submit air quality data characterizing maximum 1-hour ambient concentrations of sulfur dioxide (SO<sub>2</sub>) through ambient air quality monitoring or air quality modeling analysis at the air agency's election. These requirements are promulgated under 40 CFR Part 51.

# 3.1.5.1 40 CFR Part 51, Subpart BB—Data Requirements for Characterizing Air Quality for the Primary SO<sub>2</sub> NAAQS (SO<sub>2</sub> Data Requirements Rule or SO<sub>2</sub> DRR)

The Mill submitted facility-wide air dispersion modeling in November 2016 to comply with 40 CFR 51.1203(d). The Mill updated the facility-wide air dispersion modeling in October 2021. The actual SO<sub>2</sub> emissions following the Project are expected to remain below the SO<sub>2</sub> emission rates included in the modeling analysis submitted in 2016 and 2021. The Mill will continue to perform and annual review of the actual SO<sub>2</sub> emission rates against the 2016 and 2021 model emission rates to determine if an updated modeling demonstration is necessary.

#### 3.1.6 Title V Operating Permits

New-Indy Catawba operates under TVOP TV-2440-0005 issued on May 7, 2019, with an effective date of July 1, 2019, and an expiration date of December 31, 2023. Through this Application, New-Indy Catawba is requesting a construction permit to perform the Project. Construction permit application forms required by SCDHEC are included in Appendix A. New-Indy Catawba will request a modification to the TVOP within 15 days of startup of the Project, which is required by the Consent Order to be no later than June 30, 2025.

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#### 3.2 SOUTH CAROLINA AIR QUALITY REGULATIONS

This section addresses the applicability of state air regulatory requirements to the Project.

#### 3.2.1 Regulation 61-62.1: Section II, Permit Requirements

This regulation specifies the construction and operating permit requirements for new or modified sources. This permit application is intended to satisfy the construction permitting requirements of Regulation 62.1 Section II. Completed SCDHEC construction permit application forms are included in Appendix A.

#### 3.2.2 Regulation 61-62.5: Air Pollution Control Standards

The list below identifies potentially applicable SC air pollution control regulations and standards associated with the Project.

- Standard No. 2 Ambient Air Quality Standards
- Standard No. 3 Waste Combustion and Reduction
- Standard No. 4 Emissions from Process Industries
- Standard No. 7 Prevention of Significant Deterioration
- Standard No. 8 Toxic Air Pollutants

#### 3.2.2.1 Standard No. 2 – Ambient Air Quality Standards

SCDHEC Standard No. 2 addresses the National Ambient Air Quality Standards (NAAQS). Except for an ambient air quality standard for gaseous fluorides, the SCHDEC ambient air quality standards are equivalent to the Federal NAAQS. New-Indy Catawba has previously submitted facility-wide air dispersion modeling evaluations to demonstrate compliance with Standard No. 2.

The Project may slightly increase the actual emissions of  $SO_2$ , nitrogen oxides (NO<sub>X</sub>), and carbon monoxide (CO) from the No. 3 Recovery Furnace when burning LVHC gases. However, the maximum  $SO_2$  and  $NO_X$  emissions from the No.3 Recovery Furnace when burning LVHC gases will be less than 10 percent of the emissions from burning the LVHC gases in the Nos. 1 and 2 Combination Boilers. The maximum  $SO_2$  and  $NO_X$  emissions from LVHC combustion in the combination boilers are not expected to change as a result of the project. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers.



The emissions of SO<sub>2</sub>, NO<sub>X</sub>, CO, particulate matter (PM), PM less than 10 microns (PM<sub>10</sub>), and PM less than 2.5 microns (PM<sub>2.5</sub>) from the LVHC System natural gas ignitor in the No. 3 Recovery Furnace are well below the 1.14 pounds per hour modeling exemption threshold in the South Carolina Modeling Guidelines<sup>2</sup>, Section 2.2.3. Therefore, the very small emissions increases from the LVHC natural gas ignitor have not been modeled for this permit application.

The additional steam potentially required from the combination boilers to operate the new condensate stripper will not exceed the current steaming capacity of each combination boiler, as reflected in the SO<sub>2</sub>, NO<sub>x</sub>, CO, PM, PM<sub>10</sub>, PM<sub>2.5</sub> and CO emissions rates modeled previously. Therefore, no updates to the modeled emissions rates from the combination boilers are required for this permit application.

The SO<sub>2</sub> emissions from the Project will decrease by more than 100 tons per year. The reduction in SO<sub>2</sub> emissions meets the single factor emissions netting option 2 in the South Carolina Other Information Guidance<sup>3</sup>. The modeled SO<sub>2</sub> Emissions Rate from black liquor combustion in the 2016 and 2021 SO<sub>2</sub> DRR modeling is 18.70 lb/hr from the No. 3 Recovery Furnace. The maximum SO<sub>2</sub> emissions rate from burning black liquor in the 2018 Title V renewal application is 5.95 pounds per hour. The additional SO<sub>2</sub> emissions from LVHC gases and methanol combustion is 7.4 pounds per hour, making the new total SO<sub>2</sub> emissions rate from black liquor combustion. Therefore, no updates to the SO<sub>2</sub> modeling submitted previously in 2016 and 2021 have been prepared for this permit application.

The NO<sub>X</sub> emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The NO<sub>X</sub> emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The modeled NO<sub>X</sub> Emissions Rate for Ambient Air Standards in the current Title V permit is 146.03 lb/hr from the No. 3 Recovery Furnace. The maximum NO<sub>X</sub> emissions rate from burning black liquor in the 2018 Title V renewal application is 122.4 pounds per hour. The additional NO<sub>X</sub> emissions from LVHC gases and methanol combustion is 2.3 pounds per hour, making the new total NO<sub>X</sub> emissions rate.

<sup>&</sup>lt;sup>2</sup> South Carolina Modeling Guidelines for Air Quality Permits (Revised April 15, 2019).

<sup>&</sup>lt;sup>3</sup> Guidance Concerning Other Information Used for Permitting Requirements in Demonstrating Emissions Do Not Interfere With Attainment or Maintenance of any State of Federal Standard (Updated December 12, 2018).



Therefore, no updates to the NO<sub>X</sub> modeling submitted previously have been prepared for this permit application.

The CO emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The CO emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers. The modeled CO Emissions Rate for Ambient Air Standards in the current Title V permit is 330.96 lb/hr from the No. 3 Recovery Furnace. The maximum CO emissions rate from burning black liquor in the 2018 Title V renewal application is 102.9 pounds per hour. The additional CO emissions from LVHC gases and methanol combustion is 8.3 pounds per hour, making the new total CO emissions rate. Therefore, no updates to the CO modeling submitted previously have been prepared for this permit application.

Therefore, no updates to the previous Standard No. 2 modeling demonstration are required.

#### 3.2.2.1 Standard No. 3 – Waste Combustion and Reduction

Standard No. 3 applies to any source that burns any waste other than virgin fuels for any purpose. The standard contains various exemptions for the pulp and paper source category. Section I.J.1 specifies that recovery furnaces burning black liquor and TRS compounds are not subject to the standard. Section I.J.1 also specifies that gaseous process streams containing TRS compounds that are regulated in accordance with Section XI of Regulation 61-62.5, Standard No. 4, or NSPS are not subject to Standard No. 3. Because the SOG and LVHC collection system gases containing TRS that are regulated in accordance with Standard No. 4 or NSPS Subpart BB/BBa, combustion of those gases in combination boilers or recovery furnaces is not subject to Standard No. 3.

Standard No. 3 specifically states that any "facility with an emission unit and/or control device that complies with all the requirements of an applicable Maximum Achievable Control Technology (MACT) Standard under 40 CFR 63, including the testing and reporting requirements, may request an exemption from this standard." (61 -62.5, Section 1.J.3.)

During development of the Pulp and Paper MACT regulations at 40 CFR 63, Subpart S, U.S. EPA reviewed the practice of combusting methanol condensed from stripper-off-gases. The U.S. EPA determined that the methanol condensate "does not appear to contain metal or chlorinated organic HAP's ..." (61 Fed. Reg. 9397) (emphasis added). The U.S. EPA also found that burning methanol condensate "will not increase the potential environmental risk over the burning of the



steam stripper vent gases prior to condensation." U.S. EPA reaffirmed this conclusion in 2011 during its Residual Risk and Technology Review (RTR) of the Pulp and Paper (Subpart S) MACT. In the final RTR rule, U.S. EPA stated: "We conclude based on the Residual Risk Assessment cited here that the risks from the subpart S pulp and papermaking source category are acceptable and that the current standard protects the public health with an ample margin of safety. Consequently, we are re-adopting the MACT standards for subpart S pursuant to our 112(f)(2) review." (77 Fed. Reg. 55705)

Therefore, the combustion of black liquor and condensed methanol from stripper-off-gases in the recovery furnaces mill qualifies for the exemption from Standard No. 3 provided in Section 1.J.3.

#### 3.2.2.2 Standard No. 4 – Emissions from Process Industries

SCDHEC Regulation 61-62.5, Standard No. 4 establishes standards for opacity and certain other pollutants for specific sources in specific industries and establishes PM and opacity standards for industrial processes not otherwise regulated. The new steam stripper and the new tanks do not cause visible emissions into the atmosphere; therefore, this standard does not apply.

Section XI regulates emissions of TRS from Kraft Pulp Mills where construction or modification commenced prior to September 24, 1976 from recovery furnaces, digester systems, multiple-effect evaporator systems, lime kilns, and condensate stripper systems. The No. 2 Recovery Furnace is currently subject to Standard 4 and will continue to comply with the TRS limits after completion of the Project. The TRS emissions from the No. 3 Recovery Furnace, Nos. 1-3 Evaporator Sets with Concentrators, and the existing steam stripper are subject to 40 CFR Part 60, Subpart BB. The TRS emissions from the new condensate stripper will be subject to 40 CFR Part 60, Subpart BBa.

#### 3.2.2.3 Standard No. 7 – Prevention of Significant Deterioration – Permit Requirements

PSD requirements apply to major stationary sources of regulated NSR pollutants that are located in areas that are in attainment with the NAAQS or unclassifiable. Implementation of the PSD regulations has been delegated in full to the State of South Carolina. These air quality regulations are contained in SCDHEC Regulation 61-62.5, Standard No. 7. The PSD regulations apply to major modifications at major stationary sources, which are considered those sources belonging to any one of the 28 source categories listed in the regulations that have the potential to emit (PTE) 100 tons per year (tpy) or more of an NSR-regulated pollutant, or any other source that has the PTE 250 tpy or more of an NSR-regulated pollutant. The Mill is considered a major stationary source because it emits or has the PTE 100 tpy or more of a regulated NSR pollutant.



Because it includes physical changes to the Mill, the installation of the new steam stripper is a "project" as defined in Standard No. 7(b)(40).

New-Indy Catawba has assessed the applicability of PSD to this Project by performing the hybrid test as prescribed under U.S. EPA's PSD rules (as adopted by South Carolina) at 40 CFR 52.21(a)(2)(iv)(f), described as the hybrid test for projects that involve multiple types of emissions units. The future emissions from the backup steam stripper system, existing foul condensate Hardpipe, existing ASB, existing evaporator and turpentine recovery system LVHC gases, and steam required for the existing steam stripper system are calculated as PAE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41). The future emissions from the new steam stripper are PTE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(37).

The PSD applicability analysis has been completed for the applicable NSR regulated air pollutants, including SO<sub>2</sub>, NO<sub>x</sub>, CO, volatile organic compounds (VOC), TRS, H<sub>2</sub>S, PM, PM<sub>10</sub>, PM PM<sub>2.5</sub>, lead (Pb), sulfuric acid mist, and carbon dioxide as CO<sub>2</sub>e (CO<sub>2</sub>e). There are no increases in emissions of fluorides from the Project. Emissions calculations used for determining PSD applicability are included in Appendix B.

At this time, New-Indy Catawba has not excluded emissions the mill was capable of accommodating during the baseline period or excluded demand growth from the projected actual emissions as allowed under SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41)(b)(iii). New-Indy Catawba may decide to utilize these two exclusions from PAE during this or future permitting if desirable.

#### 3.2.2.3.1 Baseline Actual Emissions

Baseline actual emissions (BAE) from an existing source are defined by Standard No. 7, paragraph (B)(4)(b) as:

"the average rate, in tpy, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the Department for a permit required under this section or under a plan approved by the Administrator, whichever is earlier, except that the 10-year period shall not include any period earlier than November 15, 1990."

BAE for all existing sources and pollutants are based on the 24-month period following conversion of the mill to manufacturing unbleached paper grades starting in March 2021 and extending through February 2023. For simplicity, baseline annual production rates are assumed



to occur over 8,760 operating hours. The BAE for the existing steam stripper (aka future backup stripper) off gases (and the required steam) are adjusted using the actual operating days to reflect that the stripper did not return to service until May 3, 2021.

#### Sulfur Dioxide

The baseline actual  $SO_2$  emissions from burning the SOG from the existing steam stripper and LVHC collection system gases are based on the average emissions factors developed from the most recent (October 2021) source testing for  $SO_2$ . The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia  $SO_2$  emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Nitrogen Oxides and Carbon Monoxide

The baseline actual NO<sub>X</sub> and CO emissions from burning the SOG from the existing steam stripper are based on the post-Project Columbia NO<sub>X</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The baseline actual VOC emissions from the existing condensate stripper system are based on the actual amount of methanol stripped from the foul condensate during the baseline period for which records are available. The non-methanol VOC emissions (including the TRS compounds that are also VOC as further described in the next section) from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the U.S. EPA WATER9 Model. To calculate methanol emissions from the ASB, New-Indy Catawba used a spreadsheet version of the WATER9 calculations from the National Council for Air and Stream Improvement (NCASI) to calculate the fractions biodegraded and emitted developed from Procedure 5 (Multiple Zone Concentration Measurements) in 40 CFR Part 63, Appendix C, Form XIII ("NCASI Form XIII calculation spreadsheet"). The WATER9 Model and Form XIII calculation utilize site-specific liquid concentration data, the site-specific configuration of the treatment unit [including the area or length of unit, liquid depth, wind speed, aeration type (i.e., mechanical aeration)], and the total amount of aeration to calculate the emissions rate in grams per second (g/s).

Baseline actual methanol emissions from the ASB are based on the NCASI Form XIII calculations for NESHAP Subpart S performance testing conducted during the baseline period. The baseline actual VOC emissions from the LVHC collection system are based on the post-Project Columbia



VOC emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

The baseline hydrogen sulfide (H<sub>2</sub>S) and total reduced sulfur (TRS) emissions from burning the SOG from the existing steam stripper and the LVHC collection system gases are based on the average emissions factors developed from the June 2021 source testing for H<sub>2</sub>S and TRS. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia H<sub>2</sub>S and TRS emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

The baseline actual H<sub>2</sub>S emissions from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the NCASI Hydrogen Sulfide Emissions Simulator, or "H2SSIM" Model, which utilizes site-specific wastewater configuration, site-specific liquid test results for H<sub>2</sub>S, and site-specific data inputs [e.g., temperature, dissolved oxygen (DO), pH]. H2SSIM inputs are based on May and July 2022 sampling data for H<sub>2</sub>S in the foul condensate, as well as dissolved oxygen (DO) data for the ASB taken during NESHAP Subpart S performance testing during the baseline period. The baseline emissions for methyl mercaptan (MMC), dimethyl disulfide (DMDS), and dimethyl sulfide (DMS) are calculated using WATER9 based on May and July 2022 sampling of the foul condensate. During the May and July 2022 testing, foul condensate sample results were representative of the concentrations before chemical oxidant was added. The Mill has been chemically oxidizing the contents of the Hardpipe prior to entry into the ASB since June 2021. For calculating BAE of H<sub>2</sub>S and TRS emissions from the ASB, the May and July 2022 foul condensate samples were adjusted as follows to account for the effects of the chemical oxidant:

- $H_2S$  concentrations in the Hardpipe effluent were reduced by 99%.
- DMS concentrations in the Hardpipe effluent were reduced by 90%.
- MMC concentrations in the Hardpipe effluent were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed to not be reduced by chemical oxidant. DMDS concentrations in the Hardpipe effluent were increased to account for the oxidation of MMC to DMDS.

These adjustments are based on NCASI Technical Bulletin No. 949, Section 5.3.1 for Hydrogen Peroxide and additional bench scale study results and curves provided by NCASI. Pertinent pages from NCASI Technical Bulletin No. 949 and the bench scale study are attached as supporting information in Appendix B.



#### Steam Baseline

The BAE of products of combustion (NO<sub>X</sub>, CO, VOC, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, Lead, and CO<sub>2</sub>e) for the steam required by the existing steam stripper are based on the actual heat input from fossil fuels to both combination boilers during the baseline period. New-Indy Catawba operates the two recovery furnaces as base-loaded steam generators with the combination boilers handling most swings in steam load. New-Indy Catawba burns all the biomass available in the combination boilers because biomass is the most cost-effective fuel on an MMBtu basis. Additional steam is generated from burning natural gas and No. 6 fuel oil as needed. During the baseline period, natural gas accounted for 97.9% of the fossil fuel heat input to both combination boilers, with No. 6 fuel oil constituting the remaining 2.1% of the fossil fuel heat input.

#### 3.2.2.3.2 Projected Actual Emissions and Potential to Emit

PAE is defined by the SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41) as:

"the maximum annual rate, in tpy, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the five (5) years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the ten (10) years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source."

As described previously, PAE are calculated from the existing steam stripper, existing foul condensate Hardpipe, existing ASB, existing LVHC collection system gases, and steam required for the existing steam stripper.

PTE is defined by the SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(37) as:

"the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable."

The future emissions from the new steam stripper system and the generation of steam to operate the new steam stripper system are PTE.



PAE and PTE were calculated for three different stripper operating scenarios as shown below in Table 3-1. The new stripper is expected to be online at least 90% of the annual operating time. The backup steam stripper is expected to be online 8% of the annual operating time. There will also be brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds in the condensates will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are expected to be equal to or less than 2% of the annual operating time.

The PAE and PTE for all scenarios are based on the design foul condensate sulfur loading [168 parts per million by weight (ppmw)] and maximum design foul condensate flow [850 gallons per minute (gpm)]. Emissions factors [on a pound per air-dried ton of pulp (lb/ADTP) basis] are calculated based on 2,444 ADTP/day, which is at the lower range of production for which the maximum design foul condensate flow is expected. The design foul condensate sulfur loading is based on liquid samples taken during the June 2021 site-specific testing. The sulfur concentration of 168 ppmw at the design foul condensate flow is equivalent to 0.70 pound of TRS as sulfur per ADTP. PAE are calculated for each of the three stripper operating scenarios based on 8,760 hours per year and a maximum pulp production of 2,700 ADTP/day.

The following sections provide further detail and different operating configurations within particular scenarios.

#### New Steam Stripper Online Scenario

While the new steam stripper is operating, the stripped condensate from the new steam stripper will be recycled to the brownstock washers, as needed.

The new stripper has two operating configurations, with and without the rectified methanol system operating. The rectified methanol system will separate methanol from the new stripper's offgases. The rectified methanol is referred to as SRL. As stated previously, the new steam stripper is expected to be online at least 90% of the annual operating time. The rectified methanol system is expected to be online 95% of the time that the new stripper is operating. A summary of the different operating control configurations for when the new stripper is operating is summarized in Table 3-2 below.



#### **Table 3-1** Stripper Operating Scenarios

	Stripper Scenario Operating Time			
Stripper Operating Scenario	%	hrs		
New Stripper Online	90%	7,884.0		
Backup Stripper Online	8%	700.8		
No Stripper Online (Foul Condensate to Hard Pipe)	2%	175.2		

#### Table 3-2 New Stripper System Operating Scenarios

Stripper Operating	Stripper Scenario Operating Time		Operating	Oper	rating ation Time		Controls Operating Time	
Scenario	%	hrs	Configuration	%	hrs	Controls	%	hrs
			SRL Online	95%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8
New Stripper Opling	0.0%	7 994 0	SRL Online	95%	7,489.8	SRL LVHC to RF3	75.0%	5,617.4
New Stripper Unline	50%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2	25.0%	1,872.5
			SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2



The SRL methanol is expected to contain approximately 40% of the TRS, with the remaining 60% in the LVHC off-gases from the rectified methanol system. The SRL methanol will be blended with black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. The sodium fume inside the recovery furnace absorbs the sulfur from combustion of the black liquor and will also absorb the sulfur from combustion of the solution of the salt fume based on information provided in NCASI Technical Bulletin No. 604. This is expected to occur 100% of the time the rectified methanol system is operating (SRL mode).

When operating in SRL mode, the LVHC off-gases from the rectified methanol system will be vented into the LVHC System. In addition, the LVHC gases from the evaporators and turpentine recovery system will be vented to the No. 3 Recovery Furnace as part of this project. The No. 3 Recovery Furnace is expected to be available for LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive these gases, the LVHC will be combusted in the combination boilers the remaining 25% of the time. The LVHC gases will pass through the LVHC caustic scrubber prior to being combusted in the combination boilers. The LVHC scrubber removes approximately 50% of the sulfur from the gas stream. The LVHC gas scrubber is not necessary and will not be used when the LVHC gases are being combusted in the No. 3 Recovery Furnace because the salt fume in the recovery furnace provides the expected sulfur control.

#### Sulfur Dioxide, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

As previously stated, the SRL methanol is expected to contain approximately 40% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP. The sodium fume inside the recovery furnace absorbs the sulfur produced from combusting black liquor and will also absorb the sulfur produced by combusting the foul condensate present in the methanol. It is conservatively assumed that 99% of the sulfur from combusting the SRL methanol is absorbed by the sodium fume (NCASI Technical Bulletin 604), and the remaining 1% is oxidized to SO<sub>2</sub>. This is expected to occur 100% of the time in SRL mode.

To calculate TRS and  $H_2S$  emissions from burning the SRL methanol in the recovery furnaces, a sulfur capture of 99% is applied with a 99% conversion factor to SO<sub>2</sub>, for a combined capture and conversion factor of 99.9%.

Similarly, the LVHC gases from the rectified methanol system are expected to contain approximately 60% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP and will be vented into the LVHC System. When the LVHC is combusted in the No. 3 Recovery Furnace, the sodium fume inside the recovery furnace is also expected to absorb 99% of the sulfur from the LVHC gases before it can be converted to SO<sub>2</sub>. When the LVHC is combusted in the combination boilers, the LVHC scrubber will capture 50% of the sulfur before conversion to SO<sub>2</sub>. H<sub>2</sub>S and



TRS emissions from the rectified methanol system LVHC are calculated based on conservatively assuming 99.9% capture or conversion to  $SO_2$  in the recovery furnace and 99% conversion to  $SO_2$  in the combination boilers.

When the rectified methanol system is not operating, SOG from the new stripper will be vented to the combination boilers, and the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP is assumed to be 100% converted to  $SO_2$  to calculate  $SO_2$  emissions. H<sub>2</sub>S and TRS emissions from combusting SOGs in the combination boilers are based on conservatively assuming a 99% conversion to  $SO_2$ .

When the new stripper is operating, regardless of SRL status, there will be no foul or stripped condensate flow to the Hardpipe. Projected emissions of TRS compounds (excluding  $H_2S$ ) from the ASB are calculated based on the WATER9 Model. Projected emissions of  $H_2S$  from the ASB are calculated based on the H2SSIM Model. Both WATER9 and H2SSIM emissions calculations are based on the average ASB influent concentrations from data collected during the 2021 and 2022 TRS testing efforts.

#### Nitrogen Oxides

When the rectified methanol system is operating, the methanol condenser is expected to condense more than 90% of the methanol in the SOG. The SOG also contains ammonia, which is also expected to be condensed with the methanol. The remaining ammonia will be vented with the SRL off-gases into the LVHC system. As a result, there will be an increase in ammonia when (1) SRL methanol is mixed with liquor and burned in the recovery furnaces and (2) the SRL LVHC off-gases are combusted in the No. 3 Recovery Furnace.

The ammonia in the methanol is expected to contribute less than 1% of the total nitrogen in the black liquor. The NO<sub>X</sub> emissions from the recovery furnaces have been conservatively assumed to increase 1% when burning SRL methanol and the SRL LVHC.

The NO<sub>X</sub> emissions from combustion of the SRL LVHC and SOG in the combination boilers are based on the post-Project Columbia NO<sub>X</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Carbon Monoxide

In SRL mode, the SRL methanol will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. There is



no information to suggest the CO emissions will change when the SRL methanol is burned in the recovery furnaces.

The CO emissions from combustion of the SRL LVHC and SOG are based on the post-Project Columbia CO emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the new steam stripper system are based on the theoretical maximum methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day).

In SRL mode, the SRL methanol will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. The SRL methanol will be combusted in the recovery furnace to an expected 99.9% VOC destruction in the liquid phase.

When the new stripper is operating, there will be no foul or stripped condensate flow to the Hardpipe. Non-methanol VOC emissions (acetaldehyde, methyl ethyl ketone, propionaldehyde, and TRS VOCs) from the ASB are calculated based on WATER9, using the average ASB influent concentrations from data collected during 2021 and 2022 TRS and NESHAP Subpart S testing efforts. Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests.

#### **Backup Stripper Online Scenario**

As stated previously, once the new stripper is installed, the existing stripper will be demoted to the backup steam stripper role. The backup steam stripper is expected to be online 8% of the annual operating time. The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. In TRS mode, the backup stripper will also remove approximately 45% of the methanol from the foul condensate. The SOG from the backup steam stripper will be vented to the combination boilers. The stripped condensate from the backup steam stripper will be discharged to the Hardpipe where the remaining unstripped methanol will be biologically treated in the ASB.

#### Sulfur Dioxide

The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate.  $SO_2$  emissions from combustion of the backup stripper SOG in the combination



boilers are conservatively calculated assuming all of the 0.70 lb S/ADTP of sulfur present in the foul condensate will be captured in the SOG and converted to  $SO_2$  during combustion.

#### Nitrogen Oxides and Carbon Monoxide

The NO<sub>X</sub> and CO emissions from combustion of SOG are based on the post-Project Columbia NO<sub>X</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the backup stripper are based on the maximum expected methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day). To calculate VOC emissions from backup stripper SOG combustion, it is conservatively assumed that the methanol present in the foul condensate will be captured with the SOG and combusted with 98% control at the combination boilers.

Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the stripped condensate from the backup stripper is based on the theoretical maximum methanol collection (16 lb/ODTP) in the foul condensate and an expected 45% removal efficiency from the backup stripper operating in "TRS mode."

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline. Emissions of TRS compounds that are also VOC are calculated using WATER9 with the design foul condensate loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode" before entering the ASB.

#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

To calculate TRS and  $H_2S$  emissions from backup stripper SOG combustion, it is conservatively assumed that the design foul condensate sulfur loading will be captured with the SOG and only 99% will be converted to SO<sub>2</sub> at the combination boilers.

Projected emissions of TRS compounds (excluding  $H_2S$ ) from the ASB are based on WATER9. Projected emissions of  $H_2S$  from the ASB are calculated based on H2SSIM. Both WATER9 and H2SSIM emissions are based on the average ASB influent concentrations from data collected during 2021 and 2022 TRS testing and the design foul condensate sulfur loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode."



#### No Stripper Online Scenario

The post-Project emissions also account for brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are expected to be less than 2% of the annual operating time.

When there is no SOG being created by either stripper, there are no emissions of SO<sub>2</sub>, NOx, or CO corresponding to the brief periods when all foul condensate is treated in the ASB.

#### Volatile Organic Compounds, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

Methanol emissions from the ASB are based on NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the foul condensate is based on the maximum methanol collection (16 lb/ODTP).

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline.

Emissions of TRS compounds are calculated using WATER9 and H2SSIM ( $H_2S$ ) with the design foul condensate sulfur loadings of TRS compounds being adjusted based on NCASI Technical Bulletin No. 949 to account for the effects of the chemical oxidant, consistent with how baseline actual emissions are calculated.

- H<sub>2</sub>S concentrations in the Hardpipe were reduced by 99%.
- DMS concentrations in the Hardpipe were reduced by 90%.
- MMC concentrations in the Hardpipe were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed not reduced by chemical oxidant. DMDS concentrations of the Hardpipe were increased to account for the MMC oxidized into DMDS.



#### PAE and PTE Independent from Stripper Operating Scenario

#### LVHC Collection System

As stated previously, the No. 3 Recovery Furnace is expected to provide LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive the LVHC gases, the LVHC gases will then be combusted in the combination boilers the remaining 25% of the time. The emissions from combusting LVHC gases are unaffected by the stripper operating scenario. PAE of SO<sub>2</sub>, H<sub>2</sub>S, and TRS are based on 2021 stack testing. The VOC PAE from the LVHC collection system are based on the post-project Columbia VOC emissions factors presented Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### No. 3 Recovery Furnace LVHC Ignitor

The No. 3 Recovery Furnace will also have a 1 MMBtu/hr natural gas-fired LVHC ignitor to be used when the black liquor load is less than 50%. The natural gas ignitor is expected to be required no more than 15% of the time the No. 3 Recovery Furnace is in operation. PAE of products of combustion from the ignitor are based on AP-42 emissions factors.

#### Steam for New Stripper and Backup Stripper

The steam requirements for the new stripper and the backup stripper were provided by the vendor and adjusted for the thermal efficiency of the combination boilers firing natural gas and No. 6 fuel oil. The projected fossil fuel usage reflects the highest No. 6 fuel oil usage occurring during the previous 10 years. The highest fuel oil usage was during calendar year 2014 and accounted for 18.4% of the fossil fuel heat input. The PAE and PTE of products of combustion are based on AP-42 emissions factors.

#### 3.2.2.3.3 PSD Non-Applicability

The changes in emissions from the Mill as a result of the Project were compared to the significant emission rates in Standard No. 7, paragraph (B)(49). Based on the emissions calculations described above, presented in Appendix B, and summarized in Table 3-3, the Project is not subject to the PSD permitting requirements in paragraphs (J) through (R) of Standard No. 7.



Pollutant <sup>(A)</sup>	PM	PM10	PM25	NOX	SO2	со	H2504	TRS	VOC	Pb	H <sub>2</sub> S	Total COze
Baseline Actual Emissions	1.26	1,16	1.09	132	770	27.1	1.28	13.4	249	1.24E-04	3.77	13,904
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.2	9.28	7.36	16.1	-141.35	37.1	1.15	2.18	-1.4	1.95E-03	1.92	34,725
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

3-24

Table 3-3 Summary of PSD Applicability for the Project (tpy)

A - HF is not emitted from new, modified, or affected emissions units.


# 3.2.2.4 Standard No. 7 – Prevention of Significant Deterioration – Air Dispersion Modeling Requirements

Standard No. 7 also includes PSD air quality increments that apply to all increases and decreases in PSD pollutant emissions following the PSD minor source baseline date. In York County the minor source baseline dates are December 1, 1981, for PM10 and March 3, 2017 for PM2.5. This Application does not trigger PSD review as discussed above; therefore, the project is unlikely to interfere with attainment or maintenance of State or Federal ambient air quality standards.

## 3.2.2.5 Standard No. 8 – Toxic Air Pollutants

SCDHEC Standard No. 8 regulates emissions of air toxics from new and existing sources. The Standard does not apply to fuel burning sources that burn only virgin fuel or specification used oil. Section I.D(1) of Standard No. 8 exempts sources subject to a Federal NESHAP. The Mill is subject to the Federal NESHAP for the pulp and paper source category (Subparts S and MM), industrial boilers (Subpart DDDDD), and reciprocating internal combustion engines (Subpart ZZZZ). Section I.D(2) of Standard No. 8 exempts non-NESHAP sources after a facility-wide residual risk analysis is completed. U.S. EPA published the results of facility-wide residual risk analyses for Subpart S sources on December 27, 2011, and for Subpart MM sources on December 30, 2017. The residual risk analyses completed by U.S. EPA concluded that there was no unacceptable risk from pulp and paper mills. Therefore, all emissions sources of HAP at New-Indy Catawba are exempt from Standard No. 8 under sections I.D(1) and/or I.D(2).

New-Indy Catawba emits two South Carolina toxic air pollutants (TAP) that are not listed HAP,  $H_2S$  and methyl mercaptan. Both compounds are generated by the Kraft pulping process and are components of TRS gases that are contained in LVHC and HVLC gases and in the pulping process condensates. Section I.D(3) allows sources to request an exemption for non-HAPs controlled by MACT controls to reduce HAP. This Project will improve emissions of  $H_2S$  and MMC from the Mill. However, because SCDHEC recently modeled emissions of  $H_2S$  and MMC and to demonstrate that emissions from these two TAPs following the Project remain below the maximum allowable ambient concentrations (MAAC) in Standard No. 8, the Mill has included an updated modeling demonstration in Appendix C.

The updated modeling analysis for TRS (as  $H_2S$ ),  $H_2S$  and MMC in Appendix C focused on the changes to the emissions from the aerated stabilization basin. The TRS,  $H_2S$  and MMC emissions from the No. 3 Recovery furnace were not updated due to the insignificant maximum modeled concentrations from the No. 3 Recovery Furnace when compared to the overall maximum modeled concentrations for the Mill. The TRS (as  $H_2S$ ) maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled for the No. 3 Recovery Furnace were approximately 0.08% of the maximum modeled for the



concentrations from the Mill, and the TRS (as  $H_2S$ ) maximum concentrations from the No. 3 Recovery Furnace were approximately 0.04% of the maximum mill concentrations.

# 3.2.3 Regulation 61-62.60: South Carolina Designated Facility Plan and New Source Performance Standard

Regulation 61-62.60 incorporates the 40 CFR Part 60 Subparts by reference. Refer to Section 3.1.1 for a discussion of 40 CFR Part 60.

# 3.2.4 Regulation 61-62.61 and 61-62.62: National Emission Standards for Hazardous Air Pollutants

Regulation 61-62.61 incorporates the 40 CFR Part 61 Subparts by reference. Refer to Section 3.1.2 for a discussion of the non-applicability of 40 CFR Part 61. Regulation 61-62.63 incorporates the 40 CFR Part 63 Subparts by reference. Refer to Section 3.1.2 for a discussion of applicability of 40 CFR Part 63.

# 3.2.5 Regulation 61-62.70 – Title V Operating Permit Program

Refer to Section 3.1.6 for discussion of the TVOP Program.

# 3.3 PROVISIONS OF THE SCDHEC CONSENT ORDER AND EPA CONSENT DECREE

This section addresses the provisions of the November 23, 2022 SCDHEC Consent Order and Part I of Appendix A of the November 16, 2022 EPA Consent Decree.

## 3.3.1 November 23, 2022 SCDHEC Consent Order

Items 4 through 6 of the Consent Order require that New-Indy Catawba:

- Install, operate, and maintain a primary stripper that is adequately sized to collect and treat all foul condensate streams in accordance with applicable state and federal air quality regulations. *The proposed new stripper will be sized at 850 gpm, which is designed to process foul condensates generated from producing the maximum pulp production of 2,700 ADTP/d, and New-Indy Catawba will operate the unit in accordance with applicable state and federal air quality regulations.*
- The primary stripper shall use low-pressure steam and must be designed for both methanol and sulfur compound removal with the off gases being treated in the recovery boilers to absorb the sulfur compounds in the stripper off gas. The proposed new stripper will utilize 60 pounds per square inch gauge (psig) steam. *The new stripper off-gases and SRL methanol will be*



incinerated in the No. 2 or 3 Recovery Furnace, with the exception of when the SRL system is unavailable (5% of the operating time of the new stripper).

- Complete preliminary engineering and submit a construction permit application for the primary stripper within one hundred and twenty (120) days of the execution of this order. *Preliminary engineering is complete and this application is being submitted by March 23, 2023.*
- New-Indy must optimize, operate, and maintain the existing stripper at its current design capacity to allow it to be operated independently of the primary stripper. To optimize the existing stripper at its current design, it will be operated in "TRS mode" to remove 98% of the TRS and approximately 45% of the methanol from the foul condensate.
- The following required events will be completed in the future:
  - Order the primary stripper within 30 days of submitting the application for the air construction permit.
  - Within 30 days of receiving the air construction permit, New-Indy Catawba must start civil engineering preparation.
  - Within 30 days of receiving the primary stripper, New-Indy Catawba must start installation and testing.
  - New-Indy Catawba must complete startup operations and place the primary stripper into operation no later than June 30, 2025.
  - New-Indy shall operate its steam stripper system, comprised of the primary stripper and the existing stripper, in accordance with all applicable state and federal air quality regulations
  - In the event the stripping system is out of service and foul condensate must be discharged to the ASB, New-Indy Catawba must use automated control of addition of a chemical oxidant, hydrogen peroxide, to treat the unstripped foul condensate prior to discharging into the ASB to maintain a rolling 90-minute average ORP of the foul condensate above 0 millivolts.
  - New-Indy Catawba must notify SCDHEC at least 48 hours prior to any planned downtime and within 24 hours of unplanned downtime for which the primary stripper will not be operational (and for the existing stripper when it should be operating but will not be).
  - New-Indy Catawba must submit reports to the Department regarding the implementation of the Consent Order to NewIndyOrderReports@dhec.sc.gov. For twelve consecutive months after execution of this order, the reports shall be submitted monthly on the 1st business day of the month. Thereafter, reports shall only be submitted every three months on the 1st business day of the month until the order terminates.



# 3.3.2 November 16, 2022 EPA Consent Decree

## Item I(a) of Appendix A

Item I(a) of Appendix A of the Consent Decree contains requirements related to the uptime and monitoring of the foul condensate steam stripper at the Mill.

- New-Indy Catawba will operate their foul condensate treatment system (inclusive of the new and existing steam strippers) during all times that unbleached kraft pulp is being produced and foul condensate is being generated at the Mill.
- During periods the new steam stripper is experiencing downtime the existing steam stripper will be used.
- Periods of downtime in which both strippers are down will not exceed 576 hours for the first year and 460 hours annually thereafter.
- Peroxide will be added to the non-stripped condensate during the transition to the existing steam stripper and will continue to be added throughout the period in which the existing steam stripper is in operation.
- The Mill will notify the necessary authorities forty-eight (48) hours prior to any scheduled downtime and within twenty-four (24) hours of any unscheduled downtime and will operate both steam strippers according to 40 CFR Part 63, Subpart S.

## Item I(b) of Appendix A of the Consent Decree

Item I(b) of Appendix A of the Consent Decree covers the maintenance, operation, and calibration of the system used to treat the unstripped foul condensate by the Mill. The Mill's foul condensate treatment system (inclusive of the new equipment to be installed with this application) will be capable of continuously measuring the oxidation reduction potential (ORP) of the foul condensate, automatically controlling the dosage of hydrogen peroxide to maintain a rolling ninety-minute average of the ORP of the foul condensate above 0 millivolts (mV) before it is discharged to the ASB, and treating the maximum amount of foul condensate produced when both steam strippers are down and when untreated foul condensate is discharged to the Hardpipe.

## Item I(c) of Appendix A of the Consent Decree

Item I(c) of Appendix A of the Consent Decree contains recordkeeping requirements for data obtained by the ORP monitoring system used by the Mill. The Mill will maintain continuous records of the ORP monitoring system used by the Mill and will provide data to U.S. EPA upon request.



### Item I(d) of Appendix A of the Consent Decree

Item I(d) of Appendix A of the Consent Decree includes reporting requirements for the ORP monitoring system used by the Mill. When untreated foul condensate is discharged to the Hardpipe, New-Indy Catawba will include the date, time, and value of any instance of a rolling ninety-minute average of the ORP falling below 0 mV in the Mill's semi-annual report for the previous six months.

# APPENDIX A -PERMIT APPLICATION FORMS



# Bureau of Air Quality Construction Permit Application Page 1 of 9

# RECEIVED

MAR 23 2023

# **BAQ PERMITTING**

### SECTION 1 - FACILITY IDENTIFICATION

C Air Permit Number (8-digits only) Application Date			
(Leave blank if one has never been assigned)			
2440 - 0005	March 2023		
Facility Name/Legal Identity (This should be the official legal name under which the facility is owned/operated and			

should be consistent with the name registered with the S.C. Secretary of State's office, as applicable.) New-Indy Catawba LLC

Facility Site Name (Optional) (*Please provide any alternative or additional identifier of the facility, such as a specific plant identifier (e.g., Columbia plant) or any applicable "doing business as" (DBA) identity. This name will be listed on the permit and used to identify the facility at the physical address listed below.*)

Facility Federal Tax Identification Number (Established by the U.S. Internal Revenue Service to identify a business entity) 83-1904423

### REQUEST TYPE (Check all that apply)

### Exemption Request:

Complete Section 1 and attach documentation to support exemption request.

### **Construction Application:**

Minor New Source Review Project

Synthetic Minor Project

□ Prevention of Significant Deterioration Project

🗆 112(g) Project

Expedited Review Request:

If checked, include Expedited Form D-2212 in the construction application package.

### Construction Permit Modification:

Provide the construction permit ID (e.g. CA, CB, etc.) for which modification is requested:

### Application Revision:

CONSTRUCTION PERMIT APPLICATION FORMS BEING REVISED				
	(Amended construction permit forms must be filled out completely and attached to this modification request.)			
Form #	Date of Original Submittal	Brief Description of Revision		
D-2566	N/A	N/A		
D-2573	N/A	N/A		

FACILITY PHYSICAL ADDRESS				
Physical Address: 5300 Cureton Ferry Road County: York				
City: Catawba State: SC Zip Code: 29704				
Facility Coordinates (Facility coordinates should be based at the front door or main entrance of the facility)				
Latitude: 34°50′37″N	Longitude: 80°	53'25''W		



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FACILITY'S PR	ODUCTS / SERVICES
Primary Products / Services (List the primary product and/or .	service)
Linerboard / Pulp Manufacturing	
Primary <u>SIC Code</u> <i>(Standard Industrial Classification Codes)</i> 2631	Primary <u>NAICS Code</u> (North American Industry Classification System) 322130
Other Products / Services (List other products and/or services)	<i>)</i>
Other SIC Code(s):	Other NAICS Code(s):

## PROJECT DESCRIPTION

Project Description (What, why, how, etc.): Installation of a new steam stripper system to treat foul condensate prior to being recycled to the Brownstock washers. The new steam stripper will include a new stripper feed tank, new methanol tank, new hot water tank, and a new methanol rectification condenser. The rectified methanol will be burned in the recovery furnaces with the black liquor. The LVHC gases from the methanol condenser system, stripper feed tank, and methanol tank will be combusted in the No. 3 Recovery Furnace or back-up in the Nos. 1 or 2 Combination boilers. The hot water tank is not expected to be a source of air emissions. The existing steam stripper will serve as a backup to the new steam stripper. When both new and backup strippers are out of service, the condensate will be directed to the hard pipe with chemical oxidation prior to being treated in the aerated stabilization basin.

AIR PERMIT FACILITY CONTACT				
(Person listed will be in our files as the point of	of contact for all air per	mitting related questions and will rece	vive all air permitting notifications.)	
Title/Position: Sr. Environ. Engineer	Salutation: Mr.	First Name: Bob	Last Name: Tourville	
Mailing Address: P.O. Box 7				
City: Catawba		State: SC	Zip Code: 29704	
E-mail Address: bob.tourville@newindycb.com		Primary Phone No.: (803) 981-8009	Alternate Phone No.:	

The signed permit will be e-mailed	to the designated Air Permit Contact.		
If additional individuals need copies of the permit	, please provide their names and e-mail addresses.		
Name E-mail Address			
Steven Moore smoore@all4inc.com			

## **CONFIDENTIAL INFORMATION / DATA**

Is <u>confidential information</u> or data being submitted under separate cover? 🔀 No 🗌 Yes\*

\*If yes, submit ONLY ONE COMPLETE CONFIDENTIAL APPLICATION, with original signature, along with the public version of the application.

### **CO-LOCATION DETERMINATION**

Are there other facilities in close proximity that could be considered collocated? 🔀 No 🗌 Yes\*

If yes, list potential collocated facilities, including air permit numbers if applicable:

\*If yes, please submit collocation applicability determination details in an attachment to this application.



# Bureau of Air Quality Construction Permit Application Page 3 of 9

	OWNER O	ROPERATOR	
Title/Position: Technical Manager	Salutation: Mr.	First Name: Charles	Last Name: Cleveland
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: pete.cleveland@new	v-indycb.com	Primary Phone No.: 803- 981-8000	Alternate Phone No.:
	OWNER OR OPE	RATOR SIGNATURE	
l certify, to the best of my knowledge or violated. I certify that any appl	e and belief, that no lication form, supp	applicable standards and/or re orting documentation, report,	gulations will be contravened or compliance certification

submitted in this permit application is true, accurate, and complete based on information and belief formed after reasonable inquiry. I understand that any statements and/or descriptions, which are found to be incorrect, may result in the immediate revocation of any permit issued for this application.

Signature of Owner or Operator

APPLICATION PREPARER (if other than Professional Engineer below)						
Title/Position:	Senior	Managing	Salutation: Mr.	First Name: Steven	Last Name: Moore	
Consultant						
Mailing Address	: 630 Davis	Drive, Suite	203			
City: Durham				State: NC	Zip Code: 27560	
E-mail Address:	smoore@a	ll4inc.com		Phone No.: (919) 234-5981	Cell No.: (864) 616-4711	

	<b>PROFESSIONAL ENG</b>	INEER INFORMATION		
Consulting Firm Name: ALL4 LLC		SC Certificate of Authority Lie	cense No.: 6409	
Title/Position: PE	Salutation: Ms.	First Name: Sheryl Last Name: Watkins		
Mailing Address: 300 Chastain Cent	er Blvd, Suite 395			
City: Kennesaw		State: Georgia	Zip Code: 30144	
E-mail Address: swatkins@all4inc.com		Phone No.: (678) 293-9428	Cell No.: (386) 503-0266	
SC License/Registration No.: 34347				

#### **PROFESSIONAL ENGINEER SIGNATURE**

I have placed my signature and seal on the engineering documents submitted, signifying that I have reviewed this construction permit application as it pertains to the requirements of *South Carolina Regulation 61-62, Air Pollution Control Regulations and Standards*.

end Watkins 3-20-23

Signature of Professional Engineer





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	EQUIPMENT / PROCESS INFORMATION						
Equipment ID/ Process ID	Action	Equipment / Process Description	Maximum Design Capacity (Units)	Control Device ID(s)	Emission Point ID(s)		
9801	Add Remove Modify Existing	Existing Steam Stripper	850 gallons/minute	9820, 2605, 3705, 2901	2610S2, 2610S1, Fugitive		
9802	Add Remove Modify Existing	Hardpipe	850 gallons/minute	2901	Fugitive		
9803	Add Remove Modify Existing	New Steam Stripper (Methanol Condenser)	6.5 gallons/minute	5260, 5260C, 2605, 3705, 5105	5105S, 2610S2, 2610S1		
9803	Add Remove Modify Existing	New Steam Stripper (Condensed Methanol)	6.5 gallons/minute	2505, 5105	2505S, 5105S		
9803	Add Remove Modify Existing	New Steam Stripper (Stripper Off Gases)	850 gallons/minute	9820, 2605, 3705	2610S2, 2610S1		
9804	Add Remove Modify Existing	New Steam Stripper Feed Tank	80,400 gallons	5260, 5260C, 5105, 2605, 3705	261052, 2610S1, 5105S		
9805	Add Remove Modify Existing	New Steam Stripper Rectified Liquid Methanol Tank	1,300 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S		



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	CONTROL DEVICE INFORMATION							
Control Device ID	Action	Control Device Description	Maximum Design Capacity (Units)	Inherent/ Required/ Voluntary	Pollutants Controlled (Include CAS #)	Capture Efficiency	Destruction/ Removal Efficiency	Emission Point ID(s)
2505	Add Remove Modify Existing	No. 2 Recovery Furnace	412,140 tons BLS/year	Required	See Ap	See Appendix B/Narrative		25055
2605	Add Remove Modify Existing	No. 1 Combination Boiler	405 MMBtu/hr	Required	See Ap	See Appendix B/Narrative		261052
2901	Add Remove Modify Existing	Aerated Biotreatment (Aerated Stabilization Basin)	N/A	Required	See Ap	See Appendix B/Narrative		Fugitive
3705	Add Remove Modify Existing	No. 2 Combination Boiler	720 MMBtu/hr	Required	See Appendix B/Narrative		2610S1	
5105	Add Remove Modify Existing	No. 3 Recovery Furnace	744,600 tons BLS/year	Required	See Appendix B/Narrative		51055	
9820	Add Remove Modify	Stripper Off Gases Collection System	2,700 ADTP/day	Required	See Ap	pendix B/Na	arrative	261051, 261052
5260	Add Remove Modify Existing	LVHC Collection System	2,700 ADTP/day	Required	See Ap	pendix B/Na	arrative	2610S1, 2610S2, 5105S
5260C	Add Remove Modify Existing	LVHC Collection System Caustic Scrubber	2,700 ADTP/day	Required	See Ap	pendix B/Na	arrative	2610S1, 2610S2, 5105S



# Bureau of Air Quality Construction Permit Application Page 6 of 9

Check Box for information addressed	Required Information				
	Source identification and emissions:				
$\boxtimes$	Name of each source, process, and control device.				
$\boxtimes$	<ul> <li>Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application.</li> </ul>				
$\boxtimes$	Assign an Emission Point ID for each source.				
$\boxtimes$	Assign a Control Device ID for each control device.				
$\boxtimes$	List each pollutant the source will emit.				
$\boxtimes$	<ul> <li>List the Uncontrolled, Controlled, and PTE emissions for each source or equipment in lb/hr and tons/year.</li> </ul>				
$\boxtimes$	• Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.				
$\boxtimes$	• Provide the CAS# for each Hazardous Air Pollutant (HAP) and/or Toxic Air Pollutant (TAP).				
	Information to support emission rates:				
$\boxtimes$	Sample calculations.				
	<ul> <li>Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.</li> </ul>				
$\boxtimes$	Explanation of assumptions, bottlenecks, etc.				
	<ul> <li>Source test information: A copy of the source test results may be requested. If the test results are not included in the application, the application should cite whether this was a DHEC approved test, and if not, explain where the test was conducted and other identifying information.</li> </ul>				
	Manufacturer's data.				
	Vendor guarantees that support control device efficiencies.				
$\boxtimes$	New Source Review (NSR) analysis.				
$\boxtimes$	Other (e.g. example particle size analysis)				

	Existing (Permitted) Facilities					
Check Box	Required Information	Location in Application				
	<ul> <li>Facility-wide emissions prior to construction/modification:</li> <li>Include an explanation if these emissions do not match the facility- wide emissions submitted in the last application.</li> </ul>	Appendix B				
$\boxtimes$	Facility-wide emissions after construction/modification: <ul> <li>Include net change, if applicable.</li> </ul>					
	As applicable for the construction/ modification:					
	Name of each source.	See Equipment/Process Information Above				

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	Existing (Permitted) Facilities	
Check Box	Required Information	Location in Application
	<ul> <li>Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application or on your current construction / operating permit.</li> </ul>	See Equipment/Process Information Above
	Assign a Control Device ID for each control device.	See Equipment/Process Information Above
	Assign an Emission Point ID for each source.	See Equipment/Process Information Above
$\boxtimes$	List each pollutant the source will emit.	Appendix B
	<ul> <li>List the Uncontrolled, Controlled, and PTE (if applicable) emissions for each source or equipment.</li> </ul>	Appendix B
	<ul> <li>Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.</li> </ul>	Appendix B
	Provide the CAS# for each HAP and/or TAP.	Appendix B
	Information to support facility-wide emission rates:	
	Sample calculations.	Appendix B
	<ul> <li>Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.</li> </ul>	Narrative, Appendix B
	<ul> <li>Explanation of assumptions, bottlenecks, etc.</li> </ul>	Narrative
	<ul> <li>Source test information: A copy of source the test results may be requested. If the results are not included in the application, the application should cite whether this was a DHEC approved test and if not, explain where the test was conducted and other identifying information.</li> </ul>	Appendix B
	Manufacturer's data.	
	<ul> <li>Vendor guarantees that support control device efficiencies.</li> </ul>	
	NSR analysis.	Narrative
	Other (please explain)	Appendix B



# Bureau of Air Quality Construction Permit Application Page 8 of 9

Check Box	State and Federal Air Pollution Control Regulations and Standards
$\boxtimes$	S.C. Regulation 61-62.1 Section II.E Synthetic Minor Construction Permits
$\boxtimes$	S.C. Regulation 61-62.5 Air Pollution Control Standards
	Standard No. 1 Emissions from Fuel Combustion
$\boxtimes$	Standard No. 2 Ambient Air Quality
$\boxtimes$	Standard No. 3 Waste Combustion and Reduction (state only)
	Standard No. 4 Emissions from Process Industries
$\boxtimes$	(Note: If Section VIII of this Standard applies, include the process weight rate (PWR) in ton per
-	hour for each applicable source or process.)
	Standard No. 5 Volatile Organic Compounds
	Standard No. 5.2 Nitrogen Oxides Lowest Achievable Emission Rate
$\boxtimes$	<ul> <li>Standard No. 7 Prevention of Significant Deterioration (PSD)</li> </ul>
	<ul> <li>Standard No. 7.1 Nonattainment New Source Review (NSR)</li> </ul>
$\boxtimes$	Standard No. 8 Toxic Air Pollutants (TAPs) (state only)
	S.C. Regulation 61-62.6 Control of Fugitive Particulate Matter
$\boxtimes$	S.C. Regulation 61-62.60 and 40 CFR Part 60 New Source Performance Standards (NSPS)
$\boxtimes$	S.C. Regulation 61-62.61 and 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP)
	S.C. Regulation 61-62.63 and 40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants
	(NESHAP) for Source Categories
$\boxtimes$	40 CFR Part 64 Compliance Assurance Monitoring (CAM)
	S.C. Regulation 61-62.68 and 40 CFR Part 68 Chemical Accident Prevention Provisions
$\boxtimes$	S.C. Regulation 61-62.70 and 40 CFR Part 70 Title V Operating Program
	Other S.C. Air Pollution Control Regulations, as applicable.
	Other Federal Air Pollution Control Regulations, as applicable.
	40 CFR 98 Green House Gas (GHG) emissions
	(Note: Quantify GHG emissions, if S.C. Regulation 61-62.5, Standard No. 7 or S.C. Regulation 61-62.5,
	Standard No. 7.1 is triggered.)



# Bureau of Air Quality Construction Permit Application Page 9 of 9

Check Box	Completeness Checklist:										
	Applicability Determination:										
$\boxtimes$	• Is this regulation applicable, reasonably applicable, potentially applicable, or not applicable?										
$\boxtimes$	Is the basis for the applicability determination explained?										
	Affected Sources:										
$\boxtimes$	Is the name and identification of each emission source or process included?										
	Compliance Demonstration:										
$\boxtimes$	How will compliance be demonstrated?										
$\boxtimes$	<ul> <li>Are specific methods or activities to be utilized by the facility to demonstrate compliance with each specific limitation and/or requirement provided?</li> </ul>										
$\boxtimes$	Are control devices and control device requirements included?										
$\boxtimes$	<ul> <li>Are monitoring, recordkeeping, and reporting requirements necessary to demonstrate compliance included?</li> </ul>										
	Regulatory Citations:										
$\boxtimes$	Are the regulatory citations identified?										



# Bureau of Air Quality Emission Point Information Page 1 of 4

A. APPLICATION IDENTIFICATION								
. Facility Name: New-Indy Catawba LLC								
2. SC Air Permit Number (if known; 8-digits only): 2440 - 0005 3. Application Date: March 2023								
4. Project Description: New Condensate Stripper Permit Application								
Are other facilities collocated for air compliance? Yes 🛛 No 6. If Yes, provide permit numbers of collocated facilities:								

B. AIR CONTACT										
Consulting Firm Name (if applicable):		A								
Title/Position: Senior Environmental Engineer	Salutation: Mr.	First Name: Bob	Last Name: Tourville							
Mailing Address: P.O. Box 7										
City: Catawba		State: SC	Zip Code: 29704							
E-mail Address: bob.tourville@new-indycb.com		Phone No.: (803) 981-8009	Cell No.:							

	C. EMISSION POINT DISPERSION PARAM	ETERS							
• Source data requirements are based on the a	ppropriate source classification.								
• Each emission point is classified as a point, flare, area, area circular, area polygon, volume, open pit, line, or buoyant line source.									
Contact the Bureau of Air Quality for clarificat	ion of data requirements.								
• Include sources on a scaled site map. Also, a	picture of area or volume sources would be helpfu	l but is not required.							
A user generated document or spreadsheet n	nay be substituted in lieu of this form provided all o	of the required emission point parameters are submitted in							
the same order, units, etc. as presented in the	ese tables.								
Abbreviations / Units of Measure:									
AGL = Above Ground Level	<ul> <li>°F = Degrees Fahrenheit</li> </ul>	• K = Kelvin							
<ul> <li>AGL = Above Ground Level</li> <li>BTU/hr = British Thermal Unit per hour</li> </ul>	<ul> <li>°F = Degrees Fahrenheit</li> <li>ft = feet</li> </ul>	<ul> <li>K = Kelvin</li> <li>m = meters</li> </ul>							



# Bureau of Air Quality Emission Point Information Page 2 of 4

Reminder: For all Emission Points, list the unique Emission Point ID for that source. Use the same emission point ID as shown in the current permit and provided in the last modeling submittal (as applicable). If the emission point ID has been changed from what was previously submitted, please list the current emission point ID with the old emission point ID in parenthesis

	D. POINT SOURCE														
Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height		Exit Exit	Inside	Discharge	Rain	Distance To Nearest	Building				
		Easting (m)	Northing (m)	AGL (ft)	(°F)	(ft/s)	(ft)	tion	(Y/N)	Property Boundary (ft)	Height (ft)	Length (ft)	Width (ft)		
261051	No. 2 Combination Boiler Stack	510039.32	3855689.18	228	364	47.2	10.0	Vert.	N	3,937	N/A	N/A	N/A		
261052	No. 1 Combination Boiler Stack	510020.32	3855678.18	228	405	62.3	10.0	Vert.	Ν	3,937	N/A	N/A	N/A		
25055	No. 2 Recovery Furnace	510095.85	3855743.58	195	365	99.1	7.0	Vert.	N	3,953	N/A	N/A	N/A		
5105S	No. 3 Recovery Furnace	510032.37	3855802.28	225	342	61.7	10.5	Vert.	N	4,134	N/A	N/A	N/A		
L					-							-	1		

				E. FLAF	RE SOURCE							
Emission	and the second second	UTM Coordinates (NAD83)		Release	Heat	Exit	Exit	Heatloss	Distance To Nearest	Building		
Point ID	Description/Name	Easting (m)	Northing (m)	AGL (ft)	Rate (BTU/hr)	Velocity (ft/s)	Temp. (°F)	Fraction	Property Boundary (ft)	Height (ft)	Length (ft)	Width (ft)

	F. AREA SOURCE												
Emission Point ID	Description/Name	UTM Coo (NA) Easting (m)	ordinates D83) Northing (m)	Release Height AGL (ft)	Easterly Length (ft)	Northerly Length (ft)	Angle From North (°)	Initial Vertical Dimension $\sigma_z$ (ft)	Distance To Nearest Property Boundary (ft)				



# Bureau of Air Quality Emission Point Information Page 3 of 4

	G. AREA CIRCULAR SOURCE												
Emission	Description (Name	UTM Coordinates (NAD83)		Release Height	Radius of Area	Number of	Initial Vertical	Distance To Nearest					
Point ID	Description/Name	Easting (m)	Northing (m)	AGL (ft)	(ft)	Vertices	(ft)	(ft)					

	H. AREA POLYGON SOURCE														
Emission Point ID	Description/Name	UTM Cod (NA Easting-1 (m)	ordinates D83) Northing-1 (m)	Release Height AGL (ft)	Initial Vertical Dimension (ft)	Number of Vertices	Area (ft²)	Distance To Nearest Property Boundary (ft)							
Fugitive	Aerated Stabilization Basin (Zone 1)	510803.40	3856319.69	20	0	15	547,769	1,969							
Fugitive	Aerated Stabilization Basin (Zone 2)	510964.42	3856054.20	20	0	18	733,653	1,510							
Fugitive	Aerated Stabilization Basin (Zone 3)	511052.13	3855887.21	20	0	10	783,500	1,180							

				I. VOLUME S	SOURCE				
Emission Point ID	Description/Name	UTM Cod (NA Easting (m)	ordinates D83) Northing (m)	Release Height AGL (ft)	Physical Horizontal Dimension (ft)	Initial Horizontal Dimension σ <sub>y</sub> (ft)	Physical Vertical Dimension (ft)	lnitial Vertical Dimension σ <sub>z</sub> (ft)	Distance To Nearest Property Boundary (ft)

				J. OPEN PIT SOL	IRCE			
Emission	Description (Name	UTM Co (NA	ordinates D83)	Release Height	Easterly Length	Northerly Length	Pit Volume	Angle From North
Point ID	Description/Name	Easting (m)	Northing (m)	AGL (ft)	(11)	(ft)	(ft <sup>3</sup> )	(°)



# Bureau of Air Quality Emission Point Information Page 4 of 4

				K. LINE SOL	IRCE				
Emission	Description (Name		UTM Coo (NAD	rdinates 983)		Release Height	Line Length	Line Width	Initial Vertical
Point ID	Description/Marie	Start Easting (m)	K. LINE SOURCE         UTM Coordinates (NAD83)       Release Height AGL (ft)       Line Length (ft)       Line Width (ft)       Initial Vertical Dimension $\sigma_z$ (ft)         Start Northing (m)       End Easting (m)       End Northing (m)       (ft)       Line Length (ft)       Line Width (ft)       Initial Vertical Dimension $\sigma_z$ (ft)						

	L. BUOYA	NT LINE SOURCE (r	nust complete Line	Source and Buoya	ant Line Source tab	les)	
Emission Point ID	Description/Name	Average Building Length (ft)	Average Building Height (ft)	Average Building Width (ft)	Average Line Source Width (ft)	Average Building Separation (ft)	Average Buoyancy Parameter (m <sup>4</sup> /s³)
		1					

		M. EMISSION	RATES			
Emission Point ID	Pollutant Name	CAS #	Emission Rate (lb/hr)	Same as Permitted? <sup>(1)</sup>	Controlled or Uncontrolled	Averaging Period
261052, 261051						
2505S		Refer to	Appendix B			
51055						
Fugitive						

(1) Any difference between the rates used for permitting and the air compliance demonstration must be explained in the application report.

# APPENDIX B -EMISSIONS CALCULATIONS

### **NEW-INDY CATAWBA MILL STRIPPER PROJECT**

	Operati	ing Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	8%	700.8
No Stripper Online	2%	175.2

LVHC Control	Operat	ing Time
Operating Scenario	%	hrs
RF3 Available for LVHC	75%	6,570.0
LVHC to CB1/CB2	25%	2,190.0

#### Summary of PSD Applicability (tons/year)

Pollutant(A)	PM	PM10	PM25	NO	SO <sub>2</sub>	СО	H2SO4	TRS	VOC	Pb	H <sub>2</sub> S	Total CO2e
Baseline Actual Emissions	1.26	1.16	1.09	132	770	27.1	1.28	13.4	249	1.24E-04	3.77	13,904
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.2	9.28	7.36	16.1	-141.35	37.1	1.15	2.18	-1.4	1.95E-03	1.92	34,725
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units,

#### SO2 EMISSIONS CALCULATIONS

	Stripper	Sceneno Ing Time		Operating C	onfiguration me		Con Operati	trois ing Time	Produc	tion Rate	SI Emission	D2 ns Factor	Sulfur Cepture <sup>C</sup>	SO2 Er	aissions
Stripper Operating Scenario	%	hrs	Operating Configuration	56	hrs	Controls	*	hrs	Value	NOM	Ib/UOM	Reference	*	lb/hr	tpy
		-		BAS	ELINE ACTUAL	EMISSIONS (March 2021 - Februa	ry 2023)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	1.06	Stack Test	NA	63 1	252.5
IVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	1.97	Stack Test	NA.	117.0	512.4
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>ille</sup>	97.9%	7,835.7	NA	100.0%	7.835.7	29.5	mm8tu/hr	6.00E-04	AP-42	NA	0.02	0.1
Backup Stripper Steam <sup>4</sup>	91.4%	8,004.0	No.6 Oil**	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	2.20E+00	AP-42	NA	619	5.2
SOZ BASELINE ACTUAL EMISSIONS (BAI	E)			1				-			-	1			770.2
	-				PRO	ECTED ACTUAL EMISSIONS				-	(		-	_	_
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3"	100.0%	7,489.8	2,700	ADTP/day	0 56	Vendor	99%	0.6	24
New Stripper Online	90.0%	7,884 0	SRL Online	95%	7,489.8	SRL LVHC to RF3	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor	99%	0.9	2.7
New Stripper Online	90.0%	7.884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2.700	ADTP/day	1.40	Vendor	0%	157.4	31.0
Backup Stripper Online	8.0%	700.8	NA	100%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	1 40	Vendor	0%	157.4	55 1
No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100%	175.2	Hydrogen Peroxide Addition	100.0%	175 2	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6.570.0	2,700	ADTP/day	5.25	Stack Test	99%	5.9	194
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	Stack Test	50%	295-2	323 3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985-5	NA	100.0%	985-5	1.0	mmBtu/hr	6-00E-04	AP-42	NA	0.00	00
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>0,7</sup>	81.6%	6,433 3	NA	100.0%	6,433.3	96-8	mmBtu/hr	6-00E-04	AP-42	NA	0.06	0.2
New Stripper Steam - No 6 Oil	90.0%	7,884.0	No.6 Oll <sup>D.1</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2-20E+00	AP-42	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>0,1</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	6 00E-04	AP-42	NA	0 02	0.004
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No.6 Oil <sup>01</sup>	18.4%	128.9	NA	100.0%	128.9	24 1	mmBtu/hr	2 20E+00	AP-42	NA	53.1	3.4
SO2 PROJECTED ACTUAL EMISSIONS (P	AE)														628.84
				_	NET EN	ISSIONS CHANGE (PAE - BAE)		_		-					
NET EMISSIONS CHANGE (PAE - BAE)				_											-141.35

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Bolliers No 1 and No 2 during baseline

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination bollers 99%

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System

H - reserved

				Foul	Methanol <sup>6</sup>	LVHC <sup>6</sup>
				UNCTRL	UNCTRL	UNCTRL
				Ib/ADTP	Ib/ADTP	Ib/ADTP
TRS as S		MW	AHL	0 70	0 28	0 42
sulfur	s	32.065				
sulfur dioxide	5O2	64 064		1 40	0 56	0 84

#### H2504 EMISSIONS CALCULATIONS

	Stripper	Scenario Ins Time		Ope	rating ation Time		Con Operati	trois Ing Time	Produ	tion Rate		H2SO4 Emissions Factor	Sulfur Capture	H2SO4	missions
Stripper Operating Scanario	*	hrs	Operating Configuration	96	hni	Controls	*	hns	Value	UOM	Ib/ADTP	Reference	%	lb/hr	tov
Contraction of the second s					BASELINE ACT	TUAL EMISSIONS (March 202	1 - February 20	23)			-	-		-	
LVHC Collection System	100%	8,760 0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	4 93E-03	NCASI Technical Bulletin 858, Table 10	NA	03	1,3
H2504 BASELINE ACTUAL EMISSIONS	(BAE)														1,3
	10010	- 10				PROJECTED ACTUAL EMISSI	ONS			4		1000 C	-	-	
LVHC Collection System	100%	8,760.0	NA	100%	8,760 0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4,93E-03	NCASI Technical Bulletin 858, Table 10	NA	0 55	1.82
LVHC Collection System	100%	8,760 0	NA	100%	8,760 0	LVHC to CB1/CB2	25.0%	2,190 0	2,700	ADTP/day	4 93E-03	NCASI Technical Builetin 858, Table 10	NA	0 55	0 61
H2504 PROJECTED ACTUAL EMISSION	IS (PAE)						1			-					2.43
ut of the second se		-			N	ET EMISSIONS CHANGE (PAE	-BAE)						-		-
NET EMISSIONS CHANGE (PAE - BAE)								-							1.15

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Bolliers No 1 and No 2 during baseline

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System

H - reserved

#### NOX EMISSIONS CALCULATIONS

	Stripper	Scenario Ing Time		Oper	rating Ition Time		Cor	turois ting Time	Produc	tion Rate	N Emissio	OX ns Factor	Ammonia Increase <sup>C</sup>	NOX E	nissions
Stripper Operating Scenario	%	hea	Operating Configuration	%	hrs	Controls	%	hes	Value	UOM	Ib/UOM	Reference	*	lb/hr	tφγ
				BAS	ELINE ACTUAL	EMISSIONS [March 2021 - Februar	ry 2023)	_	-	1			15		
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,426	ADTP/day	0.415	Columbia	NA	24.7	98.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>&amp;E</sup>	97.9%	7,835.7	NA	100%	7.835.7	29.5	mm8tu/hr	2.80E-01	AP-42	NA	8.3	32.4
Backup Stripper Steam <sup>4</sup>	91.4%	8,004.0	No. 6 Olf <sup>e,t</sup>	2.1%	168.3	NA	100%	168.3	28.1	mm8tu/hr	3 13E-01	AP-42	NA	8.8	0.7
NOX BASELINE ACTUAL EMISSIONS				-	-										131.8
					PRC	DIECTED ACTUAL EMISSIONS				-	-	0.00			
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3"	100%	7,489.8	2,852	TBLS/day	1,500	Title V	1.0%	1.8	6.7
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1,500	Title V	1.0%	0.2	0.6
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2"	25%	1.872.5	270.0	ADTP/day	0.415	Columbia	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	Columbia	NA	46.7	9.2
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700 B	2,700	ADTP/day	0.415	Columbia	NA	46.7	16.4
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100%	175 2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>i</sup>	15.0%	985.5	NA	100%	985 5	1.0	mmBtu/hr	2 80E-01	AP-42	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2 80E-01	AP-42	NA	27 1	87 2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oll <sup>D7</sup>	18.4%	1,450 7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100%	571.9	25.3	mm8tu/hr	2.80E-01	AP-42	NA	7.1	2.0
Backup Stripper Steam - No. 6 Oli	8%	700.8	No. 6 OIPF	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	3.13E-01	AP-42	NA	7.5	0.5
NOX PROJECTED ACTUAL EMISSIONS				-	1										147.9
1 martine and the second		-		1000	NET E	MISSIONS CHANGE [PAE - BAE]									
PAE - BAE										-	_				16.1

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia Input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC)

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

#### CO EMISSIONS CALCULATIONS

	Surpper	Scenario Ine Time		Oper	ating ation Time		Con Operati	trois ng Time	Produ	ction Rate	Emissio	to ns Factor	CO Control	CO En	Analons
Stripper Operating Scenario	*	hrs	Operating Configuration	%	hra	Controls	*	Ince	Value	UOM	Ib/UOM	Reference	%	lb/hr	100Y
				BAS	ELINE ACTUAL	EMISSIONS (March 2021 - February 2	1023]								
Backup Stripper SOG*	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	0.0728	Columbia	NA	4.3	17.3
Backup Stripper Steam <sup>4</sup>	91.4%	8,004.0	Natural Gas <sup>e</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	8.40E-02	AP-42	NA	2.5	9.7
Backup Stripper Steam*	91.4%	8,004.0	No. 6 Oil	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	3.33E-02	AP-42	NA	0.9	0.1
CO BASELINE ACTUAL EMISSIONS							-								27.1
	-				PRO	ECTED ACTUAL EMISSIONS	10-0-0	-							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	Columbia	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	Columbia	NA	8.2	7.7
New Stripper Online	90%	7.884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	Columbia	NA	8.2	1.6
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.0728	Columbia	NA	8.2	2.9
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas	15.0%	985.5	NA	100.0%	985.5	1.0	mm8tu/hr	8.40E-02	AP-42	NA	01	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6 433.3	96.8	mmBtu/hr	8,40E-02	AP-42	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Olf	18.4%	1,450.7	NA	100.0%	1,450.7	92,2	mmBtu/hr	3.33E-02	AP-42	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100.0%	571 9	25.3	mmBtu/hr	8.40E-02	AP-42	NA	21	0.6
Backup Stripper Steam - No. 6 Oll	8%	700.8	No. 6 Oil	18.4%	128.9	NA	100.0%	128 9	24.1	mmBtu/hr	3.33E-02	AP-42	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS			-												64.2
					NET EN	ISSIONS CHANGE (PAE - BAE)									
PAE - BAE									-	-					37.1

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Bollers No. 1 and No. 2 during baseline.

C - reserved

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - reserved.

H - reserved

#### VOC EMISSIONS CALCULATIONS

	Stripper	Scenario ng Time		Oper	rating ation Time		Con Operati	trois Ing Time	Produ	tion Rate	V Emissio	OC ns Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scanario	%	has	Operating Configuration	%	hrit	Controls	*	hrs	Value	UOM	Ib/UOM	Reference	*	lb/hr	toy
	-	-		BAS	ELINE ACTUAL	EMISSIONS (March 2021 - February	2023)					-	1 -		
Backup Stripper SOG"	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4.37	Stripped	98.0%	5 19	20.78
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760,0	NA	100.0%	8,760.0	1,426	ADTP/day	8.73E-01	WATER9	NA	51.88	227 21
EVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	3.10E-03	Columbia	NA	0.18	0.81
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>®</sup>	97,9%	7,835,7	NA	100.0%	7,835.7	29 5	/mmBtu/hr	5 39E-03	AP-42	NA	0.2	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8 004.0	No. 6 Oll <sup>e</sup>	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	1.87E-03	AP-42	NA	0.1	0.0
VOC BASELINE ACTUAL EMISSIONS	-							-			-				249.43
	-				PRO	IECTED ACTUAL EMISSIONS							Nr.	-	-
New Stripper Online	90%	7,684.0	SRL Online	95,0%	7 489 8	SRL Methanol to RF2/3"	100%	7,489.8	2,700	ADTP/day	14_40	Vendor	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617,4	2,700	ADTP/day	1.60	Vendor	98%	3.60	10.11
New Stripper Online	90%	7,884 0	SRL Online	95,0%	7,489.8	SRL LVHC to CB1/CB2 <sup>5</sup>	25%	1,872,5	2,700	ADTP/day	1.60	Vendor	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor	98%	36.00	7 10
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	16.00	Vendor	98%	36.00	12.61
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9	NA	32.40	127.72
ASB - Backup Stripper Online	8%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100%	700.8	2,700	ADTP/day	1.42	WATER9	NA	159 98	56.06
ASB - No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	NA	100%	175.2	2,700	ADTP/day	2.20	WATER9	NA	247.05	21.64
VHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mm8tu/hr	5.39E-03	AP-42	NA	0.0	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.39E-03	AP-42	NA	0.5	1.7
New Stripper Steam - No. 6 Oll	90%	7,884.0	No. 6 Oll <sup>0</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42	NA	02	0.1
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>0</sup>	81.6%	571.9	NA	100%	571.9	25,3	mmBtu/hr	5.39E-03	AP-42	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 OII	18,4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	1.87E-03	AP-42	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS					S										248.05
V.					NET EN	ISSIONS CHANGE (PAE - BAE)		- 22 B							-
PAE - BAE	-									-					-1.38

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline...

C - VOC destruction >98% in vapor phase, 99 9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System

H - reserved

#### TRS EMISSIONS CALCULATIONS

	Stripper Operati	Scenario ng Time		Ope	rating stion Time		Con	trois Ing Time	Produc	tion Rate	Emi	TRS ssions Fector	Sulfur Capture <sup>C</sup>	TRS En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration		hrs.	Controls	%	hrs	Value.	UOM	Ib/UOM	Reference	<u>%</u> .	tb/hr	tury
				-	BASELINE ACT	UAL EMISSIONS (March 2021 - Fabru	ary 2023)	1		2 3				ni -	1
Backup Stripper SOG <sup>#</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	2.88E-03	Stack test	NA	0 17	0.68
Aerated Stabilization Basin (ASB)	100.0%	8,750.0	NA	100.0%	8,760.0	NA	100.0%	8 760 0	1,426	ADTP/day	4.08E-02	H2SSIM/WATER9	NA	2.42	10.61
LVHC Collection System	100.0%	8 760 0	NA.	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	9.01E-03	Stack test	NA	0.48	2.09
TRS BASELINE ACTUAL EMISSIONS	A 22.2												(		13.38
					1	PROJECTED ACTUAL EMISSIONS						-	-		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489 B	SRL Methanol to RF2/3	100.0%	7,489.8	2,700	ADTP/day	0.33	Vendor	99.9%	0.04	0.14
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95 0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0 81	Vendor	99%	0.91	018
Backup Stripper Online	8.0%	700.8	NA	100 0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.81	Vendor	99%	0.91	0.32
ASB - New Stripper Online	90.0%	7,884 0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9	NA	2.72	10.74
ASB - Backup Stripper Online	8.0%	700 B	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9	NA	3.06	1 07
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	7.28E-02	H255IM/WATER9	NA	8.19	0 72
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75 0%	6,570.0	2,700	ADTP/day	1 75E+00	Stack test	99.9%	0 20	0 65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25 0%	2,190.0	2,700	ADTP/day	8.76E-03	Stack test	NA	0.99	1 08
TRS PROJECTED ACTUAL EMISSIONS	-														15.56
					NE	T EMISSIONS CHANGE (PAE - BAE)				_					
PAE - BAE															2.18

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion Average fossil fuel distribution in Combination Bollers No. 1 and No. 2 during baseline

C - Sulfur capture in recovery furnace >99 9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur

					Foul	Methanol <sup>6</sup>	LVHC <sup>G</sup>
					UNCTRL	UNCTRL	UNCTRL
					Ib/ADTP	Ib/ADTP	Ib/ADTP
TRS as S		MW		AHL	0 70	0.28	0 42
sulfur	S	32 065					
hydrogen sulfide	H2S	34 081	82 3%		0 61	0 24	0 37
methyl mercaptan	CH <sub>4</sub> S	48 107	6 4%		0 07	0 03	0.04
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62 134	5 2%		0 07	0 03	0.04
dimethyl disulfide	C2H6S2	94 199	6 1%		0.06	0.03	0.04
TRS as TRS	TRS				O B1	0 33	0 49

#### H2S EMISSIONS CALCULATIONS

	Stripper Operat	Scenario Ing Time		Ope Configur	rating ation Time		Cor	itrois Ing Time	Produ	tion Rate	Emissio	125 Ins Factor	Sulfur Capture <sup>C</sup>	H25 Er	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	b/UOM	Reference	*	lb/hr	toy
				BASE	LINE ACTUAL	EMISSIONS (March 2021 - February	2023)		1000						
Backup Stripper SOG <sup>*</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4 13E-04	Stack test	NA	0.02	0.10
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,750.0	1.426	ADTP/day	1.36E-02	H2SSIM	NA	0.81	3.54
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	5.03E-04	Stack test	NA	0.03	0.13
H25 BASELINE ACTUAL EMISSION5															3.77
		-			PRO	ECTED ACTUAL EMISSIONS	3	2		A				-	
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3""	100.0%	7,489.8	2,700	ADTP/day	0.24	Vendor	99.9%	0.03	0.10
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>0,77</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2"	25.0%	1,872 5	2,700	ADTP/day	0.37	Vendor	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.14
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.24
ASB - New Stripper Online	90,0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9 27E-03	H2SSIM	NA	1.04	4.11
AS8 - Backup Stripper Online	B.0%	700.8	H2S Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	9 81E-03	H2SSIM	NA	1.10	0.39
ASB - No Stripper Online	2.0%	175 2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	9.54E-03	H2SSIM	NA	107	0.09
VHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1 17E-01	Stack test	99.9%	0 0 1	0.04
VHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	Stack test	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS							1	-	-	-		-			5.69
					NET EN	ISSIONS CHANGE [PAE - BAE]									
PAE - BAE															1.92

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No 2 during baseline.

C - Sulfur capture in recovery furnace >99 9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%

D - Historically high fuel oll percentage of fossil fuel heat Input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur

					Foul UNCTRL	Methanol <sup>6</sup> UNCTRL	
					Ib/ADTP	ID/ADTP	Ib/ADTP
TRS as S		MW		AHL	0 70	0.28	0 42
sulfur	s	32.065					
hydrogen sulfide	H2S	34.081	82.3%		0.61	0.24	0 37
methyl mercaptan	CH₄S	48.107	6 4%		0.07	0 03	0.04
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62 134	5.2%		0.07	0.03	0.04
dimethyl disulfide	C2H6S2	94 199	6 1%		0.06	0.03	0.04
TRS as TRS	TRS				0.81	0.33	0.49

#### PM EMISSIONS CALCULATIONS

	Stripper Operat	Scenario ing Time		Ope Configura	rating ation Time		Con Operat	trols ng Time	Produc	tion Rate	P Emissio	M ns Factor	PM Control	PM En	aissions
Stripper Operating Scenario	%	hrs	Operating Configuration	76	hra	Controls	76	hrs	Value	UOM	ib/UOM	Reference		lb/hr	tpy
	· · · · · · · · · · · · · · · · · · ·			BAS	ELINE ACTUAL EI	MISSIONS (March 2021	- February 2023)	11					-		
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	Natural Gas <sup>b</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	No. 6 Oil <sup>®</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.61E-01	AP-42	NA	4.5	0.4
PM BASELINE ACTUAL EMISSIONS															1.3
					PROJE	CTED ACTUAL EMISSIO	NS							_	
Recovery Furnace #3 LVHC ignitor	75 0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	985.5	10	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96 8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884 0	No 6 Oll	18 4%	1,450 7		100 0%	1,450.7	92.2	mmBtu/hr	1 61E-01	AP-42	NA	14 8	10 8
Backup Stripper Steam - Natural Gas	8.0%	700.6	Natural Gas <sup>0</sup>	81.6%	571.9		100.0%	571 9	25 3	mmBtu/hr	7 60E-03	AP-42	NA	0.2	01
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No 6 Oil	18 4%	128.9		100.0%	128.9	24 1	mmBtu/hr	1 61E-01	AP-42	NA	3.9	03
PM PROJECTED ACTUAL EMISSIONS														0	13.4
			10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		NET EMI	SSIONS CHANGE (PAE -	BAE								
PAE - BAE															12.2

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution In Combination Bollers No. 1 and No. 2 during baseline.

C - reserved

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - reserved

H - reserved

#### PM10 EMISSIONS CALCULATIONS

	Stripper	Scenario Ing Time		Ope	nting ation Time		Con Operati	trois ng Time	Produ	ction Rate	PN Emission	110 hs Factor	PM10 Control	PM10 E	missions
Stripper Operating Scenario	96	hrs	Operating Configuration	*	hrs	Controls	*	hrs	Value	UOM	Ib/UOM	Reference	%	lb/hr	tpy
				BA	SELINE ACTUAL E	MISSIONS (March 2021 -	February 2023)								
Backup Stripper Steam	91.4%	8,004.0	Natural Gas <sup>®</sup>	97.9%	7,835 7		100.0%	7,835.7	29 5	mmBtu/hr	7.60E-03	AP-42	NA	02	0.9
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oll <sup>8</sup>	2.1%	168.3		100.0%	168 3	28.1	mmBtu/hr	1 17E-01	AP-42	NA	3.3	03
PM10 BASELINE ACTUAL EMISSIONS						and the second second second				V					1.2
					PROJE	ECTED ACTUAL EMISSION	5		15					5-5-5-	-
Recovery Furnace #3 LVHC Ignitor	75.0%	6.570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oll	90.0%	7,884.0	No. 6 Oil <sup>0</sup>	18.4%	1,450.7		100.0%	1,450 7	92.2	mmBtu/hr	1 17E-01	AP-42	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	8.0%	700 B	Natural Gas <sup>0</sup>	81.6%	571.9		100 0%	571 9	25.3	mmBtu/hr	7 60E-03	AP-42	NA	0 2	01
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.17E-01	AP-42	NA	2.8	0.2
PM10 PROJECTED ACTUAL EMISSIONS														(	10.4
					NET EMI	ISSIONS CHANGE (PAE - B	AE)								
PAE - BAE															9.3

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline

C - reserved

D - Historically high fuel oll percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design.

G - reserved

H - reserved.

#### PMZ.5 EMISSIONS CALCULATIONS

	Stripper	Scenario ing Time		Ope	rating ation Time		Con Operat	trois ing Time	Produ	ction Rate	Ph Emissio	12 5 ns Fector	PMZ.5 Control	PM2.5 8	Emissions
Stripper Operating Scenario	96	hrs	Operating Configuration	*	hrs	Controls	*	hrs	Value	NON	Ib/UOM	Reference	*	ib/hr	toy
	2			8	ASELINE ACTUAL	MISSIONS (March 2021 - Fe	ebruary 2023)								
Backup Stripper Steam*	91.4%	8.004.0	Natural Gas <sup>®</sup>	97.9%	7,835.7		100.0%	7,835 7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam <sup>4</sup>	91.4%	8.004.0	No 6 Oil"	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	8.80E-02	AP-42	NA	2.5	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															1.1
					PROJ	ECTED ACTUAL EMISSIONS	-	1. 10 March 10			-			-	
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7 60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>o</sup>	81.6%	6,433,3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oll	90.0%	7,884.0	No_6 Oll	18.4%	1,450.7		100.0%	1,450 7	92.2	mmBtu/hr	6 80E-02	AP-42	NA	8,1	5.9
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>0</sup>	81.6%	571.9		100.0%	571.9	25.3	mm8tu/hr	7 60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oll <sup>o</sup>	18.4%	128.9		100.0%	128 9	24.1	mmBtu/hr	8 80E-02	AP-42	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS				1						1	-	-			8.4
					NET EM	ISSIONS CHANGE PAE - BA	E)					-			
PAE - BAE															7.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion Average fossil fuel distribution in Combination Boilers No 1 and No 2 during baseline

C - reserved

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - reserved

H - reserved

#### LEAD EMISSIONS CALCULATIONS

	Stripper Operat	Scenario Ing Time		Oper Configura	nating ation Time		Con Operati	trois Ing Time	Produ	tion Rate	Le Emissio	ead ns Factor	Lead Control	Lead Er	missions
Stripper Operating Scenario	%	brs	Operating Configuration		hrs	Controls	%	hrs	Value	UOM	Ib/UOM	Reference	%	lb/hr	tpy
		-		BASE	LINE ACTUAL EN	ASSIONS (March 2021 -	February 2023)		-						
Backup Stripper Steam	91.4%	8,004.0	Natural Gas <sup>8</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	5.00E-07	AP-42	NA	1.48E-05	5.78E-05
Backup Stripper Steam	91.4%	8,004.0	No. 6 Oil <sup>e</sup>	2 1%	168.3		100.0%	168.3	28.1	mmBtu/hr	2.80E-05	AP-42	NA	7.87E-04	6.63E-05
LEAD BASELINE ACTUAL EMISSIONS	-														1.24E-04
					PROJEC	TED ACTUAL EMISSION	5		-	1					
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	985.5	10	mmBtu/hr	5 00E-07	AP-42	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>0</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42	NA	4 84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 OIP	18.4%	1,450.7		100.0%	1,450.7	92.2	mm8tu/hr	2 BOE-05	AP-42	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>0</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	5.00E-07	AP-42	NA	1 27E-05	3.62E-06
Backup Stripper Steam - No. 6 Oli	8.0%	700.8	No. 6 Olf	18.4%	128.9		100.0%	128 9	24 1	mmBtu/hr	2.80E-05	AP-42	NA	6 75E-04	4.35E-05
LEAD PROJECTED ACTUAL EMISSIONS	-														2.08E-03
				-	NET EMIS	SIONS CHANGE (PAE - E	AE)					-		-	
PAE - BAE															1.95E-03

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion Average fossil fuel distribution in Combination Boilers No 1 and No 2 during baseline

C - reserved

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022

F - Projected steam usage at 850 gpm from vendor design

G - reserved

H - reserved

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor

8-13

#### CO2 EMISSIONS CALCULATIONS

	Stripper	Scenario ing Time		Configure	nting Ition Time		Con Operat	trois Ing Time	Produc	ction Rate	C Emissio	OZ ns Factor	CO2 Control	CO2 Em	aissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	5	hrs	Value	UOM	Ib/UOM	Reference	%	lb/hr	tpy
				BAS	ELINE ACTUAL EN	MISSIONS (March 2021 -	February 2023)	1	-		102				
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835 7		100.0%	7,835,7	29.5	mmBtu/hr	1 17E+02	AP-42	NA	3,448.9	13,512
Backup Stripper Steam <sup>4</sup>	91.4%	8,004.0	No. 6 Oll <sup>e</sup>	2.1%	168 3		100 0%	168 3	28 1	mmBtu/hr	1 66E+02	AP-42	NA	4,655.3	392
CO2 BASELINE ACTUAL EMISSIONS		-												( ) · · · · · · · · · · · · · · · · · ·	13,904
	200				PROJE	CTED ACTUAL EMISSION	5			5					
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	AP-42	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1 17E+02	AP-42	NA	11,313 5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oll	18.4%	1,450.7		100 0%	1,450 7	92 2	mmBtu/hr	1.66E+02	AP-42	NA	15,270 9	11,076
Hackup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100 0%	571 9	25 3	mmBtu/hr	1 17E+02	AP-42	NA	2,958.3	846
Backup Stripper Steam - No. 6 Oll	8.0%	700.8	No 6 Oll	18.4%	128.9		100.0%	128 9	24 1	mmBtu/hr	1 66E+02	AP-42	NA	3,993.0	257
CO2 PROJECTED ACTUAL EMISSIONS							2010-002								48,629
	-				NET EMIS	SSIONS CHANGE [PAE -	AE)								
PAE - BAE															34.725

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion, Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline

C - reserved

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design

G - reserved

H - reserved

#### SUMMARY OF ASB EMISSIONS FACTORS

	Service 2		ASB Em	issions Factors (It	o/ODTP)		
Scenario	H <sub>2</sub> S	DMDS	DMS	ммс	Methanol	voc <sup>4</sup>	TRS <sup>B</sup>
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	0.92	0.97	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	0.30	0.32	0.0269
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	1.53	1.58	0.0302
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

		Concentration (ppm)				
		Hydrogen	Methyl	Dimethyl	Dimethyl	
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	<b>Total TRS</b>
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 or 6/25		146.7	16.0	17.0	15.0	194.7

		MW
H2S	Hydrogen Sulfide	34.08 g/mol
Ch4S	Methyl Mercaptan	48.11 g/mol
C2H6S	Dimethyl Sulfide	62.13 g/mol
C2H6S2	Dimethyl Disulfide	94.20 g/mol
S	Sulfur	32.07 g/mol

Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl	
Sulfide	Mercaptan	Sulfide	Disulfide	
138.0	10.7	8.8	10.2	
82.3%	6.4%	5.2%	6.1%	

S (ppm)	168 Maximum feed to stripper (AHL)
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.70

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

#### Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG
#### CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination Boiler No. 1 Natural Gas mmBtu	Combination Boiler No. 2 Natural Gas mmBtu	Total Natural Gas mmBtu	Combination Boiler No. 1 No. 6 Fuel Oil gallons	Combination Boiler No. 2 No. 6 Fuel Oil gallons	Total No. 6 Fuel Oil gallons	Total No. 6 Fuel Oil mmBtu
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309
Apr-21	43,075	41,363	75,012	116.376	0	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384
Feb-23	39,276	78,431	96.813	175,244	21,626	53	21,679	3,252
Total	996,766		1	3,237,544				69,553
nual Average	498,383	1 1	1					
				97.9%	-			2.1%



# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PEROXIDE ADDITION





Source: TB949 H2O2 Mill Bench Scale Study

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B-19



## 1/27/2022 and 2/8/2022 H202/FC Bench Test Results w/ Corrected Ratios



NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT

# SUMMARY OF INDUSTRY EXPERIENCE WITH ODOR MINIMIZATION AT WASTEWATER TREATMENT PLANTS

TECHNICAL BULLETIN NO. 949 MAY 2008

by Diana Cook NCASI West Coast Regional Center Corvallis, Oregon

#### 5.3 Oxidation

Several oxidizing agents have been used for destruction of odors resulting from  $H_2S$ . The approach is to oxidize the sulfide into nonvolatile forms such as elemental sulfur, thiosulfate, sulfite, and sulfate. Chemical oxidation reactions are generally slower than biochemical oxidation reactions (ASCE 1989). In the presence of large organic loads, as with industrial wastewaters, the economics of oxidizing agent use can be prohibitive due to competitive reactions with organic materials. Some of the commonly used oxidizing agents are chlorine, chlorine dioxide, hypochlorite, oxygen, and hydrogen peroxide. Industry experience with use of oxidizing agents is summarized herein.

#### 5.3.1 Hydrogen Peroxide

Hydrogen peroxide ( $H_2O_2$ ) can be used to chemically oxidize  $H_2S$  into either elemental sulfur or sulfate (the former at pH <8 to 9; the latter at pH >8 to 9), as shown in Equations 5.6 and 5.7. In the range of pH 7 to 9, both reactions may occur. Excess  $H_2O_2$  can oxidize other wastewater components or decompose to release oxygen and water.

$$H_2O_2 + H_2S \rightarrow S + 2H_2O \qquad (Eq. 5.6)$$

$$4H_2O_2 + S^{2-} \rightarrow SO_4^{2-} + 4H_2O$$
 (Eq. 5.7)

 $H_2O_2$  is a clear, colorless, nonflammable compound that is miscible with water in all proportions and is normally sold as a solution expressed as a percentage of the solution's weight (e.g., a 35% solution contains 35%  $H_2O_2$  and 65% water by weight). Solutions of >8% are classified as oxidizers by the U.S. Department of Transportation.  $H_2O_2$  can be obtained in small drums or tanks equipped with metering pumps and plumbed to the addition point. Storage containers must be properly vented because contamination or excess heat can accelerate decomposition to oxygen and water. Special safety handling is required, including eye protection and protective clothing.

Davies, Christy, and O'Connor (2000) reported on the effectiveness of using  $H_2O_2$  to control odors resulting from release of  $H_2S$  at four locations around the WWTP at a pulp and paper mill in Canada. The specific objectives were to reduce  $H_2S$  concentration in an anaerobic spill basin effluent returned to the effluent clarification and treatment system; treat anaerobic sludge from the spill basin; minimize odors arising from sewering condensates; and treat all foul condensates from the mill during a scheduled shutdown of the steam stripper.

 $H_2O_2$  was found to be effective for odor reduction at all the locations. It was added to the anaerobic spill basin effluent at a location that promoted good mixing prior to introduction into the clarifier. The residence time associated with transfer of effluent from the spill basin to the clarifier was sufficient to oxidize  $H_2S$  and minimize odor. Sludge dewatering equipment consisted of a screen, an agitation tank, a centrifuge, and a belt press.  $H_2O_2$  was added to the agitation tank. In addition, an odor-controlling spray (Ecosorb) was applied to the air around the screens to capture any residual odors.  $H_2O_2$  was also used to reduce odors during occasional sewering of condensates. Dosage levels were selected based on laboratory studies that indicated that ~200 mg  $H_2O_2/L$  of treated condensate was sufficient to remove odors. A solution containing 50%  $H_2O_2$  was also used to reduce odors during steam stripper downtime events when foul condensates were piped directly into the aeration pond.

 $H_2O_2$  and calcium peroxide (CaO<sub>2</sub>) have been used in the presence of peroxidase, an enzyme found in horseradish, to remove odors in swine manure. Swine manure is known to contain large amounts of VFAs, phenolic compounds, and indolic compounds that have been implicated in odor. Peroxidase, in the presence of peroxides, has been found to polymerize phenolic odorants, thereby reducing associated odors (Govere et al. 2007).

 $H_2O_2$  has also been used successfully as one element of a multi-pronged approach to control odor attributed to VFA generation in anaerobic environments (Davis and Smith 2001).  $H_2O_2$  would be particularly beneficial for use in mills with high levels of water reuse (e.g., some recycle mills). Oxygen-limited environments in the process water transport system at those facilities can be ideal for anaerobic bacterial growth. Traditional oxidizers such as sodium hypochlorite, chlorine, and chlorine dioxide increase total chloride and conductivity in the reused effluent, which can disrupt process performance and cause corrosion. The multi-pronged approach used at a 100% recycled corrugating medium mill focused on good operating practices aimed at oxygenation, biocide application to control the amount of aerobic bacteria, and  $H_2O_2$  use to prevent anaerobic environments in the secondary treatment system (Davis and Smith 2001).

NCASI assisted a bleached kraft mill that conducted a trial to investigate the effects of adding  $H_2O_2$  to foul condensates. Foul condensates were piped directly to the first basin of a multi-stage ASB. Samples were collected at two locations (just prior to addition of peroxide and just following the addition point) over a five-day period to assess impacts on sulfide concentrations. Samples were analyzed using direct injection GC/PFPD (NCASI Method RSC-02.02; NCASI 2007).  $H_2O_2$  was added as a 50% solution at a rate of 1.78 gallons per minute (GPM) to the foul condensate stream, which had a flow rate of 3 MGD, resulting in a concentration of approximately 0.51 g  $H_2O_2/L$  of foul condensate. The average reduction in sulfide concentration was over 79%, as illustrated in Figure 5.3.



**Figure 5.3** Sulfide Concentrations after Peroxide Addition (0.51 g/L) to a Foul Condensate [numbers above bars represent percent reductions in total sulfide observed each day]

Dosage and retention time trends were evaluated using a screening technique that involved collecting 25-mL samples in a 500-mL bottle that was closed and agitated for one minute. The cap was removed and a Jerome air monitor was used to measure volatile  $H_2S$  in the headspace. The effect of peroxide dose and retention time are illustrated in Figure 5.4. Reductions of >90% were observed after the first minute, and at some dosage rates they increased modestly with additional retention time. Figure 5.5 illustrates trends for doses of 0.5 and 1.0 GPM of a 50%  $H_2O_2$  solution to the 3 MGD foul condensate at the four sampling locations (drop legs 1 through 4). Although some variability was observed, a significant reduction in sulfide was observed at the first drop leg under both addition rates investigated and increased gradually as the foul condensate progressed through the drop legs.



**Figure 5.4** Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Retention Time on Sulfide Removal Efficiency [headspace measurements]



**Figure 5.5** Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Sample Location on Sulfide Removal Efficiency [headspace measurements]

Another example of  $H_2O_2$  use at a bleached kraft mill is illustrated in Figure 5.6. The mill conducted a bench study prior to an odor reduction trial to determine the dose-response curve for peroxide addition to foul condensates. Foul condensates were treated with the oxidant (50%  $H_2O_2$ ; density 1.2 g/mL) volumes shown in the figure (equivalent to 0.14, 0.29, 0.43, and 0.56 g  $H_2O_2/L$  of foul condensate) at 50°C for 30 minutes in sealed vials. Samples were removed and analyzed by direct aqueous injection GC/sulfur chemiluminescence detectors (SCD) for sulfide, MeSH, DMS, and

DMDS. The data indicate that sulfide and MeSH were readily removed, but that DMS required significantly higher doses to achieve equivalent levels of removal. DMDS was not removed and in fact increased with peroxide dose, presumably due to oxidation of MeSH.



Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Following the bench studies, a mill trial was conducted over a five day period.  $H_2O_2$  was added to the foul condensate tank (pH 9.0 to 9.3) at a rate of 1 gallon (100%  $H_2O_2$ ) to every 500 gallons of condensate, which is equivalent to 2.8 g  $H_2O_2/L$  of foul condensate. This addition point provided a retention time of ~30 minutes prior to the WWTP. The trial resulted in overall average reductions in sulfide, MeSH, and DMS of 38.8, 64.6, and -3.9%, respectively (Table 5.1). The level of DMDS increased (probably due to oxidation of MeSH to DMDS) during the addition but reportedly did not affect overall odor from the WWTP (NCASI files). The mill continues to feed  $H_2O_2$  to the foul condensate and has reported a reduction in odor at the WWTP.

Ų			
Day of Study	$H_2S$	MeSH	DMS
1	26.1	67.3	-20.8
2	68.3	74.7	16.5
3	38.1	57.0	1.9
4	36.4	60.0	2.6
5	25.3	63.8	-19.5
Average	38.8	64.6	-3.86

Table 5.1	Percent Reduction in Hydrogen Sulfide, Methyl Mercaptan, and Dimethyl Sulfide
	during a Peroxide Addition Trial Conducted in a Foul Condensate

## WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION BASELINE ACTUAL EMISSIONS

### May/July 2022 Baseline Emissions Calculations H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

		Method: GC/SCD Reduced Sulfur Analysis (Average)					
Sample Date	Sample Location	ALS H2S, ppb	ALS DMDS, ppb	ALS DMS, ppb	ALS MMC, ppl		
2021/2022	Avg. ASB Influent (2021 and 2022)	252	86.78	199	2.60		
ALC: NO. 1	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	105,667	6,633	14,667	8,267		
5/17/2022	Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99		
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1,057	14,647	1,467	82.67		
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	58,333	5,633	5,400	3,900		
7/19/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99		
and the second second	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	583	9,414	540	39.00		
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	76.200	6.932	7.140	7,393		
7/20/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99		
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	762	14,099	714	73.93		
Deres de la compo	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	62,500	8.967	9.200	6.533		
7/21/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99		
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	625	15,300	920	65.33		
		ALS H2S, ppm	ALS DMDS, ppm	ALS DMS, ppm	ALS MMC, ppm		
	Avg. Foul Condensate Concentration (after peroxide)	0.76	13.36	0.91	0.07		
	Avg. ASB Inlet Concentration	0.25	0.09	0.20	2.60E-03		
Loading Calculation	Avg. Hardpipe Flow, MGD	0.34	1,34	034	0.57		
Louding calculation	Avg. ASB Inlet Flow, MGD	23.96	- 23/45	23.95	23,25		
	Total Flow	24.30	24.22	34129	43		
	Flow Weight. Avg. Loading (ppm)	0.2593	0.2712	0.2088	0.0035		
	H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s		
A CONTRACT LINE	ASB Zone 1		0.10	0.15	2.74E-03		
Populte and Emissions	ASB Zone 2	Multiple	1.43E-03	3.05E-03	4.63E-05		
Results and Emissions	ASB Zone 3	H2SSIM runs.	2.57E-05	1.01E-04	1.43E-06		
	Total ASB		0.10	0.16	2.78E-03		
	Baseline Emissions Factor 2200 ODTP/day	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP		
	Baseline Emissions Factor	1.51E-02	1.14E-02	1.85E-02	3.28E-04		

Type of unit is 1 Total water added at the unit (1/s) 50 0 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 8 manhole air velocity (ft/min) 128 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 15 radius of underflow conduit (cm) 12 25 16 Underflow T (C) 17 oscillation cycle time (min) 5 18 design collection velocities (ft/s) 2 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight 0 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input  $\cap$ 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

24

28

44

4.6

hl= 0.001714 atm-m3/mol vp = 45.945 mmHg (0.88868 psia)95.2 y/x 0.068011 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C kl = 0. L/q-hrdl= 1.041e-05 cm2/s dv= 0.088022 cm2/s Compound flow rate from inlet water is 0.26179 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 31.792 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 237.766. kl is estimated as 5.971e-06 m/s. kg is estimated as 0.005598 m/s. Model: 2 kg is estimated as 0.005598 m/s. Model: 2 The Schmidt number is 1.70412. The friction velocity is 37.398 m/s kg is estimated as 0.012927 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.11564 m/s. kl (agitated) is estimated as 0.017486 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 2.753e-04 m/s. The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1907.493 min. (31.792 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.11781 KL aerated (m/s) 0.017486 KL OVERALL AERATED (m/s) 0.005609 KG quiescent (m/s) 0.005703 KL quiescent (m/s) 5.971e-06 KL OVERALL QUIESCENT (m/s) 5.883e-06 2.753e-04 KL OVERALL (m/s) 84.752 air stripping time constant (min) FRACTION SURFACE VOLATILIZED 0.36432 FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.36432 FRACTION BIOLOGICALLY REMOVED 0.61949 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 0.095374 (Mg/year) 3.00772 EMISSION FACTOR (g/cm2-s) 1.096e-10 UNIT EXIT CONCENTRATION (ppmw) 0.003981 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (g/s) 0.

(Mg/year) Ο. EMISSION FACTOR (g/cm2-s) 1.096e-10 UNIT EXIT CONCENTRATION (ppmw) 6.079e-06 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (l/s)  $\cap$ 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 1 7 Open surface=1 0 8 Subsurface entrance=1  $\cap$ 9 subsurface exit =1 \_\_\_\_\_\_\_\_\_\_(Cm)
II distance to next unit (cm)
I2 slope of underflow conduit
I6 velocity air at drain opening (ft/min)
I7 municipal waste in conduit =1
I8 Assume equilibrium in unit 10 radius of underflow conduit (cm) 12 500 0.015 84 0 0 19 pH (enter 0 for no pH adjustment) 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1064.53 l/s. Weight fraction down is 2.712E-07 Gas concentration in 0 mol fraction. Gas flow 1064.53 L/s Weight fraction out at base of drop is 2.45916666343852E-07 fraction transferred in the drain drop from hub is .093228 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. 161 162 163 164 165 166 fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.093228 fraction loss in unit Ο. fraction loss in line run 0. component upstream of unit, g/s 0. mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 0. headspace end of conduit (y) 3.134e-19 mol fract. headspace vent base 6.978e-06 headspace flow out vent (cc/s) headspace flow down line (cc/s) -1.065e+06 1.065e+06 KG surface (m/s) 1860.422 KL surface (m/s) 6.37e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.2887 total component into unit, g/s 0.26179 TOTAL AIR EMISSIONS (g/s) 0.026915 (Mg/year) 0.84879 EMISSION FACTOR (g/cm2-s) 1.096e-10 UNIT EXIT CONCENTRATION (ppmw) 0.24592 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

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2 Wastewater temperature (C)
                                                                                        30.01
                3 length of aeration unit (m)
                                                                                       376
4 width of aeration unit (m)

5 depth of aeration unit (m)

6 Area of agitation (each aerator,m2)

7 Total number of agitators in the unit

8 Power of agitation (each aerator,HP)

9 Impeller diameter (cm)

10 Impeller rotation (RPM)

11 Agitator mechanical efficiency

12 aerator effectiveness, alpha

13 if there is plug flow, enter 1

14 Overall biorate (mg/g bio-hr)

15 Aeration air flow (m3/s)

16 active biomass, aeration (g/l)

17 If covered, then enter 1

205

18 special input

207

19 pH (enter 0 for no pH adjustment)
               4 width of aeration unit (m)
                                                                                       188
                                                                                       0.91
                                                                                       135
                                                                                       75
                                                                                       49.53
                                                                                       1200
                                                                                      0.83
                                                                                     0.83
                                                                                      Ω
                                                                                      19
                                                                                       0
                                                                                       0.3
                                                                                       Ω
                                                                                        0
                19 pH (enter 0 for no pH adjustment)
                                                                                        7.42
              Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
                   hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia)
                           78.352 y/x
                           0.056726 g/L gas per g/L liquid
                   Temperature adjustment factor = 1.046 ^(T-25), deg. C
                    kl= 0. L/g-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
           Compound flow rate from inlet water is 1.411e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
24.6
              The residence time in the unit is 16.785 hr.
                 ____Biomass production
                      The biomass production rate is 0.mg/hr. (0. mg/L)
                       The fraction dissolved solids converted is 0. .
                       The estimated biomass exit concentration is 0. mg/L.
                       Quiescent wind shear surface ____Springer
             kl is estimated as 5.918e-06 m/s.
              kg is estimated as 0.005575 m/s. Model: 2
          kg is estimated as 0.005575 m/s. Model: 2

kg is estimated as 0.005575 m/s. Model: 2

The Schmidt number is 1.74436.

The friction velocity is 37.398 m/s

kg is estimated as 0.012742 m/s. Model: 3

______Agitated surface

The rotation speed is 125.654 radians per second.
229
231
233
234
              The rotation factor NRW is 2.052e+06.
              The power number NPR is 7.881e-04.
              The rotation factor NFR is 797.027.
                kg (agitated) is estimated as 0.1143 m/s.
               kl (agitated) is estimated as 0.015772 m/s.
240
                      The specified and growth biomass is 0.3 g/L.
                  The effective KL (surface + diffused air) is 5.972e-05 m/s.
                  The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
                   hrs.)
                  The pump mixing time is 5 x the pumping recirculaion time, 0. min.
                  The ratio of the mixing to the striping (surface + diffused air) is 0.
                 The mean residence time is 1007.112 min. (16.785 hr.)
                 The ratio of the pump mixing to the residence time is 0.
                 KG aerated (m/s)
KL aerated (m/s)
KL OVERALL AERATED (m/s)
                                                                                0.11644
                                                                                0.015772
                                                                                0.004711
                  KG quiescent (m/s)
KL quiescent (m/s)
                                                                                0.005679
                                                                               5.918e-06
                   KL OVERALL QUIESCENT (m/s)
                                                                              5.813e-06
                   KL OVERALL (m/s)
                                                                               5.972e-05
                    air stripping time constant (min)
                                                                               253.944
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B-31
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FRACTION SURFACE VOLATILIZED 0.18189 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.18189 FRACTION BIOLOGICALLY REMOVED 0.77225 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 2.567e-05 (Mg/year) 8.094e-04 EMISSION FACTOR (g/cm2-s) 3.631e-14 UNIT EXIT CONCENTRATION (ppmw) 6.079e-06 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 32.08 2 Wastewater temperature (C) 368 3 length of aeration unit (m) 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 279 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 289 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 86.579 y/x 0.062258 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.034e-05 cm2/s dv= 0.087022 cm2/s k1=0. L/q-hrCompound flow rate from inlet water is 0.004238 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.11498 m/s.							
320	kl (agitated)is estimated as 0.016622 m/s.							
321	The specified and growth biomass is $0.3 \text{ g/L}$ .							
322	The effective KL (surface + diffused air)	is 1.598e-04 m/s.						
323	The effective stripping time (surface + diffused air) is 101.198 minutes.							
	(1.68663 hrs.)							
324	The pump mixing time is 5 x the pumping recirculaion time, 0. min.							
325	The ratio of the mixing to the striping (s	urface + diffused air) is 0.						
326	The mean residence time is 1028.32 min. (1	7.139 hr.)						
327	The ratio of the pump mixing to the reside	nce time is 0.						
328	KG aerated (m/s)	0.11714						
329	KL aerated (m/s)	0.016622						
330	KL OVERALL AERATED (m/s)	0.005152						
331	KG quiescent (m/s)	0.005738						
332	KL quiescent (m/s)	5.945e-06						
333	KL OVERALL QUIESCENT (m/s)	5.85e-06						
334	KL OVERALL (m/s)	1.598e-04						
335	air stripping time constant (min)	101.198						
336	FRACTION SURFACE VOLATILIZED	0.33837						
337	FRACTION SUBMERGED VOLATILIZED	0.						
338	TOTAL FRACTION VOLATILIZED	0.33837						
339	FRACTION BIOLOGICALLY REMOVED	0.62833						
340	FRACTION ABSORBED	0.						
341	TOTAL AIR EMISSIONS (g/s)	0.001434						
342	(Mg/year)	0.045218						
343	EMISSION FACTOR (g/cm2-s)	2.118e-12						
344	UNIT EXIT CONCENTRATION (ppmw)	1.326e-04						
345								

Type of unit is 50 0 1 Total water added at the unit (1/s) 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 ŭ., 25 6 Temperature of air (C) 7 Drain air velocity (ft/min) 84 8 manhole air velocity (ft/min) 128 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 .006 14 friction factor gas 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 17 oscillation cycle time (min) 5 2 18 design collection velocities (ft/s) 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight Ο 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

hl= 0.002924 atm-m3/mol vp = 704.653 mmHg (13.629 psia)162.463 v/x 0.11606 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s k1=0. L/g-hrCompound flow rate from inlet water is 0.19189 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 31.792 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 237.766. kl is estimated as 7.634e-06 m/s. kg is estimated as 0.007917 m/s. Model: 2 kg is estimated as 0.007917 m/s. Model: 2 The Schmidt number is 1.01591. The friction velocity is 37.398 m/s kg is estimated as 0.017873 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14978 m/s. kl (agitated) is estimated as 0.021024 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 4.77e-04 m/s. The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1907.493 min. (31.792 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15258 KL aerated (m/s) 0.021024 KL OVERALL AERATED (m/s) 0.009769 KG quiescent (m/s) 0.008066 KL quiescent (m/s) 7.634e-06 KL OVERALL QUIESCENT (m/s) 7.574e-06 KL OVERALL (m/s) 4.77e-04 air stripping time constant (min) 48.915 FRACTION SURFACE VOLATILIZED 0.80226 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.80226 FRACTION BIOLOGICALLY REMOVED 0.17717 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 0.15394 (Mg/year) 4.85471 EMISSION FACTOR (g/cm2-s) 1.769e-10 UNIT EXIT CONCENTRATION (ppmw) 0.003708 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (q/s) 0. B-35

104

114

(Mg/year) EMISSION FACTOR (g/cm2-s) 0. 1.769e-10 UNIT EXIT CONCENTRATION (ppmw) 1.362e-05 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential \New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)Ω 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 8 Subsurface entrance=1 0 144 9 subsurface exit =1  $\cap$ 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 17 municipal waste in conduit =1 18 Assume equilibrium in unit, =1 84 0 0 19 pH (enter 0 for no pH adjustment) 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1064.53 l/s. Weight fraction down is 2.088E-07 Gas concentration in 0 mol fraction. Gas flow 1064.53 L/s Weight fraction out at base of drop is 1.80253671574623E-07 fraction transferred in the drain drop from hub is .136716 161 162 163 164 165 166 166 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.13672 fraction loss in unit Ο fraction loss in unit
fraction loss in line run
component upstream of unit, g/s
mol fract. headspace upstream (y)
headspace at conduit discharge, y
headspace end of conduit (y)
mol fract. headspace vent base
headspace flow out vent (cc/s)
headspace flow down line (cc/s)
KG surface (m/s)
KL surface (m/s) 0. Ο. 0. Ο. 4.509e-19 171 1.195e-05 -1.065e+06 1.065e+06 2626.947 KL surface (m/s)2020.74KL surface (m/s)8.245e-flow of waste down hub (l/s)0.component flow in waste into unit (g/s)0.22227total component into unit, g/s0.19189TOTAL AIR EMISSIONS (g/s)0.03038 8.245e-09 0.030388 (Mg/year) 0.95833 EMISSION FACTOR (g/cm2-s) 1.769e-10 UNIT EXIT CONCENTRATION (ppmw) 0.18025 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

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30.01 2 Wastewater temperature (C) 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 o rower of agitation (each aerator 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall bisects (min) 49.53 1200 11 Agitator mechanical efficiency 0.83 0.83 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 0.3 204 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F) hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia) 139.945 y/x 0.10132 g/L gas per g/L liquid 213 Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deq. C k1= 0. L/q-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s Compound flow rate from inlet water is 1.708e-04 g/s. Compound flow rate from inlet vent is 0. q/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.785 hr. \_\_\_\_Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.566e-06 m/s. kg is estimated as 0.007884 m/s. Model: 2 kg is estimated as 0.007884 m/s. Model: 2 230 The Schmidt number is 1.03989. The friction velocity is 37.398 m/s kg is estimated as 0.017611 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. 234 235 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14804 m/s. kl (agitated) is estimated as 0.018962 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.053e-04 m/s. The effective stripping time (surface + diffused air) is 144.073 minutes. (2.40122 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1007.112 min. (16.785 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15081 KL aerated (m/s) 0.018962 KL OVERALL AERATED (m/s) 0.00854 KG quiescent (m/s) KL quiescent (m/s) 0.008032 7.566e-06 KL OVERALL QUIESCENT (m/s) 7.497e-06 KL OVERALL (m/s) 1.053e-04 air stripping time constant (min) 144.073

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FRACTION SURFACE VOLATILIZED 0.59355 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.59355 FRACTION BIOLOGICALLY REMOVED 0.32154 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 1.014e-04 (Mg/year) 0.003197 EMISSION FACTOR (g/cm2-s) 1.434e-13 UNIT EXIT CONCENTRATION (ppmw) 1.362e-05 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential \New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment ASB Zone 2 1 Description of unit 18 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 274 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 15 75 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical eff 49.53 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 0 19 284 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 287 18 special input Ω 19 pH (enter 0 for no pH adjustment) 7.24 290 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) 291 hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 292 151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.495e-05 cm2/s dv= 0.14597 cm2/s k1= 0. L/g-hr Compound flow rate from inlet water is 0.003948 g/s. Compound flow rate from inlet vent is 0. g/s. 297 298 Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.14892 m/s.						
320	kl (agitated) is estimated as 0.019984 m/s						
321	The specified and growth biomass is 0	.3 g/L.					
322	The effective KL (surface + diffused air) is 2.809e-04 m/s.						
323	The effective stripping time (surface + o	diffused air) is 57.552 minutes. (0.9592					
	hrs.)						
324	The pump mixing time is 5 x the pumping :	recirculaion time, O. min.					
325	The ratio of the mixing to the striping	(surface + diffused air) is 0.					
326	The mean residence time is 1028.32 min.	(17.139 hr.)					
327	The ratio of the pump mixing to the resid	dence time is 0.					
328	KG aerated (m/s)	0.15171					
329	KL aerated (m/s)	0.019984					
330	KL OVERALL AERATED (m/s)	0.009148					
331	KG quiescent (m/s)	0.008115					
332	KL quiescent (m/s)	7.6e-06					
333	KL OVERALL QUIESCENT (m/s)	7.537e-06					
334	KL OVERALL (m/s)	2.809e-04					
335	air stripping time constant (min)	57.552					
336	FRACTION SURFACE VOLATILIZED	0.77311					
337	FRACTION SUBMERGED VOLATILIZED	0.					
338	TOTAL FRACTION VOLATILIZED	0.77311					
339	FRACTION BIOLOGICALLY REMOVED	0.18362					
340	FRACTION ABSORBED	0.					
341	TOTAL AIR EMISSIONS (g/s)	0.003052					
342	(Mg/year)	0.096247					
343	EMISSION FACTOR (g/cm2-s)	4.507e-12					
344	UNIT EXIT CONCENTRATION (ppmw)	1.605e-04					
345							

Type of unit is 1 Total water added at the unit (1/s)50 0 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 128 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 12 15 radius of underflow conduit (cm) 25 16 Underflow T (C) 17 oscillation cycle time (min) 5 2 18 design collection velocities (ft/s) 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight 0 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential \New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 295 3 length of aeration unit (m) 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

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hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia) 230.99 y/x 0.16502 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s k1=0. L/q-hrCompound flow rate from inlet water is 0.003078 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 31.792 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 237.766. kl is estimated as 7.703e-06 m/s. kg is estimated as 0.010871 m/s. Model: 2 kg is estimated as 0.010871 m/s. Model: 2 The Schmidt number is 0.63285. The friction velocity is 37.398 m/s kg is estimated as 0.024173 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.18977 m/s. kl (agitated) is estimated as 0.021167 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 6.265e-04 m/s. The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1907.493 min. (31.792 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.19332 KL aerated (m/s) 0.021167 KL OVERALL AERATED (m/s) 0.012876 KG quiescent (m/s) 0.011075 KL quiescent (m/s) 7.703e-06 KL OVERALL QUIESCENT (m/s) 7.672e-06 KL OVERALL (m/s) 6.265e-04 air stripping time constant (min) 37.242 FRACTION SURFACE VOLATILIZED 0.88891 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.88891 FRACTION BIOLOGICALLY REMOVED 0.093739 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 0.002736 0.086272 (Mg/year) EMISSION FACTOR (g/cm2-s)3.144e-12 UNIT EXIT CONCENTRATION (ppmw) 5.017e-05 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (g/s) 0. B-41

(Mg/year) 0. EMISSION FACTOR (q/cm2-s) 3.144e-12 UNIT EXIT CONCENTRATION (ppmw) 1.458e-07 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 0 8 Subsurface entrance=1 9 subsurface exit =1 Ω 10 radius of underflow conduit (cm) 11 distance to next unit (cm) 12 slope of underflow conduit 16 velocity air at drain opening (ft/min) 17 municipal waste in conduit =1 18 Assume equilibrium in unit, =1 19 pH (enter 0 for no pH adjustment) 12 500 0.015 84 0 0 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1064.53 l/s. Weight fraction down is 3.5E-09 Gas concentration in 0 mol fraction. Gas flow 1064.53 L/s Gas flow1064.53 L/sWeight fraction out at base of drop is2.89099406807993E-09fraction transferred in the drain drop from hub is.174002fraction loss in wastel drop to hub0.fraction loss in waste2 drop to hub0.fraction loss in waste3 drop to hub0.fraction loss in collection hub drop0.174 159 160 161 162 163 164 165 166 167 fraction loss in collection hub drop fraction loss in unit fraction loss in line run component upstream of unit, g/s mol fract. headspace upstream (y) headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base headspace flow out vent (cc/s) headspace flow down line (cc/s) KG surface (m/s) KL surface (m/s) 0. 0. 0. 0. 0. 9.429e-21 3.292e-07 -1.065e+06 1.065e+06 3602.086 KL surface (m/s)8.324e-0KL surface (m/s)8.324e-0flow of waste down hub (l/s)0.component flow in waste into unit (g/s)0.003726total component into unit, g/s0.003078TOTAL AIR EMISSIONS (g/s)6.483e-0 8.324e-09 6.483e-04 (Mg/year) 0.020445 EMISSION FACTOR (g/cm2-s)3.144e-1UNIT EXIT CONCENTRATION (ppmw)0.002891 3.144e-12 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

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30.01
            2 Wastewater temperature (C)
                                                                            376
             3 length of aeration unit (m)
             4 width of aeration unit (m)
                                                                            188
            5 depth of aeration unit (m)
                                                                            0.91
            6 Area of agitation (each aerator,m2)
                                                                           135
           6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
16 active biomass, aeration (g/l)
17 If covered, then enter 1
                                                                            6
                                                                            75
                                                                            49.53
                                                                            1200
                                                                            0.83
                                                                           0.83
                                                                            0
                                                                           19
                                                                            0
                                                                           0.3
             17 If covered, then enter 1
                                                                            Ο
             18 special input
                                                                            0
                                                                            7.42
              19 pH (enter 0 for no pH adjustment)
            Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
              hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
                        204.826 y/x
                        0.14829 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
                 kl=0. L/g-hr dl=1.505e-05 cm2/s dv=0.23155 cm2/s
           Compound flow rate from inlet water is 1.957e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
              Total submerged aeration is 0. m3/s.
            The residence time in the unit is 16.785 hr.
              ____Biomass production
                   The biomass production rate is 0.mg/hr. (0. mg/L)
                    The fraction dissolved solids converted is 0. .
                    The estimated biomass exit concentration is 0. mg/L.
                     Quiescent wind shear surface Springer
           The fetch to depth ratio is 329.675.
              kl is estimated as 7.635e-06 m/s.
              kg is estimated as 0.010826 m/s. Model: 2
              kg is estimated as 0.010826 m/s. Model: 2
            kg is estimated as 0.010826 m/s. Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s. Model: 3
The rotation factor NRW is 2.052e+06.
             The power number NPR is 7.881e-04.
             The rotation factor NFR is 797.027.
              kg (agitated) is estimated as 0.18756 m/s.
              kl (agitated) is estimated as 0.019092 m/s.
240
                   The specified and growth biomass is 0.3 g/L.
                The effective KL (surface + diffused air) is 1.391e-04 m/s.
                The effective stripping time (surface + diffused air) is 109.038 minutes.
                (1.81731 hrs.)
                The pump mixing time is 5 x the pumping recirculaion time, 0. min.
                The ratio of the mixing to the striping (surface + diffused air) is 0.
               The mean residence time is 1007.112 min. (16.785 hr.)
              The ratio of the pump mixing to the residence time is 0.
                KG aerated (m/s)
                                                                      0.19108
                 KL aerated (m/s)
                                                                      0.019092
               KL OVERALL AERATED (m/s)
KG quiescent (m/s)
KL quiescent (m/s)
                                                                      0.011483
                                                                      0.011029
                                                                      7.635e-06
                KL OVERALL QUIESCENT (m/s)
                                                                      7.6e-06
                KL OVERALL (m/s)
                                                                     1.391e-04
                air stripping time constant (min)
                                                                     109.038
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FRACTION SURFACE VOLATILIZED 0.7324 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.7324 FRACTION BIOLOGICALLY REMOVED 0.1883 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 1.433e-06 (Mg/year) 4.52e-05 EMISSION FACTOR (g/cm2-s) 2.028e-15 UNIT EXIT CONCENTRATION (ppmw) 1.458e-07 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) Ω 19 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl = 0.003921 atm - m3/mol vp = 2142.771 mmHg (41.446 psia)217.838 y/x 293 0.15664 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/g-hrdl= 1.515e-05 cm2/s dv= 0.23433 cm2/s Compound flow rate from inlet water is 5.341e-05 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139 hr. \_\_\_\_Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. 309 kg is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0.010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.18868 m/s.									
320	kl (agitated)is estimated as 0.020121 m/s.									
321	The specified and growth biomass is $0.3 \text{ g/L}$ .									
322	The effective KL (surface + diffused air) is 3.715e-04 m/s.									
323	The effective stripping time (surface + d	iffused air) is 43.518 minutes. (0.72529								
	hrs.)									
324	The pump mixing time is 5 x the pumping recirculaion time, 0. min.									
325	The ratio of the mixing to the striping (	surface + diffused air) is 0.								
326	The mean residence time is 1028.32 min. (	17.139 hr.)								
327	The ratio of the pump mixing to the resid	ence time is 0.								
328	KG aerated (m/s)	0.19222								
329	KL aerated (m/s)	0.020121								
330	KL OVERALL AERATED (m/s)	0.012174								
331	KG quiescent (m/s)	0.011143								
332	KL quiescent (m/s)	7.67e-06								
333	KL OVERALL QUIESCENT (m/s)	7.637e-06								
334	KL OVERALL (m/s)	3.715e-04								
335	air stripping time constant (min)	43.518								
336	FRACTION SURFACE VOLATILIZED	0.86584								
337	FRACTION SUBMERGED VOLATILIZED	0.								
338	TOTAL FRACTION VOLATILIZED	0.86584								
339	FRACTION BIOLOGICALLY REMOVED	0.097514								
340	FRACTION ABSORBED	0.								
341	TOTAL AIR EMISSIONS (g/s)	4.625e-05								
342	(Mg/year)	0.001458								
343	EMISSION FACTOR (g/cm2-s)	6.83e-14								
344	UNIT EXIT CONCENTRATION (ppmw)	1.838e-06								
345										

#### BAE H2S Factor Summary of H2SSIM Inputs and Outputs

		H2SSI	M Inputs		Windspee	d: 3.55	mph			H2SSIM Outputs		
5/17/202	2											
		Zone 1	Zone 2	Zone 3						Zone 1 Zone 2	Zone 3	Total ASB
	DO	1.57	7 4.6	3 4.66		Main Inlet	Hardpip	e Units	H2S g/s	0.07 0.02	0.02	0.111 g/s
	Temp	87.5	2 83.9	1 80.19	Flow	25.11	0	.35 MGD				1723 ODTP
	рН	6.7	7 7.1	9 7.44	Total Sulfide	0.060	1	.06 mg/L				0.012 Ib/ODTP
	Length	968	3 120	8 1235	Sulfate	390		390 mg/L				
	Width	968	3 60-	4 617								
	Aerators	3	1 1	56								
	Total HP	232	5 112	5 450								
7/19/202	2										7 0	7 4 4 4 6 5
		Zone 1	Zone 2	Zone 3						Zone 1 Zone 2	Zone 3	I OTAL ASB
	DO	1.5	7 4.6	3 4.66	_	Main Inlet	Hardpip		H2S g/s	0.09 0.03	0.02	U.144 g/s
	Temp	96.2	7 93.3	7 89,26	Flow	25.32	0	.42 MGD				1900 ODTP
	рН	7.1	7 7.3	7 7.48	Total Sulfide	0.921	0.5	583 mg/L				0.014 ID/ODTP
	Length	96	8 120	8 1235	Sulfate	390		390 mg/L				
	Width	96	B 60	4 617								
	Aerators	3	1 1	56								
7/00/000	~											
//20/202	2	Zono 1	7000 0	7000 2						Zone 1 Zone 2	7000 3	Total ASB
	00	Zone 1	Zone Z	Zone s		Main Inlot	Hardnir	o Unite	H2S g/s		2016 3	
	Tomo	04.9	/ 4.0 0 01-0	J 4.00	Flow		пагорц		H25 9/5	0.00 0.00	0.02	1900 ODTP
	Temp	94.0	0 91.2 0 70	7 7 20	Total Sulfide	20.40	0	762 mg/l				
	Longth	7.1	0 7.2. B 120	2 7.59	Sulfate	300	0.1					0.011 10/0011
	Midth	90	B 60	A 617	Sullate	550		So mg/L				0.01
	Aoratore	30	0 00 1 1	4 017 5 6								0.01
	Aciditis	5		5 0								
7/21/202	2											
112 11202	<b>L</b>	Zone 1	Zone 2	Zone 3						Zone 1 Zone 2	Zone 3	Total ASB
	DO	1.5	7 4.6	3 4.66		Main Inlet	Hardpig	e Units	H2S a/s	0.06 0.03	0.02	0.111 a/s
	Temp	94.7	6 90.4	2 87.08	Flow	19.93	0	19 MGD				940 ODTP
	рН	7.1	0 7.1	9 7.35	Total Sulfide	0.094	0.0	625 ma/L				0.022 lb/ODTP
	Length	96	8 120	8 1235	Sulfate	390	1 1	390 mg/L				
	Width	96	8 60	4 617								
	Aerators	3	1 1	5 6								
		·	*DO are t	ased on avera	age of all DO readings fro	om 2021 and	2022 Su	bpart S pe	rformance testing.	AVG		0.015 Ib/ODTP

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

)ata Type 1. Site Ide	ntification		1.	Data Type 5. Zone Physi	cal and Chemical	Conditions						
Company Name New-Indy		Company Name New-In		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	5	Model Controls	
Facility Na	me	Catav	vba SC	Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/			
Basin Nar	Basin Name		SB	Temperature	87.52	83.91	80.19		F		Run H2SSIM	
Data Type 2. Model	Zone Informa	tion	The second	pH	6.77	7.19	7.44		s,u.			
Number of Zones	3 •			Redox Condition	Aerobic 💌	Aerobic *	Aerobic 💌	Aerobic 💌			View	
Zone Location of Hardpipe	1 🗸			Length	968	1208	1235		feet	•	Parameters	
Type of Basin	ASB -	2. J. P.		Width	968	604	617		feet	•	Clear Input	
ata Type 3. Load Ch	aracteristics			Depth	4.5	3.2	3		feet	-	Sheet	
Loading Characteristics	Main Influent	Hardpipe	Units	Mixing	Moderat	Moderat	Moderat -					
Flow	25.11	0.35	MGD -	Number of Aerators	31	15	6					
Total Sulfide	0.06	1.057	mg/L 🝷	Total Horsepower	2325	1125	450		HP			
Sulfate	390	390	mg/L 🕶	Impellor Size	1.625	1.625	1.625		feet	•		
ata Type 4. Atmosp	heric Conditi	ons		Impellor RPM	1200	1200	1200		RPN			
Windspeed	3.55	mph 🝷		Diffused Air Flow	0	0	0		cms			
Ambient Temperature	79	F -		Weir Height	0	0	0		feet	•		

5/17/2022

## **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7726.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.02	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4978.9	1486.3	1261.7	1.1	lbs/yr
Emission Flux (H <sub>2</sub> S)	25.9	9.9	8.1		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	34.400	6.200	5.200		lbs/yr

5/17/2022

Current Parameters						
kgen	0.25					
ThetaGen	1.06					
KDO	0.05					
KSO4	10					
kanox	0.006					
ThetaOx	1.05					
m	1					
n	0.2					
MLVSS	272.2					
O <sub>2</sub> Transfer Coeff.	2					
alpha 1	0.83					
alpha 2	0.6					

Percent Inlet Sulfide Removed -35.4%

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

7/19/2022

Data Type 1. Site Renuncation				Data Type 5. Zone Physi	cai and chemical	conditions						
Company N	ame	New	-Indy		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	5	Model Controls
Facility Na	Facility Name Catawba SC		Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/	£			
Basin Nar	Basin Name ASB			Temperature	96.27	93.37	89.26		F 💌		Run H2SSIM	
Data Type 2. Model	Zone Informat	tion	1	1	рH	7.17	7.37	7.48		s.u.	-	
Number of Zones	3 🔹				Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 🝷			View
Zone Location of Hardpipe	1 .				Length	968	1208	1235		feet	•	Parameters
Type of Basin	ASB -	and the second second		Width	968	604	617		feet		Clear Input	
Data Type 3. Load Ch	aracteristics			-	Depth	4.5	3.2	3		feet	-	Sheet
Loading Characteristics	Main Influent	Hardpipe	Units		Mixing	Moderat	Moderat	Moderat -				The second
Flow	25.32	0.42	MGD	•	Number of Aerators	31	15	6				
Total Sulfide	0.921	0.583	mg/L	•	Total Horsepower	2325	1125	450		HP		
Sulfate	390	390	mg/L	-	Impellor Size	1.625	1.625	1.625		feet	•	
Data Type 4. Atmosp	heric Conditio	ons			Impellor RPM	1200	1200	1200		RPM	•	
Windspeed	3.55	mph 🔸			Diffused Air Flow	0	0	0		cms		
Ambient	79	F 🗣			Weir Height	0	0	0		feet	•	

## **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.145	gms/s
Total Emissions (H <sub>2</sub> S)	10050.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	5.0	tons/yr
Total Emissions (H <sub>2</sub> S)	4.6	tonnes/yr
Emission Flux (H <sub>2</sub> S)	20.2	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.09	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	6430.8	1936.5	1683.0		lbs/yr
Emission Flux $(H_2S)$	33.5	13.0	10.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.005	0.000	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	60.200	6.100	5.400	say Ker	lbs/yr

7/19/2022

Current Parameters						
kgen	0.25					
ThetaGen	1.06					
KDO	0.05					
KSO4	10					
kanox	0.006					
ThetaOx	1.05					
m	1					
n	0.2					
MLVSS	272.2					
O <sub>2</sub> Transfer Coeff.	2					
alpha 1	0.83					
alpha 2	0.6					

Percent Inlet Sulfide Removed 86.0%

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

7/20/2022

Data Type 1. Site Identification			Data Type 5. Zone Physi	cal and Chemical	Conditions							
Company N	iny Name New-Indy		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units		Model Controls		
Facility Na	Facility Name Catawba SC		Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L		The second second		
Basin Nan	Basin Name ASB		Temperature	94.8	91.27	87.57		F	•	Run H2SSIM		
Data Type 2. Model 2	Zone informat	tion	19152	рH	7.1	7.22	7.39		s.u.			
Number of Zones	3 •	246		Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic -			View	
Zone Location of Hardpipe	1 -			Length	968	1208	1235		feet		Parameters	
Type of Basin	ASB 🗸			Width	968	604	617		feet	•	Clear Input	
Data Type 3. Load Ch	aracteristics			Depth	4.5	3.2	3		feet	-	Sheet	
Loading Characteristics	Main Influent	Hardpipe	Units	Mixing	Moderat	Moderat	Moderat -					
Flow	25.48	0.39	MGD -	Number of Aerators	31	15	6		100	N.		
Total Sulfide	0.053	0.762	mg/L 🕶	Total Horsepower	2325	1125	450		HP			
Sulfate	390	390	mg/L 💌	Impelior Size	1.625	1.625	1.625		feet	•		
Data Type 4. Atmospheric Conditions			Impellor RPM	1200	1200	1200		RPM				
Windspeed	3.55	mph 🔸		Diffused Air Flow	0	0	0		cms			
Ambient Temperature	79	F 🗸		Weir Height	0	0	0		feet			

### **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7721.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux $(H_2S)$	15.5	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4266.3	1852.9	1602.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	22.2	12.4	10.3		gms/m² yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	26.800	6.300	5.600		lbs/yr

**Current Parameters** 0.25 kgen ThetaGen 1.06 KDO 0.05 KSO4 10 0.006 kanox ThetaOx 1.05 1 m n 0.2 MLVSS 272.2 O<sub>2</sub> Transfer Coeff. 2 alpha 1 0.83 alpha 2 0.6

7/20/2022

Percent Inlet Sulfide Removed -54.1%
# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Ide	ntification			Data Type 5. Zone Physi	ical and Chemical	Conditions					
Company N	lame	New	-Indy	Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	s ] [	Model Controls
Facility Na	ime	Catav	vba SC	Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/		
Basin Na	me	A	SB	Temperature	94.76	90.42	87.08		F	•	Run H2SSIM
Data Type 2. Model	Zone Informat	tion		рН	7.1	7.19	7.35		s.u.		
Number of Zones	3 -			Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌			View
Zone Location of Hardpipe	1 -	43.94		Length	968	1208	1235		feet	•	Parameters
Type of Basin	ASB 🗸			Width	968	604	617	12,2-1	feet	•	Clear Input
Data Type 3. Load Cl	haracteristics			Depth	4.5	3.2	3		feet	•	Sheet
Loading Characteristics	Main Influent	Hardpipe	Units	Mixing	Moderat -	Moderat -	Moderat -				
Flow	19.93	0.19	MGD -	Number of Aerators	31	15	6				
Total Sulfide	0.094	0.625	mg/L 💌	Total Horsepower	2325	1125	450		HP		
Sulfate	390	390	mg/L 🝷	Impellor Size	1.625	1.625	1.625		feet	•	
Data Type 4. Atmosp	pheric Condition	ons	A PARA	Impellor RPM	1200	1200	1200		RPN		
Windspeed	3.55	mph 👻		Diffused Air Flow	0	0	0	24.24	cms	•	
Ambient Temperature	79	F -		Weir Height	0	0	0		feet	•	

7/21/2022

### **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7700.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4305.7	1814.2	1580.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	22.4	12.1	10.1		gms/m² yı
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000	14581 34	mg/L
Liquid Sulfide Load (lbs/yr)	21.300	5.000	4.400		lbs/yr

**Current Parameters** kgen 0.25 ThetaGen 1.06 0.05 KDO 10 KSO4 kanox 0.006 ThetaOx 1.05 1 m n 0.2 MLVSS 272.2 O<sub>2</sub> Transfer Coeff. 2 alpha 1 0.83 alpha 2 0.6

Percent Inlet Sulfide Removed -27.1%

7/21/2022

			Methanol Emissions
Date of Subpart S	Air Stripping*	Pulp	Factor
Performance Testing	g/s	Production	lb/ODTP
7/9/2021	14.10	1694	1.59
7/10/2021	11.58	1609	1.37
7/11/2021	8.71	1356	1.22
10/26/2021	15.17	1523	1.90
10/27/2021	12.03	1463	1.57
10/28/2021	13.31	1675	1.51
10/29/2021	12.16	1749	1.32
2/14/2022	8.69	1612	1.03
2/15/2022	8.96	1441	1.18
2/16/2022	10.15	1424	1.36
5/4/2022	0.50	2090	0.05
5/5/2022	1.54	1954	0.15
5/6/2022	1.03	2121	0.09
8/9/2022	1.60	2104	0.15
8/10/2022	1.78	1987	0.17
8/11/2022	1.33	1631	0.15
9/27/2022	1.60	1602	0.19
9/28/2022	1.78	1816	0.19
9/29/2022	1.33	1944	0.13
10/18/2022	0.89	1609	0.11
10/19/2022	0.33	1610	0.04
10/20/2022	0.19	1738	0.02

#### **Baseline Methanol Emissions Factor**

1.50 lb/ODTP, 2021 average 0.33 lb/ODTP, 2022 average 0.92 lb/ODTP, BAE Factor

\*Air Stripping (g/s) for each day of Subpart S performance testing in 2021 and 2022 are from the NCASI Form XIII calculations provided in the performance test reports.

# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PROJECTED ACTUAL EMISSIONS

## New Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

<b>Concentration Loadings</b>	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
No Hardpipe flow (foul or stripped)	N/A	N/A	N/A	N/A
ASB Influent (Wastewater)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.25	0.09	0.20	2.60E-03
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.03	0.15	2.13E-03
ASB Zone 2	0.03	5.03E-04	3.19E-03	3.77E-05
ASB Zone 3	0.02	9.42E-06	1.11E-04	1.22E-06
Total ASB	0.12	0.03	0.16	2.17E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.03E-02	2.81E-03	1.36E-02	1.88E-04

Hardpipe Flow (Foul or Stripped Condensate)	0	MGD
Post-Project ASB Influent Flow:	25.48	MGD
Total ASB Flow:	25.48	MGD
Total ASB Flow:	1116.47	L/s
Pulp Production	2200	ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is 1 Total water added at the unit (1/s)50 0 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 128 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 500 11 distance to next unit (cm) 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 12 15 radius of underflow conduit (cm) 16 Underflow T (C) 25 5 17 oscillation cycle time (min) 2 18 design collection velocities (ft/s) 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption Ω 9 unit recycle convergence number 200 10 oil molecular weight Ω 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature 34.08 (C) 295 3 length of aeration unit (m) 295 4 width of aeration unit (m) 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

18

32

```
hl= 0.001714 atm-m3/mol
                                vp = 45.945 mmHq (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
                          dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
   kl = 0. L/g-hr
Compound flow rate from inlet water is 0.087838 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
   Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
        Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
                                             0.11781
   KG aerated (m/s)
   KL aerated (m/s)
                                             0.017486
                                             0.005609
  KL OVERALL AERATED (m/s)
  KG quiescent (m/s)
                                            0.005703
  KL quiescent (m/s)
                                            5.971e-06
  KL OVERALL QUIESCENT (m/s)
                                            5.883e-06
  KL OVERALL (m/s)
                                            2.753e-04
                                            84.752
   air stripping time constant (min)
   FRACTION SURFACE VOLATILIZED
                                            0.36393
   FRACTION SUBMERGED VOLATILIZED
                                            0.
   TOTAL FRACTION VOLATILIZED
                                            0.36393
   FRACTION BIOLOGICALLY REMOVED
                                            0.61912
   FRACTION ABSORBED
                                            Ο.
   TOTAL AIR EMISSIONS (q/s)
                                            0.031967
                    (Mg/year)
                                            1.00811
   EMISSION FACTOR (g/cm2-s)
                                             3.673e-11
   UNIT EXIT CONCENTRATION (ppmw)
                                             0.001334
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50
COMPOUND: DIMETHYL DISULFIDE
Type of unit is system exit stream
1 Description of unit
                                            12
                                                  def.system exit st
   TOTAL AIR EMISSIONS (g/s)
                                             0.
                                  B-59
```

(Mg/year) 0. EMISSION FACTOR (g/cm2-s) 3.673e-11 UNIT EXIT CONCENTRATION (ppmw) 2.231e-06 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential New Stripper Permitting Emissions WWTP PAE New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 COMPOUND: DIMETHYL DISULFIDE Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 0 144 8 Subsurface entrance=1 9 subsurface exit =1 Ω 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 0 18 Assume equilibrium in unit, =1 0 19 pH (enter 0 for no pH adjustment) 8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1116 1/s. Weight fraction down is 8.680001E-08 Gas concentration in 0 mol fraction. Gas flow 1116 L/s Weight fraction out at base of drop is 7.87078550837274E-08 fraction transferred in the drain drop from hub is .093228 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 0.093228 fraction loss in unit 0. fraction loss in line run 0. component upstream of unit, g/s 0. mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 0. headspace end of conduit (y) 9.876e-20 mol fract. headspace vent base 2.233e-06 headspace flow out vent (cc/s) -1.116e+06 headspace flow down line (cc/s) 1.116e+06 KG surface (m/s) 1932.406 KL surface (m/s) 6.575e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.096869 total component into unit, g/s 0.087838 TOTAL AIR EMISSIONS (g/s) 0.009031 (Mg/year) 0.2848 EMISSION FACTOR (g/cm2-s) 3.673e-11 UNIT EXIT CONCENTRATION (ppmw) 0.078708 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3 B-60

2 Wastewater temperature (C) 30.01 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 6 7 Focal Humber of agitators in the unit 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Departies files (mg/g bio-hr) 75 49.53 1200 0.83 0.83 Ω 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F) hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia) 78.352 y/x 0.056726 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C 214 k1= 0. L/q-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/sCompound flow rate from inlet water is 5.19e-05 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.011 hr. \_\_\_\_Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 5.918e-06 m/s. kg is estimated as 0.005575 m/s. Model: 2 kg is estimated as 0.005575 m/s. Model: 2 The Schmidt number is 1.74436. 231 The friction velocity is 37.398 m/s kg is estimated as 0.012742 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. 234 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.1143 m/s. kl (agitated) is estimated as 0.015772 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 5.972e-05 m/s. The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. 244 The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 960.664 min. (16.011 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.11644 KL aerated (m/s) 0.015772 KL OVERALL AERATED (m/s) KG quiescent (m/s) KL quiescent (m/s) KL OVERALL QUIESCENT (m/s) KL OVERALL (m/s) 0.004711 0.005679 5.918e-06 5.813e-06 5.972e-05 air stripping time constant (min) 253,944

FRACTION SURFACE VOLATILIZED 0.18149 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.18149 FRACTION BIOLOGICALLY REMOVED 0.77054 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 9.419e-06 2.97e-04 (Mg/year) EMISSION FACTOR (g/cm2-s) 1.332e-14 UNIT EXIT CONCENTRATION (ppmw) 2.231e-06 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 267 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 32.08 2 Wastewater temperature (C) 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 0.3 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp=41.785 mmHq (0.80821 psia) 86.579 y/x 293 0.062258 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/g-hrdl= 1.034e-05 cm2/s dv= 0.087022 cm2/s 296 Compound flow rate from inlet water is 0.001489 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. q/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. B-62

319	kg (agitated)is estimated as 0.11498 m/s.				
320	kl (agitated)is estimated as 0.016622 m/s.				
321	The specified and growth biomass is 0.	3 g/L.			
322	The effective KL (surface + diffused air)	is 1.598e-04 m/s.			
323	The effective stripping time (surface + d	liffused air) is 101.198 minutes.			
	(1.68663 hrs.)				
324	The pump mixing time is 5 x the pumping r	ecirculaion time, 0. min.			
325	The ratio of the mixing to the striping (	surface + diffused air) is 0.			
326	The mean residence time is 980.894 min. (	16.348 hr.)			
327	The ratio of the pump mixing to the resid	lence time is 0.			
328	KG aerated (m/s)	0.11714			
329	KL aerated (m/s)	0.016622			
330	KL OVERALL AERATED (m/s)	0.005152			
331	KG quiescent (m/s)	0.005738			
332	KL quiescent (m/s)	5.945e-06			
333	KL OVERALL QUIESCENT (m/s)	5.85e-06			
334	KL OVERALL (m/s)	1.598e-04			
335	air stripping time constant (min)	101.198			
336	FRACTION SURFACE VOLATILIZED	0.33782			
337	FRACTION SUBMERGED VOLATILIZED	0.			
338	TOTAL FRACTION VOLATILIZED	0.33782			
339	FRACTION BIOLOGICALLY REMOVED	0.62732			
340	FRACTION ABSORBED	0.			
341	TOTAL AIR EMISSIONS (g/s)	5.03e-04			
342	(Mg/year)	0.015863			
343	EMISSION FACTOR (g/cm2-s)	7.429e-13			
344	UNIT EXIT CONCENTRATION (ppmw)	4.65e-05			
345					

Type of unit is 50 0 1 Total water added at the unit (l/s) 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 25 6 Temperature of air (C) 7 Drain air velocity (ft/min) 84 8 manhole air velocity (ft/min) 128 9 Conduit air velocity (ft/min) 66 447 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 .006 14 friction factor gas 12 15 radius of underflow conduit (cm) 25 16 Underflow T (C) 5 17 oscillation cycle time (min) 18 design collection velocities (ft/s) 2 19 design branch line fraction full . 4 24 Type of unit is 0 8 HL partition flag=1, adjust for sorption 200 9 unit recycle convergence number 10 oil molecular weight Ο 0 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential New Stripper Permitting Emissions WWTP PAE New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS) 43 Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 47 295 4 width of aeration unit (m) 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 0.3 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0 18 special input  $\cap$ 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

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hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia) 162.463 y/x 0.11606 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s k1=0. L/a-hrCompound flow rate from inlet water is 0.19163 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 30.325 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Ouiescent wind shear surface \_\_\_ Springer\_ The fetch to depth ratio is 237.766. kl is estimated as 7.634e-06 m/s. kg is estimated as 0.007917 m/s. Model: 2 kg is estimated as 0.007917 m/s. Model: 2 The Schmidt number is 1.01591. The friction velocity is 37.398 m/s kg is estimated as 0.017873 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14978 m/s. kl (agitated) is estimated as 0.021024 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 4.77e-04 m/s. The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1819.519 min. (30.325 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15258 KL aerated (m/s) 0.021024 KL OVERALL AERATED (m/s) 0.009769 KG quiescent (m/s) 0.008066 KL guiescent (m/s) 7.634e-06 KL OVERALL QUIESCENT (m/s) 7.574e-06 KL OVERALL (m/s) 4.77e-04 air stripping time constant (min) 48.915 FRACTION SURFACE VOLATILIZED 0.80146 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.80146 FRACTION BIOLOGICALLY REMOVED 0.17699 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 0.15358 (Mg/year) 4.84331 EMISSION FACTOR (g/cm2-s) 1.765e - 10UNIT EXIT CONCENTRATION (ppmw) 0.0037 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (g/s) 0.

(Mg/year) 0. EMISSION FACTOR (g/cm2-s) 1.765e-10 UNIT EXIT CONCENTRATION (ppmw) 1.485e-05 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 134 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s) 0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 Ω 8 Subsurface entrance=1 0 9 subsurface exit =1 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 Ω 18 Assume equilibrium in unit, =1 0 19 pH (enter 0 for no pH adjustment) 8.9 154Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1116 l/s. Weight fraction down is 1.989E-07 Gas concentration in 0 mol fraction. Gas flow 1116 L/s 159 Weight fraction out at base of drop is 1.71707119336225E-07 fraction transferred in the drain drop from hub is .136716 161 162 163 164 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 0.13672 165 166 fraction loss in unit 0. fraction loss in line run component upstream of unit, g/s mol fract. headspace upstream (y) 0. Ο. Ο. headspace at conduit discharge, y 0. headspace end of conduit (y) mol fract. headspace vent base 4.229e-19 1.138e-05 headspace flow out vent (cc/s) headspace flow down line (cc/s) -1.116e+06 1.116e+06 174 KG surface (m/s) 2728.591 KL surface (m/s) 8.51e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.22197 178 total component into unit, g/s 0.19163 TOTAL AIR EMISSIONS (g/s) 0.030347 (Mg/year) 0.95703 EMISSION FACTOR (g/cm2-s) 1.765e-10 UNIT EXIT CONCENTRATION (ppmw) 0.17171 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

```
2 Wastewater temperature (C)
                                                                            30.01
             3 length of aeration unit (m)
                                                                            376
          4 width of aeration unit (m)
5 depth of aeration unit (m)
6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
            4 width of aeration unit (m)
                                                                            188
                                                                            0.91
                                                                            135
                                                                            6
                                                                           75
                                                                            49.53
                                                                           1200
                                                                           0.83
                                                                          0.83
                                                                           Ο
                                                                           19
            15 Aeration air flow (m3/s)
                                                                            0
            16 active biomass, aeration (g/l)
17 If covered, then enter 1
204
                                                                           0.3
                                                                            Ω
             18 special input
                                                                            0
             19 pH (enter 0 for no pH adjustment)
                                                                            7.42
            Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
                hl = 0.002519 \text{ atm} - m3/mol vp= 606.985 mmHg (11.74 psia)
                       139.945 y/x
                       0.10132 g/L gas per g/L liquid
                Temperature adjustment factor = 1.046 ^(T-25), deg. C
                 k1= 0. L/g-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
        Compound flow rate from inlet water is 1.869e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
            The residence time in the unit is 16.011 hr.
              Biomass production
                   The biomass production rate is 0.mg/hr. (0. mg/L)
                   The fraction dissolved solids converted is 0. .
                   The estimated biomass exit concentration is 0. mg/L.
                   Quiescent wind shear surface Springer
          The fetch to depth ratio is 329.675.
            kl is estimated as 7.566e-06 m/s.
           kg is estimated as 0.007884 m/s. Model: 2
           kg is estimated as 0.007884 m/s. Model: 2
The Schmidt number is 1.03989.
           The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s. Model: 3
                       Agitated surface
           The rotation speed is 125.654 radians per second.
            The rotation factor NRW is 2.052e+06.
             The power number NPR is 7.881e-04.
              The rotation factor NFR is 797.027.
              kg (agitated) is estimated as 0.14804 m/s.
             kl (agitated) is estimated as 0.018962 m/s.
                   The specified and growth biomass is 0.3 \text{ g/L}.
               The effective KL (surface + diffused air) is 1.053e-04 m/s.
               The effective stripping time (surface + diffused air) is 144.073 minutes.
               (2.40122 hrs.)
               The pump mixing time is 5 x the pumping recirculaion time, 0. min.
               The ratio of the mixing to the striping (surface + diffused air) is 0.
               The mean residence time is 960.664 min. (16.011 hr.)
             The ratio of the pump mixing to the residence time is 0.
              KG aerated (m/s)
                                                                      0.15081
                KL aerated (m/s)
                                                                     0.018962
               KL OVERALL AERATED (m/s)
                                                                     0.00854
               KG quiescent (m/s)
KL quiescent (m/s)
                                                                     0.008032
                                                                     7.566e-06
               KL OVERALL QUIESCENT (m/s)
                                                                     7.497e-06
               KL OVERALL (m/s)
                                                                     1.053e-04
                air stripping time constant (min)
                                                                     144.073
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FRACTION SURFACE VOLATILIZED 0.59112 FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.59112 FRACTION BIOLOGICALLY REMOVED 0.32022 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 1.105e-04 (Mg/year) 0.003484 EMISSION FACTOR (g/cm2-s) 1.563e-13 UNIT EXIT CONCENTRATION (ppmw) 1.485e-05 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 274 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 1200 0.83 0.83 Ο 19 284 0 0.3 17 If covered, then enter 1 18 special input 0 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) vp= 655.201 mmHg (12.673 psia) hl= 0.002719 atm-m3/mol 151.062 y/x 0.10863 g/L gas per g/L liquid 294 Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deq. C kl = 0. L/q-hrdl= 1.495e-05 cm2/s dv= 0.14597 cm2/s Compound flow rate from inlet water is 0.004129 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.14892 m/s	•
320	kl (agitated) is estimated as 0.019984 m/	s.
321	The specified and growth biomass is	0.3 g/L.
322	The effective KL (surface + diffused ai	r) is 2.809e-04 m/s.
323	The effective stripping time (surface +	diffused air) is 57.552 minutes. (0.9592
	hrs.)	
324	The pump mixing time is 5 x the pumping	recirculaion time, 0. min.
325	The ratio of the mixing to the striping	(surface + diffused air) is 0.
326	The mean residence time is 980.894 min.	(16.348 hr.)
327	The ratio of the pump mixing to the res	idence time is 0.
328	KG aerated (m/s)	0.15171
329	KL aerated (m/s)	0.019984
330	KL OVERALL AERATED (m/s)	0.009148
331	KG quiescent (m/s)	0.008115
332	KL quiescent (m/s)	7.6e-06
333	KL OVERALL QUIESCENT (m/s)	7.537e-06
334	KL OVERALL (m/s)	2.809e-04
335	air stripping time constant (min)	57.552
336	FRACTION SURFACE VOLATILIZED	0.7715
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.7715
339	FRACTION BIOLOGICALLY REMOVED	0.18324
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	0.003185
342	(Mg/year)	0.10045
343	EMISSION FACTOR (g/cm2-s)	4.704e-12
344	UNIT EXIT CONCENTRATION (ppmw)	1.675e-04
3 4 E		

Type of unit is 50 1 Total water added at the unit (l/s) 0 2 Area of openings at unit (cm2) 50 5 3 Radius of drop pipe (cm) 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 8 manhole air velocity (ft/min) 128 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 17 oscillation cycle time (min) 5 2 18 design collection velocities (ft/s) 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight 0 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 11 1 Description of unit ASB Zone 1 2 Wastewater temperature 34.08 (C) 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 31 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia) 230.99 y/x 0.16502 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s k1=0. L/g-hrCompound flow rate from inlet water is 0.002397 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 30.325 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 237.766. kl is estimated as 7.703e-06 m/s. kg is estimated as 0.010871 m/s. Model: 2 kg is estimated as 0.010871 m/s. Model: 2 The Schmidt number is 0.63285. The friction velocity is 37.398 m/s kg is estimated as 0.024173 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.18977 m/s. kl (agitated) is estimated as 0.021167 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 6.265e-04 m/s. The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1819.519 min. (30.325 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s)0.19332 KL aerated (m/s) 0.021167 KL OVERALL AERATED (m/s) 0.012876 KG quiescent (m/s) 0.011075 KL quiescent (m/s) 7.703e-06 KL OVERALL QUIESCENT (m/s) 7.672e-06 KL OVERALL (m/s) 6.265e-04 air stripping time constant (min) 37.242 FRACTION SURFACE VOLATILIZED 0.88816 FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.88816 0.09366 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 0.002129 (Mg/year) 0.06713 EMISSION FACTOR (g/cm2-s) 2.446e-12 UNIT EXIT CONCENTRATION (ppmw) 3.904e-05 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL (methyl mercaptan) Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (g/s) 0. B-71

(Mg/year) 0. EMISSION FACTOR (g/cm2-s) 2.446e-12 UNIT EXIT CONCENTRATION (ppmw) 1.24e-07 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is open hub drain 13 default open hub d 1 Description of unit 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 8 Subsurface entrance=1 0 0 9 subsurface exit =1 12 10 radius of underflow conduit (cm) 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1  $\cap$ 18 Assume equilibrium in unit, =1 0 19 pH (enter 0 for no pH adjustment) 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1116 l/s. Weight fraction down is 2.6E-09 Gas concentration in 0 mol fraction. Gas flow 1116 L/s Weight fraction out at base of drop is 2.14759568570224E-09 fraction transferred in the drain drop from hub is .174002 161 162 163 164 165 166 167 168 Ο. fraction loss in wastel drop to hub fraction loss in waste2 drop to hub Ο. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.174 fraction loss in unit Ο. fraction loss in unit fraction loss in line run component upstream of unit, g/s mol fract. headspace upstream (y) headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base headspace flow out vent (cc/s) headspace flow down line (cc/s) KG surface (m/s) Ο. 0. 0. Ο. 6.896e-21 171 2.445e-07 -1.116e+06 1.116e+06 3741.46 KL surface (m/s)3/41.46KL surface (m/s)8.591e-0flow of waste down hub (1/s)0.component flow in waste into unit (g/s)0.002902total component into unit, g/s0.002397TOTAL ALP EMISSIONS(-(-)) 8.591e-09 TOTAL AIR EMISSIONS (g/s) 5.049e-04 (Mg/year) 0.015922 EMISSION FACTOR (g/cm2-s) 2.446e-12 UNIT EXIT CONCENTRATION (ppmw) 0.002148 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

```
30.01
           2 Wastewater temperature (C)
                                                                376
           3 length of aeration unit (m)
           4 width of aeration unit (m)
                                                                188
           5 depth of aeration unit (m)
                                                                0.91
           6 Area of agitation (each aerator,m2)
                                                               135
          7 Total number of agitators in the unit
                                                                6
         / Total number of agitators in the unit
8 Power of agitation (each aerator, HP)
                                                                75
          9 Impeller diameter (cm)
                                                                49.53
         10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
                                                                1200
                                                                0.83
                                                               0.83
                                                               0
           14 Overall biorate (mg/g bio-hr)
                                                               19
           15 Aeration air flow (m3/s)
                                                                Ω
           16 active biomass, aeration (g/1)
                                                                0.3
           17 If covered, then enter 1
                                                                Ω
                                                                0
           18 special input
           19 pH (enter 0 for no pH adjustment)
                                                                7.42
208
         Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
              hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
                    204.826 y/x
                    0.14829 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
               k1= 0. L/g-hr dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
          Compound flow rate from inlet water is 1.671e-06 g/s.
            Compound flow rate from inlet vent is 0. g/s.
           Compound flow rate from inlet duct is 0. g/s.
           Submerged aeration rate from inlet vent is 0. m3/s.
           Total submerged aeration is 0. m3/s.
           The residence time in the unit is 16.011 hr.
                Biomass production
                The biomass production rate is 0.mg/hr. (0. mg/L)
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
                    Quiescent wind shear surface _____ Springer____
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.635e-06 m/s.
            kg is estimated as 0.010826 m/s. Model: 2
            kg is estimated as 0.010826 m/s. Model: 2
           The Schmidt number is 0.64779.
           The friction velocity is 37.398 m/s
           kg is estimated as 0.023814 m/s. Model: 3
                    Agitated surface
          The rotation speed is 125.654 radians per second.
234
           The rotation factor NRW is 2.052e+06.
           The power number NPR is 7.881e-04.
            The rotation factor NFR is 797.027.
            kg (agitated) is estimated as 0.18756 m/s.
            kl (agitated) is estimated as 0.019092 m/s.
                The specified and growth biomass is 0.3 \text{ g/L}.
             The effective KL (surface + diffused air) is 1.391e-04 m/s.
             The effective stripping time (surface + diffused air) is 109.038 minutes.
             (1.81731 hrs.)
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
             The mean residence time is 960.664 min. (16.011 hr.)
             The ratio of the pump mixing to the residence time is 0.
              KG aerated (m/s)
                                                           0.19108
              KL aerated (m/s)
                                                           0.019092
              KL OVERALL AERATED (m/s)
                                                          0.011483
             KG quiescent (m/s)
KL quiescent (m/s)
KL OVERALL QUIESCENT (m/s)
                                                           0.011029
                                                           7.635e-06
                                                           7.6e-06
             KL OVERALL (m/s)
                                                          1.391e-04
              air stripping time constant (min)
                                                          109.038
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B-73

FRACTION SURFACE VOLATILIZED 0.7296 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.7296 FRACTION BIOLOGICALLY REMOVED 0.18759 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 1.219e-06 3.844e-05 (Mg/year) EMISSION FACTOR (q/cm2-s) 1.724e-15 UNIT EXIT CONCENTRATION (ppmw) 1.24e-07 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature 32.08 (C) 3 length of aeration unit (m) 368 184 4 width of aeration unit (m) 0.97 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 0.3 285 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/g-hrdl= 1.515e-05 cm2/s dv= 0.23433 cm2/s Compound flow rate from inlet water is 4.357e-05 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. kg is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0.010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.18868 m/s	S.
320	kl (agitated) is estimated as 0.020121 m,	/s.
321	The specified and growth biomass is	0.3 g/L.
322	The effective KL (surface + diffused as	ir) is 3.715e-04 m/s.
323	The effective stripping time (surface -	+ diffused air) is 43.518 minutes. (0.72529
	hrs.)	
324	The pump mixing time is 5 x the pumping	g recirculaion time, 0. min.
325	The ratio of the mixing to the striping	g (surface + diffused air) is 0.
326	The mean residence time is 980.894 min.	. (16.348 hr.)
327	The ratio of the pump mixing to the res	sidence time is 0.
328	KG aerated (m/s)	0.19222
329	KL aerated (m/s)	0.020121
330	KL OVERALL AERATED (m/s)	0.012174
331	KG quiescent (m/s)	0.011143
332	KL quiescent (m/s)	7.67e-06
333	KL OVERALL QUIESCENT (m/s)	7.637e-06
334	KL OVERALL (m/s)	3.715e-04
335	air stripping time constant (min)	43.518
336	FRACTION SURFACE VOLATILIZED	0.86431
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.86431
339	FRACTION BIOLOGICALLY REMOVED	0.097342
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	3.766e-05
342	(Mg/year)	0.001188
343	EMISSION FACTOR (g/cm2-s)	5.562e-14
344	UNIT EXIT CONCENTRATION (ppmw)	1.497e-06
345		

### Backup Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings to Backup				
Stripper	147	15.00	17.00	16.00
Backup Stripper TRS Removal Efficiency	0.98	0.98	0.98	0.98
Stripped Condensate to Hardpipe	2.93	0.30	0.34	0.32
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.38	0.10	0.21	0.02
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.04	0.17	0.01
ASB Zone 2	0.03	6.14E-04	3.60E-03	2.73E-04
ASB Zone 3	0.02	1.20E-05	1.31E-04	9.23E-06
Total ASB	0.13	0.04	0.17	0.02
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.09E-02	3.28E-03	1.47E-02	1.30E-03

Post-Project Stripped Condensate Flow: Post-Project Stripped Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: Pulp Production 850 gpm 1.22 MGD 25.48 MGD 26.71 MGD 1170 L/s 2200 ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is 1 Total water added at the unit (1/s) 50 0 50 2 Area of openings at unit (cm2) 5 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 84 1213 128 66 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 447 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 15 radius of underflow conduit (cm) 12 25 16 Underflow T (C) 5 17 oscillation cycle time (min) 2 18 design collection velocities (ft/s) 19 design branch line fraction full . 4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight 0 11 oil density (g/cc) Ο 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. z=equid 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 13 NaUT 1=mass tr. 2=equil Ω 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 4 width of aeration unit (m)
5 depth of aeration unit (m)
6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr) 295 1.4 135 7 Total number of agitators in the unit 31 75 49.53 1200 0.83 0.83 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

2.8

42

46

47

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hl= 0.001714 atm-m3/mol
                               vp=45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
                          dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
   kl = 0. L/q-hr
Compound flow rate from inlet water is 0.10249 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
   Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
        Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
   The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                            0.11781
  KL aerated (m/s)
                                            0.017486
  KL OVERALL AERATED (m/s)
                                            0.005609
  KG quiescent (m/s)
                                            0.005703
 KL quiescent (m/s)
                                            5.971e-06
 KL OVERALL QUIESCENT (m/s)
                                            5.883e-06
 KL OVERALL (m/s)
                                            2.753e-04
  air stripping time constant (min)
                                            84.752
  FRACTION SURFACE VOLATILIZED
                                            0.36364
  FRACTION SUBMERGED VOLATILIZED
                                            Ο.
  TOTAL FRACTION VOLATILIZED
                                            0.36364
  FRACTION BIOLOGICALLY REMOVED
                                            0.6186
  FRACTION ABSORBED
                                            Ο.
  TOTAL AIR EMISSIONS (g/s)
                                            0.037268
                    (Mg/year)
                                            1.17529
  EMISSION FACTOR (g/cm2-s)
                                            4.282e-11
  UNIT EXIT CONCENTRATION (ppmw)
                                            0.001555
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37
COMPOUND: DIMETHYL DISULFIDE
Type of unit is system exit stream
1 Description of unit
                                           12
                                                 def.system exit st
   TOTAL AIR EMISSIONS (g/s)
                                            0.
                                 B-78
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106

120

(Mg/year) 0. EMISSION FACTOR (g/cm2-s) 4.282e-11 UNIT EXIT CONCENTRATION (ppmw) 2.847e-06 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 144 8 Subsurface entrance=1 0 0 9 subsurface exit =1 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 Ω 18 Assume equilibrium in unit, =1 Ο 19 pH (enter 0 for no pH adjustment) 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 9.66E-08 Gas concentration in 0 mol fraction. Gas flow 1170 L/s 159 Weight fraction out at base of drop is 8.7594214355091E-08 fraction transferred in the drain drop from hub is .093228 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub Ο. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.093228 fraction loss in unit 0. fraction loss in line run -7.27e-08 component upstream of unit, g/s 0. mol fract. headspace upstream (y) 0. headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base 0. 1.082e-19 2.486e-06 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) 1.17e+06 174KG surface (m/s) 2007.233 KL surface (m/s) 6.787e-09 flow of waste down hub (l/s) 0. component flow in waste into unit (g/s) 0.11302 total component into unit, g/s 0.10249 TOTAL AIR EMISSIONS (g/s) 0.010537 (Mg/year) 0.33229 EMISSION FACTOR (g/cm2-s) 4.282e-11 UNIT EXIT CONCENTRATION (ppmw) 0.087594 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

```
30.01
           2 Wastewater temperature (C)
                                                                   376
           3 length of aeration unit (m)
           4 width of aeration unit (m)
                                                                   188
           5 depth of aeration unit (m)
                                                                   0.91
           6 Area of agitation (each aerator,m2)
                                                                   135
         7 Total number of agitators in the unit
8 Power of agitation (each aerator, HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Decetion air flow (m3/s)
          7 Total number of agitators in the unit
                                                                   6
                                                                   75
                                                                   49.53
                                                                   1200
                                                                   0.83
                                                                   0.83
                                                                  0
                                                                  19
           15 Aeration air flow (m3/s)
                                                                   Ω
                                                                   0.3
           16 active biomass, aeration (g/1)
           17 If covered, then enter 1
                                                                   Ο
            18 special input
                                                                    0
                                                                    7.42
            19 pH (enter 0 for no pH adjustment)
           Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
               hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia)
                    78.352 y/x
                     0.056726 g/L gas per g/L liquid
213
                Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
               k1= 0. L/g-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
           Compound flow rate from inlet water is 6.639e-05 g/s.
            Compound flow rate from inlet vent is 0. g/s.
           Compound flow rate from inlet duct is 0. g/s.
           Submerged aeration rate from inlet vent is 0. m3/s.
            Total submerged aeration is 0. m3/s.
219
            The residence time in the unit is 15.272 hr.
            ____Biomass production
                 The biomass production rate is 0.mg/hr. (0. mg/L)
                 The fraction dissolved solids converted is 0. .
                 The estimated biomass exit concentration is 0. mg/L.
                     Quiescent wind shear surface Springer
             The fetch to depth ratio is 329.675.
            kl is estimated as 5.918e-06 m/s.
            kg is estimated as 0.005575 m/s. Model: 2
            kg is estimated as 0.005575 m/s. Model: 2
            The Schmidt number is 1.74436.
            The friction velocity is 37.398 m/s
           kg is estimated as 0.012742 m/s. Model: 3
                     Agitated surface
           The rotation speed is 125.654 radians per second.
234
            The rotation factor NRW is 2.052e+06.
            The power number NPR is 7.881e-04.
             The rotation factor NFR is 797.027.
             kg (agitated) is estimated as 0.1143 m/s.
            kl (agitated) is estimated as 0.015772 m/s.
                 The specified and growth biomass is 0.3 \text{ g/L}.
              The effective KL (surface + diffused air) is 5.972e-05 m/s.
              The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
              hrs.)
              The pump mixing time is 5 x the pumping recirculaion time, 0. min.
              The ratio of the mixing to the striping (surface + diffused air) is 0.
              The mean residence time is 916.326 min. (15.272 hr.)
              The ratio of the pump mixing to the residence time is 0.
              KG aerated (m/s)
                                                              0.11644
                KL aerated (m/s)
                                                              0.015772
               KL OVERALL AERATED (m/s)
                                                              0.004711
              KG quiescent (m/s)
KL quiescent (m/s)
KL OVERALL QUIESCENT (m/s)
KL OVERALL (m/s)
                                                             0.005679
                                                             5.918e-06
                                                             5.813e-06
                                                             5.972e-05
               air stripping time constant (min)
                                                             253.944
```

FRACTION SURFACE VOLATILIZED 0.18107 FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.18107 FRACTION BIOLOGICALLY REMOVED 0.76875 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 1.202e-05 (Mg/year) 3.791e-04 1.7e-14 EMISSION FACTOR (g/cm2-s) UNIT EXIT CONCENTRATION (ppmw) DETAILED CALCULATIONS at Unit 18 ASB Zone 2 UNIT EXIT CONCENTRATION (ppmw) 2.847e-06 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 32.08 2 Wastewater temperature (C) 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 274 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 75 49.53 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 0 283 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 287 18 special input  $\cap$ 19 pH (enter 0 for no pH adjustment) 7.24 289 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 86.579 y/x 0.062258 g/L gas per g/L liquid 294 Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/q-hrdl= 1.034e-05 cm2/s dv= 0.087022 cm2/s Compound flow rate from inlet water is 0.00182 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. 309 kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.11498 m/s.	
320	kl (agitated)is estimated as 0.016622 m/s.	
321	The specified and growth biomass is $0.3 \text{ g/L}$ .	
322	The effective KL (surface + diffused air) is 1.598e-04 m/s.	
323	The effective stripping time (surface + o	diffused air) is 101.198 minutes.
	(1.68663 hrs.)	
324	The pump mixing time is 5 x the pumping a	recirculaion time, 0. min.
325	The ratio of the mixing to the striping	(surface + diffused air) is 0.
326	The mean residence time is 935.622 min.	(15.594 hr.)
327	The ratio of the pump mixing to the residence time is 0.	
323	KG aerated (m/s)	0.11714
329	KL aerated (m/s)	0.016622
330	KL OVERALL AERATED (m/s)	0.005152
331	KG quiescent (m/s)	0.005738
332	KL quiescent (m/s)	5.945e-06
333	KL OVERALL QUIESCENT (m/s)	5.85e-06
334	KL OVERALL (m/s)	1.598e-04
335	air stripping time constant (min)	101.198
336	FRACTION SURFACE VOLATILIZED	0.33725
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.33725
339	FRACTION BIOLOGICALLY REMOVED	0.62627
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	6.138e-04
342	(Mg/year)	0.019356
343	EMISSION FACTOR (g/cm2-s)	9.065e-13
344	UNIT EXIT CONCENTRATION (ppmw)	5.674e-05
345		

Type of unit is 1 Total water added at the unit (1/s)50 0 50 2 Area of openings at unit (cm2) 5 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 61 40 5 Humidity of inlet air (%) 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 128 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 5 17 oscillation cycle time (min) 2 18 design collection velocities (ft/s) 19 design branch line fraction full .4 Type of unit is 8 HL partition flag=1, adjust for sorption 0 200 9 unit recycle convergence number 0 10 oil molecular weight 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 31 75 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 49.53 1200 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 0.83 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

42

```
hl= 0.002924 atm-m3/mol
                                            vp=704.653 mmHg (13.629 psia)
                   162.463 v/x
                   0.11606 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
                                     dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
               k1 = 0. L/q-hr
            Compound flow rate from inlet water is 0.20746 g/s.
            Compound flow rate from inlet vent is 0. g/s.
            Compound flow rate from inlet duct is 0. g/s.
            Submerged aeration rate from inlet vent is 0. m3/s.
           Total submerged aeration is 0. m3/s.
           The residence time in the unit is 28.926 hr.
                Biomass production
                The biomass production rate is 0.mg/hr. (0. mg/L)
                The fraction dissolved solids converted is 0. .
                The estimated biomass exit concentration is 0. mg/L.
                    Quiescent wind shear surface Springer
           The fetch to depth ratio is 237.766.
           kl is estimated as 7.634e-06 m/s.
           kg is estimated as 0.007917 m/s. Model: 2
           kq is estimated as 0.007917 m/s. Model: 2
           The Schmidt number is 1.01591.
           The friction velocity is 37.398 m/s
           kg is estimated as 0.017873 m/s. Model: 3
                   Agitated surface
           The rotation speed is 125.654 radians per second.
           The rotation factor NRW is 2.052e+06.
           The power number NPR is 7.881e-04.
           The rotation factor NFR is 797.027.
           kg (agitated) is estimated as 0.14978 m/s.
           kl (agitated) is estimated as 0.021024 m/s.
               The specified and growth biomass is 0.3 \text{ g/L}.
            The effective KL (surface + diffused air) is 4.77e-04 m/s.
            The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
            hrs.)
            The pump mixing time is 5 x the pumping recirculaion time, 0. min.
            The ratio of the mixing to the striping (surface + diffused air) is 0.
            The mean residence time is 1735.541 min. (28.926 hr.)
            The ratio of the pump mixing to the residence time is 0.
102
              KG aerated (m/s)
                                                        0.15258
                                                        0.021024
              KL aerated (m/s)
104
              KL OVERALL AERATED (m/s)
                                                        0.009769
             KG quiescent (m/s)
                                                        0.008066
             KL quiescent (m/s)
                                                        7.634e-06
             KL OVERALL QUIESCENT (m/s)
                                                        7.574e-06
             KL OVERALL (m/s)
                                                        4.77e-04
                                                        48.915
              air stripping time constant (min)
              FRACTION SURFACE VOLATILIZED
                                                        0.80063
              FRACTION SUBMERGED VOLATILIZED
                                                        0.
              TOTAL FRACTION VOLATILIZED
                                                        0.80063
              FRACTION BIOLOGICALLY REMOVED
                                                        0.17681
114
              FRACTION ABSORBED
                                                        0.
                                                        0.1661
              TOTAL AIR EMISSIONS (g/s)
                                (Mg/year)
                                                        5.23815
              EMISSION FACTOR (q/cm2-s)
                                                        1.909e-10
              UNIT EXIT CONCENTRATION (ppmw)
                                                        0.004001
           DETAILED CALCULATIONS at Unit 12 def.system exit st
           Type: system exit stream
              Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
              Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
              Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18
           COMPOUND: DIMETHYL SULFIDE (DMS)
           Type of unit is system exit stream
           1 Description of unit
                                                       12
                                                             def.system exit st
              TOTAL AIR EMISSIONS (q/s)
                                                        0.
```

(Mg/year) 0. EMISSION FACTOR (g/cm2-s) 1.909e-10 UNIT EXIT CONCENTRATION (ppmw) 1.753e-05 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 134 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s) 0 140 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 61 6 Drop length to conduit (cm) 7 Open surface=1 1 8 Subsurface entrance=1 Ω 0 9 subsurface exit =1 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 0 18 Assume equilibrium in unit, =1 0 19 pH (enter 0 for no pH adjustment) 8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 2.054E-07 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is 1.77318497496617E-07 fraction transferred in the drain drop from hub is .136716 161 162 163 164 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 0.13672 fraction loss in unit Ο. fraction loss in line run 0 Ο. component upstream of unit, g/s mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 0. headspace end of conduit (y) 4.299e-19 mol fract. headspace vent base 1.175e-05 172 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) 1.17e+06 KG surface (m/s) 2834.248 KL surface (m/s) 8.784e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.24032 total component into unit, g/s 0.20746 TOTAL AIR EMISSIONS (q/s) 0.032855 (Mg/year) 1.03613 EMISSION FACTOR (g/cm2-s) 1.909e-10 UNIT EXIT CONCENTRATION (ppmw) 0.17732 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

```
2 Wastewater temperature (C)
                                                                  30.01
           3 length of aeration unit (m)
                                                                  376
           4 width of aeration unit (m)
                                                                 188
           5 depth of aeration unit (m)
                                                                 0.91
           6 Area of agitation (each aerator,m2)
                                                                 135
           7 Total number of agitators in the unit
                                                                  6
         7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
                                                                 75
                                                                 49.53
                                                                 1200
                                                                 0.83
                                                                 0.83
                                                                 0
                                                                19
                                                                 0
           16 active biomass, aeration (g/l)
                                                                 0.3
           17 If covered, then enter 1
                                                                  0
           18 special input
                                                                  0
            19 pH (enter 0 for no pH adjustment)
                                                                  7.42
209
          Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
              hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia)
                    139.945 y/x
                    0.10132 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
               kl= 0. L/g-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
          Compound flow rate from inlet water is 2.217e-04 g/s.
            Compound flow rate from inlet vent is 0. g/s.
          Compound flow rate from inlet duct is 0. g/s.
          Submerged aeration rate from inlet vent is 0. m3/s.
            Total submerged aeration is 0. m3/s.
           The residence time in the unit is 15.272 hr.
            ____Biomass production
                The biomass production rate is 0.mg/hr. (0. mg/L)
                 The fraction dissolved solids converted is 0. .
                 The estimated biomass exit concentration is 0. mg/L.
                    Quiescent wind shear surface Springer
            The fetch to depth ratio is 329.675.
            kl is estimated as 7.566e-06 m/s.
            kg is estimated as 0.007884 m/s. Model: 2
            kg is estimated as 0.007884 m/s. Model: 2
            The Schmidt number is 1.03989.
            The friction velocity is 37.398 m/s
          kg is estimated as 0.017611 m/s. Model: 3
                    Agitated surface
          The rotation speed is 125.654 radians per second.
234
            The rotation factor NRW is 2.052e+06.
            The power number NPR is 7.881e-04.
            The rotation factor NFR is 797.027.
            kg (agitated) is estimated as 0.14804 m/s.
            kl (agitated) is estimated as 0.018962 m/s.
                The specified and growth biomass is 0.3 g/L.
             The effective KL (surface + diffused air) is 1.053e-04 m/s.
             The effective stripping time (surface + diffused air) is 144.073 minutes.
             (2.40122 hrs.)
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
             The mean residence time is 916.326 min. (15.272 hr.)
             The ratio of the pump mixing to the residence time is 0.
              KG aerated (m/s)
                                                            0.15081
              KL aerated (m/s)
                                                            0.018962
              KL OVERALL AERATED (m/s)
                                                            0.00854
             KG quiescent (m/s)
                                                            0.008032
             KL quiescent (m/s)
                                                            7.566e-06
             KL OVERALL QUIESCENT (m/s)
                                                           7.497e-06
             KL OVERALL (m/s)
                                                           1.053e-04
              air stripping time constant (min)
                                                            144.073
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FRACTION SURFACE VOLATILIZED 0.5886 FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.5886 0.31886 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 1.305e-04 (Mg/year) 0.004115 EMISSION FACTOR (g/cm2-s) 1.846e-13 1.753e-05 UNIT EXIT CONCENTRATION (ppmw) DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 18 ASB Zone 2 1 Description of unit 32.08 2 Wastewater temperature (C) 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 0.83 12 aerator effectiveness, alpha 0 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) Ο 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 289 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/q-hrdl= 1.495e-05 cm2/s dv= 0.14597 cm2/s Compound flow rate from inlet water is 0.004681 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.14892 m/s	
320	kl (agitated)is estimated as 0.019984 m/s.	
321	The specified and growth biomass is $0.3 \text{ g/L}$ .	
322	The effective KL (surface + diffused ai	r) is 2.809e-04 m/s.
323	The effective stripping time (surface +	diffused air) is 57.552 minutes. (0.9592
	hrs.)	
324	The pump mixing time is 5 x the pumping	recirculaion time, 0. min.
325	The ratio of the mixing to the striping	(surface + diffused air) is 0.
326	The mean residence time is 935.622 min.	(15.594 hr.)
327	The ratio of the pump mixing to the residence time is 0.	
328	KG aerated (m/s)	0.15171
329	KL aerated (m/s)	0.019984
330	KL OVERALL AERATED (m/s)	0.009148
331	KG quiescent (m/s)	0.008115
332	KL quiescent (m/s)	7.6e-06
333	KL OVERALL QUIESCENT (m/s)	7.537e-06
334	KL OVERALL (m/s)	2.809e-04
335	air stripping time constant (min)	57.552
336	FRACTION SURFACE VOLATILIZED	0.76981
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.76981
339	FRACTION BIOLOGICALLY REMOVED	0.18284
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	0.003604
342	(Mg/year)	0.11365
343	EMISSION FACTOR (g/cm2-s)	5.322e-12
344	UNIT EXIT CONCENTRATION (ppmw)	1.895e-04
345		
Type of unit is 50 0 1 Total water added at the unit (1/s)2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%)  $4 \cap$ 6 Temperature of air (C) 25 7 Drain air velocity (It/MIN, 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 84 128 66 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 500 12 slope of underflow conduit .015 13 friction factor liquid .016 14 friction factor gas .006 15 radius of underflow conduit (cm) 12 25 16 Underflow T (C) 5 17 oscillation cycle time (min) 2 18 design collection velocities (ft/s) .4 19 design branch line fraction full Type of unit is 8 HL partition flag=1, adjust for sorption 0 9 unit recycle convergence number 200 10 oil molecular weight 0 11 oil density (g/cc) 0 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 0 13 NaUT 1=mass tr. 2=equil 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 7 Total number of agitators in the unit 31 75 49.53 1200 0.83 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input Ο 19 pH (enter 0 for no pH adjustment) 7.04 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

43

44

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hl= 0.004158 atm-m3/mol
                                vp = 2272.142 \text{ mmHg} (43.948 \text{ psia})
       230.99 v/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
                          dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
   kl = 0. L/q-hr
Compound flow rate from inlet water is 0.016622 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s. Model: 2
kg is estimated as 0.010871 m/s. Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s. Model: 3
        Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18977 m/s.
kl (agitated) is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                             0.19332
  KL aerated (m/s)
                                             0.021167
  KL OVERALL AERATED (m/s)
                                             0.012876
  KG quiescent (m/s)
                                             0.011075
  KL quiescent (m/s)
                                             7.703e-06
  KL OVERALL QUIESCENT (m/s)
                                             7.672e-06
  KL OVERALL (m/s)
                                             6.265e-04
  air stripping time constant (min)
                                             37.242
  FRACTION SURFACE VOLATILIZED
                                             0.88738
  FRACTION SUBMERGED VOLATILIZED
                                             Ο.
  TOTAL FRACTION VOLATILIZED
                                             0.88738
                                             0.093577
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                             0.
  TOTAL AIR EMISSIONS (g/s)
                                             0.01475
                                             0.46517
                    (Mq/year)
   EMISSION FACTOR (g/cm2-s)
                                             1.695e-11
   UNIT EXIT CONCENTRATION (ppmw)
                                             2.705e-04
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)
Type of unit is system exit stream
1 Description of unit
                                            12
                                                  def.system exit st
   TOTAL AIR EMISSIONS (q/s)
                                             0.
                                  B-90
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(Mg/year) Ο. 1.695e-11 EMISSION FACTOR (q/cm2-s) UNIT EXIT CONCENTRATION (ppmw) 9.387e-07 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential New Stripper Permitting Emissions \WWTP \PAE \Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 61 6 Drop length to conduit (cm) 7 Open surface=1 1 8 Subsurface entrance=1 0 144 9 subsurface exit =1 0 146 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 147 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 0 18 Assume equilibrium in unit, =1 0 19 pH (enter 0 for no pH adjustment) 8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 1.72E-08 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is 1.42071711698917E-08 fraction transferred in the drain drop from hub is .174002 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub Ο. fraction loss in waste3 drop to hub Ο. 0.174 fraction loss in collection hub drop fraction loss in unit Ο. fraction loss in line run 0. component upstream of unit, g/s 0. mol fract. headspace upstream (y) headspace at conduit discharge, y 0. 0. headspace end of conduit (y) mol fract. headspace vent base 4.491e-20 1.618e-06 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) KG surface (m/s) 1.17e+06 3886.338 KL surface (m/s) 8.868e-09 flow of waste down hub (l/s) 0. component flow in waste into unit (g/s) 0.020124 total component into unit, g/s 0.016622 179 TOTAL AIR EMISSIONS (g/s) 0.003502 (Mg/year) 0.11043 EMISSION FACTOR (q/cm2-s) 1.695e-11 UNIT EXIT CONCENTRATION (ppmw) 0.014207 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3

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2 Wastewater temperature (C)
                                                                                                              30.01
                                                                                                             376
                   3 length of aeration unit (m)
4 width of aeration unit (m)

5 depth of aeration unit (m)

6 Area of agitation (each aerator,m2)

7 Total number of agitators in the unit

8 Power of agitation (each aerator,HP)

9 Impeller diameter (cm)

10 Impeller rotation (RPM)

10 Impeller rotation (RPM)

12 aerator effectiveness, alpha

20 12 aerator effectiveness, alpha

20 13 if there is plug flow, enter 1

20 14 Overall biorate (mg/g bio-hr)

20 15 Aeration air flow (m3/s)

20 16 active biomass, aeration (g/l)

20 17 If covered, then enter 1

20 18 special input

20 19 pH (enter 0 for no pH adjustment)
                   4 width of aeration unit (m)
                                                                                                             188
                                                                                                             0.91
                                                                                                             135
                                                                                                              6
                                                                                                             75
                                                                                                             49.53
                                                                                                             1200
                                                                                                             0.83
                                                                                                          0.83
                                                                                                           0
                                                                                                            19
                                                                                                             0
                                                                                                           0.3
                                                                                                             0
                                                                                                              0
                     19 pH (enter 0 for no pH adjustment)
                                                                                                              7.42
                  Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
                    hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
                                  204.826 y/x
                                  0.14829 g/L gas per g/L liquid
                     Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
k1= 0. L/g-hr dl= 1.505e-05 \text{ cm}2/\text{s} dv= 0.23155 \text{ cm}2/\text{s}
                Compound flow rate from inlet water is 1.27e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
                     ____Biomass production
                            The biomass production rate is 0.mg/hr. (0. mg/L)
                            The fraction dissolved solids converted is 0. .
                             The estimated biomass exit concentration is 0. mg/L.
Quiescent wind shear surface __Springer_226The fetch to depth ratio is 329.675.227kl is estimated as 7.635e-06 m/s.228kg is estimated as 0.010826 m/s. Model: 2229kg is estimated as 0.010826 m/s. Model: 2230The Schmidt number is 0.64779.231The friction velocity is 37.398 m/s232kg is estimated as 0.023814 m/s. Model: 3233__Agitated surface234The rotation speed is 125.654 radians per second.235The power number NPR is 7.881e-04.236The rotation factor NFR is 797.027.239kg (agitated)is estimated as 0.18756 m/s.
                             Quiescent wind shear surface Springer
                     kg (agitated) is estimated as 0.18756 m/s.
                   kl (agitated)is estimated as 0.019092 m/s.
                             The specified and growth biomass is 0.3 \text{ g/L}.
                      The effective KL (surface + diffused air) is 1.391e-04 m/s.
                       The effective stripping time (surface + diffused air) is 109.038 minutes.
                       (1.81731 hrs.)
                       The pump mixing time is 5 x the pumping recirculaion time, 0. min.
                       The ratio of the mixing to the striping (surface + diffused air) is 0.
                    The mean residence time is 916.326 min. (15.272 hr.)
                    The ratio of the pump mixing to the residence time is 0.
                      KG aerated (m/s)
                                                                                                    0.19108
                       KL aerated (m/s)
KL OVERALL AERATED (m/s)
                                                                                                    0.019092
                                                                                                    0.011483
                       KG quiescent (m/s)
KL quiescent (m/s)
                                                                                                    0.011029
                                                                                                   7.635e-06
                        KL OVERALL QUIESCENT (m/s)
                                                                                                   7.6e-06
                        KL OVERALL (m/s)
                                                                                                  1.391e-04
                        air stripping time constant (min)
                                                                                                   109.038
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B-92

0.72669 FRACTION SURFACE VOLATILIZED FRACTION SUBMERGED VOLATILIZED 0. TOTAL FRACTION VOLATILIZED 0.72669 FRACTION BIOLOGICALLY REMOVED 0.18684 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (q/s) 9.23e-06 2.911e-04 (Mg/year) EMISSION FACTOR (g/cm2-s) 1.306e-14 UNIT EXIT CONCENTRATION (ppmw) 9.387e-07 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature 32.08 (C) 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 279 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1  $\cap$ 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.515e-05 cm2/s dv= 0.23433 cm2/s k1=0. L/q-hrCompound flow rate from inlet water is 3.165e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. kg is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0.010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

319	kg (agitated)is estimated as 0.18868 m/s	5 <b>.</b>
320	kl (agitated) is estimated as 0.020121 m/	's.
321	The specified and growth biomass is	0.3 g/L.
322	The effective KL (surface + diffused ai	r) is 3.715e-04 m/s.
323	The effective stripping time (surface +	diffused air) is 43.518 minutes. (0.72529
	hrs.)	
324	The pump mixing time is 5 x the pumping	recirculaion time, 0. min.
325	The ratio of the mixing to the striping	(surface + diffused air) is 0.
326	The mean residence time is 935.622 min.	(15.594 hr.)
327	The ratio of the pump mixing to the res	sidence time is 0.
328	KG aerated (m/s)	0.19222
329	KL aerated (m/s)	0.020121
330	KL OVERALL AERATED (m/s)	0.012174
331	KG quiescent (m/s)	0.011143
332	KL quiescent (m/s)	7.67e-06
333	KL OVERALL QUIESCENT (m/s)	7.637e-06
334	KL OVERALL (m/s)	3.715e-04
335	air stripping time constant (min)	43.518
336	FRACTION SURFACE VOLATILIZED	0.86271
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.86271
339	FRACTION BIOLOGICALLY REMOVED	0.097161
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	2.731e-04
342	(Mg/year)	0.008611
343	EMISSION FACTOR (g/cm2-s)	4.033e-13
344	UNIT EXIT CONCENTRATION (ppmw)	1.086e-05
345		

## No Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings (prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.31	1.48	0.27	9.82E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.57	0.22	8.40E-03
ASB Zone 2	0.03	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	0.02	1.85E-04	1.70E-04	5.26E-06
Total ASB	0.12	0.58	0.22	8.56E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.06E-02	5.04E-02	1.92E-02	7.42E-04

Post-Project Foul Condensate Flow:		850	gom
Post-Project Foul Condensate Flow:		1.22	MGD
Post-Project ASB Influent Flow:		25.48	MGD
Total ASB Flow:		26.71	MGD
Total ASB Flow:		1170	L/s
Pulp Production		2200	ODTP/day
			MW
	H2S		34
	DMDS		94
	DMS		62
	MMC		48

Led at the unit openings at unit (cm2) addius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 18 manhole air velocity (ft/min) 19 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm' 12 slope of underflow 13 friction fac' 14 frict' 15 Type of unit is 1 Total water added at the unit (1/s) 50 0 2 Area of openings at unit (cm2) 50 5 61 40 25 84 128 66 447 500 .015 .016 .006 12 15 radius of underflow conduit (cm) 16 Underflow T (C) 25 20 21 22 17 oscillation cycle time (min) 5 2 18 design collection velocities (ft/s) 19 design branch line fraction full .4 Type of unit is 8 HL partition flag=1, adjust for sorption 9 unit recycle convergence number 0 200 10 oil molecular weight 11 oil density (g/cc) 0 0 12NAUT 1=municipal 2=industrial3=t3013NaUT 1=mass tr. 2=equil3114parts biomass per 1000 parts COD3215oil water partition method 0=owpc3316use UNIFAC aqueous data base =13417specify mass transfer for unit, =13518Use biomass for unit option, =13619biogrowth Monod half concentration 12 NaUT 1=municipal 2=industrial 3=turb. 0 0 19 biogrowth Monod half concentration ppm 30 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 1 Description of unit 11 ASB Zone 1 2 Wastewater temperature (C) 34.08 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 5 depth of aeration unit (m) 1.4 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 31 75 49.53 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 1200 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0.83 0 19 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04

42

47

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Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)
   hl = 0.001714 \text{ atm} - m3/mol vp = 45.945 \text{ mmHg} (0.88868 \text{ psia})
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
Compound flow rate from inlet water is 1.57133 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                            0.11781
  KL aerated (m/s)
                                            0.017486
 KL OVERALL AERATED (m/s)
                                            0.005609
                                            0.005703
 KG quiescent (m/s)
 KL quiescent (m/s)
                                            5.971e-06
 KL OVERALL QUIESCENT (m/s)
                                            5.883e-06
 KL OVERALL (m/s)
                                            2.753e-04
                                            84.752
  air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                            0.36452
 FRACTION SUBMERGED VOLATILIZED
                                            0.
  TOTAL FRACTION VOLATILIZED
                                            0.36452
 FRACTION BIOLOGICALLY REMOVED
                                            0.61768
 FRACTION ABSORBED
                                            0.
  TOTAL AIR EMISSIONS (g/s)
                                            0.57278
                    (Mg/year)
                                            18.063
   EMISSION FACTOR (g/cm2-s)
                                            6.582e-10
  UNIT EXIT CONCENTRATION (ppmw)
                                            0.023907
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM 19:20:20
COMPOUND: DIMETHYL DISULFIDE
Type of unit is system exit stream
1 Description of unit
                                           12
                                                 def.system exit st
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TOTAL AIR EMISSIONS (q/s) Ο. (Mg/year) Ο. EMISSION FACTOR (g/cm2-s) 6.582e-10 UNIT EXIT CONCENTRATION (ppmw) 4.376e-05 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 8 Subsurface entrance=1 0 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 16 velocity air at drain opening (ft/min) 84 17 municipal waste in conduit =1 0 18 Assume equilibrium in unit, =1 Ω 19 pH (enter 0 for no pH adjustment) 8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 1.4811E-06 Gas concentration in 0 mol fraction. Gas flow 1170 L/s 159 Weight fraction out at base of drop is 1.3430203399053E-06 fraction transferred in the drain drop from hub is .093228 Ο. fraction loss in wastel drop to hub fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.093228 fraction loss in unit 0 fraction loss in line run 0. component upstream of unit, g/s 0. mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 0. headspace end of conduit (y) 1.659e-18 mol fract. headspace vent base 3.811e-05 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) 1.17e+06 KG surface (m/s) 2007.233 KL surface (m/s) 6.787e-09 flow of waste down hub (l/s) 0. component flow in waste into unit (g/s) 1.73289 total component into unit, g/s 1.57133 179 TOTAL AIR EMISSIONS (g/s) 0.16155 (Mg/year) 5.09474 EMISSION FACTOR (q/cm2-s) 6.582e-10 UNIT EXIT CONCENTRATION (ppmw) 1.34302 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20

COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment 17 ASB Zone 3 1 Description of unit 2 Wastewater temperature (C) 30.01 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 0.3 16 active biomass, aeration (g/l) Ω 17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL DISULFIDE at 30. deq.C (86. deq.F) vp= 37.814 mmHg (0.7314 psia) hl= 0.00141 atm-m3/mol 78.352 y/x 0.056726 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s 214 k1=0. L/g-hrCompound flow rate from inlet water is 0.00102 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 5.918e-06 m/s. kg is estimated as 0.005575 m/s. Model: 2 kg is estimated as 0.005575 m/s. Model: 2 The Schmidt number is 1.74436. The friction velocity is 37.398 m/s kg is estimated as 0.012742 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.1143 m/s. kl (agitated) is estimated as 0.015772 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 5.972e-05 m/s. The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.11644 KL aerated (m/s) 0.015772 KL OVERALL AERATED (m/s) 0.004711 KG quiescent (m/s) 0.005679

5.918e-06 KL quiescent (m/s) KL OVERALL QUIESCENT (m/s) 5.813e-06 5.972e-05 KL OVERALL (m/s) air stripping time constant (min) FRACTION SURFACE VOLATILIZED 253.944 0.18107 FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. 0.18107 0.76875 258 0. TOTAL AIR EMISSIONS (g/s) 1.848e-04 0.005827 (Mg/year) EMISSION FACTOR (g/cm2-s) UNIT EXIT CONCENTRATION (ppmw) DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment 2.614e-13 4.376e-05 264 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment 18 1 Description of unit ASB Zone 2 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 368 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 184 0.97 275 135 6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
16 active biomass, aeration (g/l) 15 75 49.53 1200 0.83 0.83 0 19 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 86.579 y/x 0.062258 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C kl= 0. L/q-hr dl= 1.034e-05 cm2/s dv= 0.087022 cm2/s Compound flow rate from inlet water is 0.027971 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. \_\_\_\_Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3

314	Agitated surface	
315	The rotation speed is 125.654 radians per s	second.
316	The rotation factor NRW is 2.052e+06.	
317	The power number NPR is 7.881e-04.	
318	The rotation factor NFR is 797.027.	
319	kg (agitated)is estimated as 0.11498 m/s.	
320	kl (agitated) is estimated as 0.016622 m/s.	
321	The specified and growth biomass is 0.3	βg/L.
322	The effective KL (surface + diffused air)	is 1.598e-04 m/s.
323	The effective stripping time (surface + di	ffused air) is 101.198 minutes.
	(1.68663 hrs.)	
324	The pump mixing time is 5 x the pumping re	circulaion time, O. min.
325	The ratio of the mixing to the striping (s	surface + diffused air) is 0.
326	The mean residence time is 935.622 min. (1	5.594 hr.)
327	The ratio of the pump mixing to the reside	ence time is 0.
328	KG aerated (m/s)	0.11714
329	KL aerated (m/s)	0.016622
330	KL OVERALL AERATED (m/s)	0.005152
331	KG quiescent (m/s)	0.005738
332	KL quiescent (m/s)	5.945e-06
333	KL OVERALL QUIESCENT (m/s)	5.85e-06
334	KL OVERALL (m/s)	1.598e-04
335	air stripping time constant (min)	101.198
336	FRACTION SURFACE VOLATILIZED	0.33728
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.33728
339	FRACTION BIOLOGICALLY REMOVED	0.62623
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	0.009434
342	(Mg/year)	0.29751
343	EMISSION FACTOR (g/cm2-s)	1.393e-11
344	UNIT EXIT CONCENTRATION (ppmw)	8.721e-04
345		

1 Focal water added at the unit (1, 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 10 % ind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 13 friction factor liquid 14 friction factor gas 15 radius of underflow Type of unit is 1 Total water added at the unit (1/s) 50 0 2 Area of openings at unit (cm2) 50 5 61 40 25 84 128 66 447 500 .015 .016 .006 15 radius of underflow conduit (cm) 12 25 16 Underflow T (C) 17 oscillation cycle time (min) 18 design collection velocities (ft/s) 19 design branch line fraction full 5 2 .4 Type of unit is 8 HL partition flag=1, adjust for sorption 9 unit recycle convergence number 0 8 HL partition flag=1, adjust for sorption
9 unit recycle convergence number
10 oil molecular weight
11 oil density (g/cc)
12 NaUT 1=municipal 2=industrial 3=turb.
13 NaUT 1=mass tr. 2=equil
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm 200 0 0 0 0 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is aerated biotreatment 1Description of unit112Wastewater temperature (C)113length of aeration unit (m)114width of aeration unit (m)115depth of aeration unit (m)6Area of agitation (each aerator,m2)7Total number of agitators in the unit8Power of agitation (each aerator,HP)9Impeller diameter (cm)10Impeller rotation (RPM)11Agitator mechanical efficiency12aerator effectiveness, alpha13if there is plug flow, enter 114Overall biorate (mg/g bio-hr)15Aeration air flow (m3/s)16active biomass, aeration (g/l)17If covered, then enter 1 11 1 Description of unit ASB Zone 1 34.08 295 295 1.4 135 31 75 49.53 1200 1200 0.83 0.83 0 19 0 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04

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Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F) hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia) 162.463 v/x 0.11606 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1= 0. L/g-hr dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s Compound flow rate from inlet water is 0.27039 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 28.926 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 237.766. kl is estimated as 7.634e-06 m/s. kg is estimated as 0.007917 m/s. Model: 2 kg is estimated as 0.007917 m/s. Model: 2 The Schmidt number is 1.01591. The friction velocity is 37.398 m/s kg is estimated as 0.017873 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14978 m/s. 94 kl (agitated) is estimated as 0.021024 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 4.77e-04 m/s. The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1735.541 min. (28,926 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15258 KL aerated (m/s) 0.021024 104KL OVERALL AERATED (m/s) 0.009769 KG quiescent (m/s) 0.008066 KL quiescent (m/s) 7.634e-06 KL OVERALL QUIESCENT (m/s) 7.574e-06 KL OVERALL (m/s) 4.77e-04 air stripping time constant (min) 48.915 FRACTION SURFACE VOLATILIZED 0.80064 FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.80064 0.1768 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 0.21648 6.82699 (Mg/year) EMISSION FACTOR (g/cm2-s) 2.488e-10 UNIT EXIT CONCENTRATION (ppmw) 0.005215 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is system exit stream 12 1 Description of unit def.system exit st

TOTAL AIR EMISSIONS (q/s) 0. (Mg/year) 0. EMISSION FACTOR (g/cm2-s) 2.488e-10 UNIT EXIT CONCENTRATION (ppmw) 2.285e-05 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain 1 Description of unit 13 default open hub d 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s) $\cap$ 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 61 6 Drop length to conduit (cm) 7 Open surface=1 1 8 Subsurface entrance=1 0 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 0.015 12 Slope of underflow conduit 16 velocity air at drain opening (ft/min) 17 municipal waste in conduit =1 18 Assume equilibrium in unit, =1 19 pH (enter 0 for no pH adjustment) 84 Ω 0 19 pH (enter 0 for no pH adjustment) 8.9 154 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 2.677E-07 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is 2.31101058606837E-07 fraction transferred in the drain drop from hub is .136716 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. Ο. fraction loss in waste3 drop to hub fraction loss in collection hub drop 0.13672 fraction loss in unit Ο. fraction loss in line run 0. component upstream of unit, g/s 0. mol fract. headspace upstream (y) headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base 0. 0. 5 5.603e-19 1.532e-05 headspace flow out vent (cc/s) headspace flow down line (cc/s) KG surface (m/s) -1.17e+06 1.17e+06 2834.248 KL surface (m/s) 8.784e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.31321 total component into unit, g/s0.27039TOTAL AIR EMISSIONS (g/s)0.04282 0.042821 1.3504 (Mg/year) EMISSION FACTOR (g/cm2-s) 2.488e-10 UNIT EXIT CONCENTRATION (ppmw) 0.2311 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06

COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 17 ASB Zone 3 1 Description of unit 2 Wastewater temperature (C) 30.01 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ω 0 18 special input 7.42 19 pH (enter 0 for no pH adjustment) Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F) hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia) 139.945 y/x 0.10132 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C 214 k1 = 0. L/q-hrdl= 1.485e-05 cm2/s dv= 0.14425 cm2/s Compound flow rate from inlet water is 2.889e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . 224 The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.566e-06 m/s. kg is estimated as 0.007884 m/s. Model: 2 kg is estimated as 0.007884 m/s. Model: 2 The Schmidt number is 1.03989. The friction velocity is 37.398 m/s kg is estimated as 0.017611 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14804 m/s. kl (agitated) is estimated as 0.018962 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.053e-04 m/s. The effective stripping time (surface + diffused air) is 144.073 minutes. (2.40122 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15081 KL aerated (m/s) 0.018962 KL OVERALL AERATED (m/s) 0.00854 KG quiescent (m/s) 0.008032

KL quiescent (m/s) 7.566e-06 KL OVERALL QUIESCENT (m/s) 7.497e-06 KL OVERALL (m/s) 1.053e-04 air stripping time constant (min) FRACTION SURFACE VOLATILIZED FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED TOTAL AIR EMISSIONS (g/s) 144.073 0.5886 Ο. 0.5886 0.31886 Ο. TOTAL AIR EMISSIONS (g/s) 1.701e-04 0.005363 (Mg/year) EMISSION FACTOR (g/cm2-s)2.406e-13UNIT EXIT CONCENTRATION (ppmw)2.285e-05DETAILED CALCULATIONS at Unit 18 ASB Zone 2Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS) 269Type of unit is aerated biotreatment2701 Description of unit2712 Wastewater temperature (C)2723 length of aeration unit (m)2734 width of aeration unit (m)2745 depth of aeration unit (m)2756 Area of agitation (each aerator,m2)2767 Total number of agitators in the unit2778 Power of agitation (each aerator,HP)2789 Impeller diameter (cm)27910 Impeller rotation (RPM)28011 Agitator mechanical efficiency28112 aerator effectiveness, alpha28314 Overall biorate (mg/g bio-hr)28415 Aeration air flow (m3/s)28516 active biomass, aeration (g/l)28617 If covered, then enter 128718 special input28819 pH (enter 0 for no pH adjustment) Type of unit is aerated biotreatment 18 ASB Zone 2 32.08 368 184 0.97 135 15 75 49.53 1200 0.83 0.83 0 19 0 0.3 0 0 7.24 289 290 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) 291 292 hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr dl= 1.495e-05 cm2/s dv= 0.14597 cm2/skl= 0. L/g-hr dl= 1.495e-05 cm2/s dv= 0
Compound flow rate from inlet water is 0.006101 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s. 298 Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. \_\_\_\_Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3

314	Agitated surface	
315	The rotation speed is 125.654 radians pe	er second.
316	The rotation factor NRW is 2.052e+06.	
317	The power number NPR is 7.881e-04.	
318	The rotation factor NFR is 797.027.	
319	kg (agitated)is estimated as 0.14892 m/s	3.
320	kl (agitated)is estimated as 0.019984 m/	′s.
321	The specified and growth biomass is	0.3 g/L.
322	The effective KL (surface + diffused ai	r) is 2.809e-04 m/s.
323	The effective stripping time (surface +	- diffused air) is 57.552 minutes. (0.9592
	hrs.)	
324	The pump mixing time is 5 x the pumping	y recirculaion time, O. min.
325	The ratio of the mixing to the striping	y (surface + diffused air) is 0.
326	The mean residence time is 935.622 min.	(15.594 hr.)
327	The ratio of the pump mixing to the res	sidence time is 0.
328	KG aerated (m/s)	0.15171
329	KL aerated (m/s)	0.019984
330	KL OVERALL AERATED (m/s)	0.009148
331	KG quiescent (m/s)	0.008115
332	KL quiescent (m/s)	7.6e-06
333	KL OVERALL QUIESCENT (m/s)	7.537e-06
334	KL OVERALL (m/s)	2.809e-04
335	air stripping time constant (min)	57.552
336	FRACTION SURFACE VOLATILIZED	0.76981
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.76981
339	FRACTION BIOLOGICALLY REMOVED	0.18284
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	0.004697
342	(Mg/year)	0.14812
343	EMISSION FACTOR (g/cm2-s)	6.937e-12
344	UNIT EXIT CONCENTRATION (ppmw)	2.469e-04
245		

Type of unit is 1 Total water added at the unit (1/s) 50 0 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 6 Temperature of air (C) 25 7 Drain air velocity (tt/min, 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 84 128 66 447 500 .015 13 friction factor liquid .016 .006 14 friction factor gas 15 radius of underflow conduit (cm) 12 25 16 Underflow T (C) 17 oscillation cycle time (min) 18 design collection velocities (ft/s) 19 design branch line fraction full 5 2 .4 Type of unit is Type of unit is 8 HL partition flag=1, adjust for sorption 9 unit recycle convergence number 10 oil molecular weight 11 oil density (g/cc) 12 NaUT 1=municipal 2=industrial 3=turb. 13 NaUT 1=mass tr. 2=equil 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm 0 26 27 29 30 33 33 33 33 35 200 0 0 0 0 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 11
2 Wastewater temperature (C)
3 length of aeration unit (m)
4 width of aeration unit (m)
5 depth of aeration unit (m)
6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
9 Impeller diameter (cm)
10 Impeller rotation (RPM)
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s) 11 1 Description of unit ASB Zone 1 34.08 295 295 1.4 135 31 75 49.53 1200 1200 0.83 0.83 0 19 55678 555 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0 0.3 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.04

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Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)
              hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia)
                   230.99 y/x
                   0.16502 g/L gas per g/L liquid
              Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
              k1=0. L/g-hr
                                    dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
           Compound flow rate from inlet water is 0.009471 g/s.
           Compound flow rate from inlet vent is 0. g/s.
           Compound flow rate from inlet duct is 0. q/s.
           Submerged aeration rate from inlet vent is 0. m3/s.
           Total submerged aeration is 0. m3/s.
           The residence time in the unit is 28.926 hr.
               Biomass production
               The biomass production rate is 0.mg/hr. (0. mg/L)
               The fraction dissolved solids converted is 0. .
               The estimated biomass exit concentration is 0. mg/L.
                   Quiescent wind shear surface
                                                 Springer
           The fetch to depth ratio is 237.766.
           kl is estimated as 7.703e-06 m/s.
           kg is estimated as 0.010871 m/s. Model: 2
           kg is estimated as 0.010871 m/s. Model: 2
           The Schmidt number is 0.63285.
           The friction velocity is 37.398 m/s
           kg is estimated as 0.024173 m/s. Model: 3
                   Agitated surface
           The rotation speed is 125.654 radians per second.
           The rotation factor NRW is 2.052e+06.
           The power number NPR is 7.881e-04.
           The rotation factor NFR is 797.027.
           kg (agitated) is estimated as 0.18977 m/s.
           kl (agitated) is estimated as 0.021167 m/s.
               The specified and growth biomass is 0.3 \text{ g/L}.
            The effective KL (surface + diffused air) is 6.265e-04 m/s.
            The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
            hrs.)
            The pump mixing time is 5 x the pumping recirculaion time, 0. min.
            The ratio of the mixing to the striping (surface + diffused air) is 0.
            The mean residence time is 1735.541 min. (28.926 hr.)
            The ratio of the pump mixing to the residence time is 0.
              KG aerated (m/s)
102
                                                        0.19332
              KL aerated (m/s)
                                                        0.021167
              KL OVERALL AERATED (m/s)
                                                        0.012876
              KG quiescent (m/s)
                                                        0.011075
             KL quiescent (m/s)
                                                        7.703e-06
             KL OVERALL QUIESCENT (m/s)
                                                        7.672e-06
             KL OVERALL (m/s)
                                                        6.265e-04
             air stripping time constant (min)
                                                        37.242
              FRACTION SURFACE VOLATILIZED
                                                       0.88738
              FRACTION SUBMERGED VOLATILIZED
                                                        Ο.
              TOTAL FRACTION VOLATILIZED
                                                        0.88738
                                                        0.093578
              FRACTION BIOLOGICALLY REMOVED
              FRACTION ABSORBED
                                                        0.
              TOTAL AIR EMISSIONS (g/s)
                                                        0.008404
                                                        0.26504
                               (Mg/year)
              EMISSION FACTOR (g/cm2-s)
                                                        9.657e-12
              UNIT EXIT CONCENTRATION (ppmw)
                                                        1.541e-04
           DETAILED CALCULATIONS at Unit 12 def.system exit st
           Type: system exit stream
             Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
             Poe Privileged and Confidential\New Stripper
             Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
             3/16/2023 1:47:24 PM 19:21:41
           COMPOUND: METHANETHIOL(methyl mercaptan)
           Type of unit is system exit stream
           1 Description of unit
                                                       12
                                                             def.system exit st
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TOTAL AIR EMISSIONS (q/s) 0. 0. (Mg/year) EMISSION FACTOR (g/cm2-s) 9.657e-12 UNIT EXIT CONCENTRATION (ppmw) 5.348e-07 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is open hub drain 13 default open hub d 1 Description of unit 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)0 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 61 6 Drop length to conduit (cm) 7 Open surface=1 1 0 8 Subsurface entrance=1 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 12 11 distance to next unit (cm) 500 12 slope of underflow conduit 16 velocity air at drain opening (ft/min) 0.015 84 17 municipal waste in conduit =1 18 Assume equilibrium in unit, =1 19 pH (enter 0 for no pH adjustment) 0 0 8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 9.8E-09 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is 8.09478308097639E-09 fraction transferred in the drain drop from hub is .174002 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub Ο. fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 0.174 fraction loss in unit 0. fraction loss in unit0.fraction loss in line run0.component upstream of unit, g/s0.mol fract. headspace upstream (y)0.headspace at conduit discharge, y0.headspace end of conduit (y)2.559e-20mol fract. headspace vent base9.217e-07headspace flow out vent (cc/s)-1.17e+06 headspace flow due vent (cc/s) headspace flow down line (cc/s) KG surface (m/s) KL surface (m/s) 1.17e+06 3886.338 8.868e-09 flow of waste down hub (l/s) Ο. component flow in waste into unit (g/s) 0.011466 total component into unit, g/s 0.009471 TOTAL AIR EMISSIONS (g/s) 0.001995 0.062918 (Mg/year) EMISSION FACTOR (g/cm2-s) 9.657e-12 UNIT EXIT CONCENTRATION (ppmw) 0.008095 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41

COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 17 ASB Zone 3 2 Wastewater temperature 30.01 (C) 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 0 15 Aeration air flow (m3/s) 16 active biomass, aeration (q/1)0.3 17 If covered, then enter 1 0 18 special input 0 7.42 19 pH (enter 0 for no pH adjustment) Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F) hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia) 204.826 y/x 0.14829 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1 = 0. L/g-hrdl= 1.505e-05 cm2/s dv= 0.23155 cm2/s Compound flow rate from inlet water is 7.237e-06 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.635e-06 m/s. kg is estimated as 0.010826 m/s. Model: 2 kg is estimated as 0.010826 m/s. Model: 2 The Schmidt number is 0.64779. The friction velocity is 37.398 m/s kg is estimated as 0.023814 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.18756 m/s. kl (agitated) is estimated as 0.019092 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.391e-04 m/s. The effective stripping time (surface + diffused air) is 109.038 minutes. (1.81731 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. 244 The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.19108 KL aerated (m/s) 0.019092 KL OVERALL AERATED (m/s) 0.011483 KG quiescent (m/s) 0.011029

KL quiescent (m/s) 7.635e-06 KL OVERALL QUIESCENT (m/s) 7.6e-06 KL OVERALL (m/s) 1.391e-04 air stripping time constant (min) 109.038 FRACTION SURFACE VOLATILIZED 0.72669 FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. 0.72669 0.18684 0. TOTAL AIR EMISSIONS (g/s) 5.259e-06 (Mg/year) 1.658e-04 EMISSION FACTOR (g/cm2-s) 7.439e-15 UNIT EXIT CONCENTRATION (ppmw) UNIT EXIT CONCENTRATION (ppmw) DETAILED CALCULATIONS at Unit 18 ASB Zone 2 5.348e-07 Type: aerated biotreatment Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 368 4 width of aeration unit (m) 184 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 274 0.97 135 15 75 49.53 1200 0.83 0.83 0 19 15 Aeration air flow (m3/s) 0 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ω 18 special input Ο 19 pH (enter 0 for no pH adjustment) 7.24 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C kl= 0. L/g-hr dl= 1.515e-05 cm2/s dv= 0.23433 cm2/s Compound flow rate from inlet water is 1.803e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. kg is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0.010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 B-112

314	Agitated surface	
315	The rotation speed is 125.654 radians p	er second.
316	The rotation factor NRW is 2.052e+06.	
317	The power number NPR is 7.881e-04.	
318	The rotation factor NFR is 797.027.	
319	kg (agitated)is estimated as 0.18868 m/	s.
320	kl (agitated)is estimated as 0.020121 m	/s.
321	The specified and growth biomass is	0.3 g/L.
322	The effective KL (surface + diffused as	ir) is 3.715e-04 m/s.
323	The effective stripping time (surface	+ diffused air) is 43.518 minutes. (0.72529
	hrs.)	
324	The pump mixing time is 5 x the pumping	g recirculaion time, O. min.
325	The ratio of the mixing to the striping	g (surface + diffused air) is 0.
326	The mean residence time is 935.622 min	. (15.594 hr.)
327	The ratio of the pump mixing to the rea	sidence time is 0.
328	KG aerated (m/s)	0.19222
329	KL aerated (m/s)	0.020121
330	KL OVERALL AERATED (m/s)	0.012174
331	KG quiescent (m/s)	0.011143
332	KL quiescent (m/s)	7.67e-06
333	KL OVERALL QUIESCENT (m/s)	7.637e-06
334	KL OVERALL (m/s)	3.715e-04
335	air stripping time constant (min)	43.518
336	FRACTION SURFACE VOLATILIZED	0.86271
337	FRACTION SUBMERGED VOLATILIZED	0.
338	TOTAL FRACTION VOLATILIZED	0.86271
339	FRACTION BIOLOGICALLY REMOVED	0.097161
340	FRACTION ABSORBED	0.
341	TOTAL AIR EMISSIONS (g/s)	1.556e-04
342	(Mg/year)	0.004907
343	EMISSION FACTOR (g/cm2-s)	2.298e-13
344	UNIT EXIT CONCENTRATION (ppmw)	6.185e-06
345		

#### PAE H2S Factor Summary of H2SSIM Inputs and Outputs

•••••••••••••••••••••									Zone 1 Zone 2	7000 3	Total ASB
PAE - No Stripper Scenaric DO Temp pH Length	2 Zone 1 1.57 93.34 7.04 968	Zone 2 7 4.63 4 89.74 4 7.24 3 1208	Zone 3 4.66 86.02 7.42 1235	Flow Total Sulfide Sulfate	Main Inlet 25.48 0.252 390	Hardpipe 1.22 1.47 390	Units MGD mg/L mg/L	H2S g/s	0.08 0.03	0.02	0.122 g/s 2200 ODTP/day 1.06E-02 lb/ODTP
Width	968	3 604	617								
Aerato	rs 31	1 15	5 6							-	
PAE - Backup Stripper	Zone 1	Zone 2	Zone 3	_	Main Inlet	Hardpipe	Units	H2S g/s	0.08 0.03	20ne 3	0.126 g/s
DO	1.57	7 4.63	3 4.66	Flow	25.48	1.22	MGD				2200 ODTP/day
Temp	93.34	4 89.74	86.02	Total Sulfide	0.252	2.93	mg/L				1.09E-02 Ib/ODTP
pH	7.04	4 7.24	7.42	Sulfate	390	390	mg/L				
Length	968	3 1208	3 1235								
Width	968	3 604	617								
Aerato	rs 31	1 15	56								
									Zone 1 Zone 2	Zone 3	Total ASB
PAE - New Stripper	Zone 1	Zone 2	Zone 3		Main Inlet	Hardpipe	Units	H2S g/s	0.07 0.03	0.02	0.119
DO	1.57	7 4.63	4.66	Flow	25.48	0.00	MGD				2200 ODTP/day
Temp	93.34	4 89.74	86.02	Total Sulfide	0.252	0.00	mg/L				1.03E-02 Ib/ODTP
pH	7.04	4 7.24	7.42	Sulfate	390	390	mg/L				
Length	968	3 1208	3 1235				-				
Width	968	3 604	617								
Aerato	rs 31	1 1!	5 6								

\*DO are based on average of all DO readings from 2021 and 2022 Subpart S performance testing.

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

New Stripper Scenario

Data Type 1. Site Ide	entification			-	Data Type 5. Zone Phys	ical and Chemica	I Conditions			12.00	-	
Company N	lame	New	-Indy		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units		Model Controls
Facility Na	ime	Cataw	/ba SC		Dissolved Oxygen	1.57	4.63	4.66		mg/L		
Basin Nar	ne	A	SB		Temperature	93.34	89.74	86.02		F		Run H2SSIM
Data Type 2. Model Zone Informat		tion			pH	7.04	7.24	7.42		s.u.		
Number of Zones	3 •	100			Redox Condition	Aerobic 💌	Aerobic 🔻	Aerobic 💌	Aerobic 💌			View
Zone Location of Hardpipe	1 -				Length	968	1208	1235		feet	Run H2SSIM     View     Parameters     Clear Input     Sheet	
Type of Basin	ASB 🗸	1012			Width	968	604	617		feet	•	Clear Input
Data Type 3. Load C	haracteristics				Depth	4.5	3.2	3		feet	-	Sheet
Loading Characteristics	Main Influent	Hardpipe	Unit	s	Mixing	Moderat	Moderat	Moderat				
Flow	25.48	MI NAV	MGD	•	Number of Aerators	31	15	6				
Total Sulfide	0.252		mg/L	•	Total Horsepower	2325	1125	450		HP		
Sulfate	390	390	mg/L	•	Impellor Size	1.625	1.625	1.625		feet	•	
Data Type 4. Atmos	pheric Conditi	ons			Impellor RPM	1200	1200	1200		RPM		
Windspeed	3.55	mph 👻	-		Diffused Air Flow	0	0	0		cms	•	
Ambient Temperature	79	F .	S.M		Weir Height	O	0	0		feet	•	

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.119	gms/s
Total Emissions (H <sub>2</sub> S)	8271.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.1	tons/yr
Total Emissions (H <sub>2</sub> S)	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.6	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4987.3	1762.5	1522.0		lbs/yr
Emission Flux $(H_2S)$	26.0	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	36.300	6.200	5.400		lbs/yr

New Stripper Scenario

Current Parameters								
kgen	0.25							
ThetaGen	1.06							
KDO	0.05							
KSO4	10							
kanox	0.006							
ThetaOx	1.05							
m	1							
n	0.2							
MLVSS	272.2							
O <sub>2</sub> Transfer Coeff.	2							
alpha 1	0.83							
alpha 2	0.6							

Percent Inlet Sulfide Removed 57.7%

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Backup Stripper Scenario

ata type 1. Site ide	inuncation	_		Data Type 5. Zone Phys	cal and Chemica	Conditions					and the second se
Company Name New-Indy				Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unft	s	Model Controls
Facility Name Catawba SC		/ba SC	Dissolved Oxygen	1.57	4.63	4.66		mg/L			
Basin Nan	ne	A	SB	Temperature	93.34	89.74	86.02		F 🔹		Run H2SSIM
ata Type 2. Model :	Zone Informa	tion	N - 57	рH	7.04	7.24	7.42		s.u.		
Number of Zones	3 💌			Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 🔻			View
Zone Location of Hardpipe	1 •			Length	968	1208	1235	6.13	feet		Parameters
Type of Basin	ASB 🔸			Width	968	604	617	5-11-11	feet		Clear Input
Data Type 3. Load Characteristics		1. Sec. 1.	Depth	4.5	3.2	3		feet	•	Sheet	
Loading Characteristics	Main Influent	Hardpipe	Units	Mixing	Moderat -	Moderat	Moderat -		16. V -		
Flow	25.48	1.22	MGD -	Number of Aerators	31	15	6				1.
Total Sulfide	0.252	2.93	mg/L 🔹	Total Horsepower	2325	1125	450		HP		
Sulfate	390	390	mg/L 🔹	Impellor Size	1.625	1.625	1.625		feet		
ata Type 4. Atmosp	pheric Conditi	ons	- 78 EB-	Impellor RPM	1200	1200	1200		RPM	1	
Windspeed	3.55	mph 👻		Diffused Air Flow	0	0	0	10 M	cms		
Ambient Temperature	79	F -		Weir Height	0	0	0	MAR -	feet	-	

B-117

## **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.126	gms/s
Total Emissions (H <sub>2</sub> S)	8765.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.4	tons/yr
Total Emissions (H <sub>2</sub> S)	4.0	tonnes/yr
Emission Flux $(H_2S)$	17.6	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5479.5	1763.8	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	28.6	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.004	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	45.000	6.500	5.700		lbs/yr

Backup Stripper					
Scenario	10 million				
Current Parameters					
kgen	0.25				
ThetaGen	1.06				
KDO	0.05				
KSO4	10				
kanox	0.006				
ThetaOx	1.05				
m	1				
n	0.2				
MLVSS	272.2				
O <sub>2</sub> Transfer Coeff.	2				
alpha 1	0.83				
alpha 2	0.6				

Percent Inlet Sulfide Removed 71.2%

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification Data Type 5. Zone Physical and Chemical Conditions **Company Name** Zone 3 Zone 4 Units **Model Controls** New-Indv **Zone** Condition Zone 1 Zone 2 **Facility Name Dissolved Oxygen** 1.57 4.63 4.66 mg/L Catawba SC **Basin Name** Temperature 93.34 89.74 86.02 F -ASB Run H2SSIM 7.42 pH 7.04 7.24 s.u. Data Type 2. Model Zone Information Number of Zones 3 . **Redox Condition** Aerobic -Aerobic -Aerobic 🔻 Aerobic -View Zone Location of **Parameters** 1 feet -968 1208 1235 . Length Hardpipe ASB feet Type of Basin -Width 968 604 617 -**Clear Input** Sheet Depth feet -**Data Type 3. Load Characteristics** 4.5 3.2 3 Loading Main Mixing Moderat -Moderal \* Moderat -Units Characteristics Influent Hardpipe Flow 25.48 MGD . Number of Aerators 31 15 6 1.22 **Total Sulfide** 0.252 2325 1125 450 HP mg/L · **Total Horsepower** 1.47 feet -Sulfate 390 mg/L • Impellor Size 1.625 1.625 1.625 390 Impellor RPM 1200 1200 1200 RPM **Data Type 4. Atmospheric Conditions** mph cm\$ -Windspeed 3.55 **Diffused Air Flow** 0 0 0 Ambient feet -79 F . Weir Height 0 0 0

Temperature

No Stripper Scenario

### **H2SSIM Results**

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.123	gms/s
Total Emissions (H <sub>2</sub> S)	8518.1	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.3	tons/yr
Total Emissions (H <sub>2</sub> S)	3.9	tonnes/yr
Emission Flux (H <sub>2</sub> S)	17.1	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5232.9	1763.2	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	27.3	11.8	9.8	1.82.54	gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	41.500	6.500	5.700		lbs/yr

No Stripper Scenario

Current Parameters						
kgen	0.25					
ThetaGen	1.06					
KDO	0.05					
KSO4	10					
kanox	0.006					
ThetaOx	1.05					
m	1					
n	0.2					
MLVSS	272.2					
O <sub>2</sub> Transfer Coeff.	2					
alpha 1	0.83					
alpha 2	0.6					

Percent Inlet Sulfide Removed 65.9%

#### **Methanol PAE Emissions Factors**

Methanol PAE Scenarios	Hardpipe ppm	Hardpipe Flow, MGD	Air Stripping g/s	Pulp Production	Methanol Emissions Factor Ib/ODTP
New Stripper	N/A	N/A	3.47	2200	0.30
Backup Stripper	2095	1.22	17.63	2200	1.53
No Stripper	3809	1.22	26.69	2200	2.31

Design MeOH:

lb/hr

1620 16

Ib/ODT

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date:

PAE - New Stripper Scenario

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

BIOTREATMENT UNIT DESCRIPTION					II. OVERALL PARAMS -	individual flow	S	7
	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L	
Number of 75 HP Aerators	#	31	15	6				
Number of 100 HP Aerators	#	0	0	0				
Total Horsepower	HP	2325	1125	450	Inlet Stream **	25.48	60.0	AVG ASB Inlet, 2021 and 2022
Temperature	С	35.4	33.5	31.3	Condensate Stream	0.0	0	
Length	ft	968	1,208	1,235	Outlet	25.5	5.1	AVG ASB Effluent, 2021 and 2022
Width	ft	968	604	617	** except conde	nsate flow		
Average Depth	ft	4.5	3.2	3				
Aerator Rotation	грт	1200	1200	1200				
Agitation Area per 75 HP aerator	ft2	1452	1452	1452				
Agitation Area per 100 HP aerator	ft2	2206	2206	2206				
Impellor Diameter	in	19.5	19.5	19.5	NA - individual flow/conc	data not availat	ole	-

II. OVERALL PARAMS - tota	I flows		III. HAP DA	ГА					
	Flow	Flow MeOH	Methanol			Average	Jone Conc	entration	Detec
	m3/sec	MGD mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3	Limit
Influent Concentration	-	25.5 60.0	Conc.	mg/L	60.0	7.4	5.4	3.2	0.5
			Temp.	F		95.7	92.3	88.3	
Effluent Concentration		5.10							
Wind Speed	mph	3.8							
IV. RESULTS		1				12%	9%	5%	

IV. RESULTS	
fbio - Methanol	6 %
Fraction biodegraded	86.3
Fraction air emissions	5.2
Fraction remaining in unit effluent	8.5

Expected zone concentration reductions similar to 2022 data. No Hardpipe Stream

#### **APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED** PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - New Stripper Scenario

	Equil. Ratio (Hc)								
	Diff in Water	Diff in Water Diff in Air Henry's Law or (Keq) MW ScG							
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	с	
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13	
Acetaldehyde	1.41E-05	0.1 <b>24</b>	8.77E-05	3.58E-03	45.1	1.216	1600	291.8	
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27	

General			
	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT **KL Params** Zone 1 Zone 2 126.3 126.3 w Re 2.07E+06 2.07E+06 2.07E+06 Ы 35063 35063 7.92E-04 7.92E-04 7.92E-04 Power Number, p 8.06E+02 8.06E+02 8.06E+02 Fr

	Total TurbArea (ft2)	45012	21780	8712	
	Total TurbArea (m2)	4181.6	2023.4	809.3	
	Frac. Agitated	0.048	0.030	0.011	
	(by surface aerators)				
	QUIESCENT				
	Depth	1.37	0.98	0.92	
	SurfArea (ft2)	937472	729750	762343	
	SurfArea (m2)	87208.33	67885.00	70916.98	
	F/D Ratio	243	301	328	
These Parameters are used	ScL - Methanol	NA	NA	NA	
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA	
m/s	ScL - MEK	NA	NA	NA	
	U* (Friction Velocity)	NA	NA	NA	

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Zone 3

126.3

35063

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED Calculating Mass Transfer Coefficient KL for Various Zones

#### Data Date: PAE - New Stripper Scenario

	Surface Aeration												
		Turbulent Area			П	Quiescient Area							
					11		kL, m/s						
	Temp Adj	kG	kL	KL turb		kG			U10 > 3.25		kL	KL quisc	KL overall
	н	m/s	m/s	m/s		m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s
Zone1					11			A					
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05		3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2						1							
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05		3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3				I									
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05		3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06
# FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

### Data Date: PAE - New Stripper Scenario

NAME OF COMPOUN Number of VOLUME of Average DI	hanol 0372.98 0878333									
FLOW RATE of wastewater to the unit (m3/s)       4       1.116         FLOW RATE of condensate to the unit (m3/s)       5       0.000         Total wastewater flowrate - (including condensates) (m3/s)       5-A       1.116         ESTIMATE OF KL (m/s)       6       see table         Concentration in the wastewater treated in the unit (mg/L)       7       60         Concentration in the condensates (mg/L)       8       0         Concentration in wastewater (total - inc. cond) in (mg/L)       8-A       60         Concentration in the effluent (mg/L)       9       5.0982378										
TOTAL INL TOTAL RE TOTAL AR	ET FLOW (m3/s) line 4 pl SIDENCE TIME (s) line 2 EA OF IMPOUNDMENT (	10 11 12	1.116 224279 230157	2.60 days						
	Lines 13 through 15 Not Use	ed								
7-7-7	Concentration for some	Area of the	Estimate of KL							
Zone	Concentration for zone,		in the zone							
Number	7 29609521	2011e, A (1112) 97001 1501	2 542655 06		(y/s) 2 2705	0 209621				
	5 303164807	67703 7816	2 397195-06		0.8765	0.300021				
	3 166816433	70821 6825	1 37942E-06		0.0700	0.097693				
4 5 6	0.100010400	10021.0020			0.000	0.001000				
TOTALS -	sum for each zone.	15 225706.614		16	3.47					
Removal by	y air stripping (g/s). Line 1 effluent (g/s) Line 9 times	6. line 10.		17 18	3.47 5.69					
Total loadin	a (a/s). {(line 5*line 8)+(lir	ne 4*line 7)} or {line	5-A*line 8-A}	19	67.0					
Removal b	v biodegradation (g/s) Line	19 minus (line 17 -	+ line 18).	20	57.8					
Fraction bio	degraded: Divide line 20	by line 19.		21	0.863					
Fraction air	emissions: Divide line 17		22	0.052						
Fraction rea	maining in unit effluent. D	ivide line 18 by 19.		23	0.085					

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date:

PAE - Old Stripper Scenario

instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT	TION	II. OVERALL PARAMS -	Individual flov	/\$							
-	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L				
Number of 75 HP Aerators	#	31	15	6							
Number of 100 HP Aerators	#	0	0	0							
Total Horsepower	HP	2325	1125	450	Inlet Stream **	25.48	59.5				
Temperature	С	35.4	33.5	31.3	Condensate Stream	1.2	2,095				
Length	ft	968	1,208	1,235	Outlet	26.7	5.1				
Width	ft	968	604	617	** except conde	ensate flow					
Average Depth	ft	4.5	3.2	3	51564 (FUE-566 (EFF556 930.003						
Aerator Rotation	rpm	1200	1200	1200							
Agitation Area per 75 HP aerator	ft2	1452	1452	1452							
Agitation Area per 100 HP aerator	ft2	2206	2206	2206							
Impellor Diameter	in	19.5	19.5	19.5	NA - individual flow/conc	NA - individual flow/conc data not available					

II. OVERALL PARAMS - total flows	5			III. HAP DAT	A					
	Flow	Flow	MeOH	Methanol			Average	Zone Conc	entration	Detect
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3	Limit
Influent Concentration		26.7	152.8	Conc.	mg/L	152.8	41.9	24.2	7.6	0.5
				Temp.	F		95.7	92.3	88.3	
Effluent Concentration			5.10	65						
Wind Speed	mph		3.8							

IV. RESULTS	
fbio - Methanol	i %
Fraction biodegraded	86.8
Fraction air emissions	9.9
Fraction remaining in unit effluent	3.3

27% 16% 5% Avg. 2021/2022 Zone Reductions

### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - Old Stripper Scenario

	Equil. Ratio (Hc)											
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn					
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С				
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13				
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8				
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27				

General			
	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	9
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

# TURBULENT KL Params w

	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Zone 1

Zone 2

Zone 3

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED Calculating Mass Transfer Coefficient KL for Various Zones

### Data Date: PAE - Old Stripper Scenario

	Surface Aeration													
		Tu	urbulent Area			10101			Quiescient Area					
						kL, m/s								
	Temp Adj	kG	kL	KL turb		kG			U10 > 3.25		kL	KL quisc	KL overall	
	Ĥ	m/s	m/s	m/s		m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s	
Zone1							-							
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05		3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06	
Zone 2														
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05		3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06	
Zone 3														
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06	

# FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

### Data Date: PAE - Old Stripper Scenario

NAME OF THE FACILITYCOMPOUND for site specific biorate determinationNumber of zones in the biological treatment unitVOLUME of full-scale system (cubic meters)Average DEPTH of the full-scale system (meters)Average DEPTH of the full-scale system (meters)FLOW RATE of wastewater to the unit (m3/s)FLOW RATE of condensate to the unit (m3/s)Total wastewater flowrate - (including condensates) (m3/s)ESTIMATE OF KL (m/s)Concentration in the wastewater treated in the unit (mg/L)Concentration in the condensates (mg/L)Concentration in the effluent (mg/L)Concentration in the effluent (mg/L)TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3									
Lines 13 through 15 Not Use	d								
		Estimate of KL							
Zone Concentration for zone,	Area of the	in the zone	AIR STF	RIPPING					
Number Ci (mg/L)	zone, A (m2)	(m/s)	KL A Ci	(g/s)					
1 41.94854003	87091.1501	3.54365E-06		12.9462	0.308621				
2 24.242506	67793.7816	2.39719E-06		3.9398	0.162515				
3 7.579459633	70821.6825	1.37942E-06		0.740	0.097693				
4									
5									
6									
TOTALS - sum for each zone.	15 225706.614		16	17.63					
Removal by air stripping (g/s) Line 1	6		17	17.63					
Loading in effluent (g/s) Line 9 times	line 10		18	5.96					
Total loading (g/s), {(line 5*line 8)+(line	e 4*line 7)} or {line	5-A*line 8-A3	19	178.8					
Removal by biodegradation (g/s) Line	Removal by biodegradation $(a/c)$ line 19 minus (line 17 + line 19)								
(g/d) ===	19 minus (line 17 -	+ line 18).	20	155.2					
Fraction biodegraded: Divide line 20	19 minus (line 17 · by line 19.	+ line 18).	20 21	155.2 0.868					
Fraction biodegraded: Divide line 20 Fraction air emissions: Divide line 17	19 minus (line 17 · by line 19. by line 19.	+ line 18).	20 21 22	155.2 0.868 0.099					

### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date:

PAE - No Stripper

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT	ION		II. OVERALL PARAMS	- individual	flows		
0-	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L
Number of 75 HP Aerators	#	31	15	6			
Number of 100 HP Aerators	#	0	0	0			
Total Horsepower	HP	2325	1125	450	Inlet Stream **	25.48	59.5
Temperature	С	35.4	33.5	31.3	Condensate Stream	1.2	3,809
Length	ft	968	1,208	1,235	Outlet	26.7	5.1
Width	ft	968	604	617	** except con	densate flow	
Average Depth	ft	4.5	3.2	3			
Aerator Rotation	rpm	1200	1200	1200			
Agitation Area per 75 HP aerator	ft2	1452	1452	1452			
Agitation Area per 100 HP aerator	ft2	2206	2206	2206			
Impellor Diameter	in	19.5	19.5	19.5	NA - individual flow/cor	ic data not ava	ailable

II. OVERALL PARAMS - total flows			III. HAP DA	III. HAP DATA								
	Flow	Flow	MeOH	Methanol	Methanol			Average Zone Concentration				
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3	-	Limit	
Influent Concentration		26.7	231.3	Conc.	mg/L	231.3	63.5	36.7	11.5		0.5	
				Temp.	F		95.7	92.3	88.3			
Effluent Concentration			5.09824									
Wind Speed	mph		3.8									

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	( )
Fraction air emissions	9.9
Fraction remaining in unit effluent	2.2

27% 16% 5% Avg. 2021/2022 Zone Reductions

## APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - No Stripper

	Equil. Ratio (Hc)									
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoir	ne Eqtn		
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С		
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13		
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8		
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27		

General			
	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT KL Params

		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - No Stripper

Surface Aeration													
		Te	urbulent Area		er illest	Quiescient Área							
								kL, m/s					
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall	
	н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s	
Zone1		·											
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06	
Zone 2												1	
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06	
Zone 3		2.2										1	
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06	

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE **BIODEGRADATION FROM UNIT CONCENTRATIONS**

# Data Date: PAE - No Stripper

NAME OF COMPOUN Number of VOLUME of Average DI FLOW RAT FLOW RAT Total wast ESTIMATE Concentrat Concentrat Concentrat Concentrat TOTAL INL TOTAL INL TOTAL RE TOTAL AR	THE FACILITY ND for site specific biorate of zones in the biological treat of full-scale system (cubic m EPTH of the full-scale system TE of wastewater to the uning water flowrate - (including to f KL (m/s) ion in the wastewater treated ion in the condensates (mg tion in the effluent (mg/L) LET FLOW (m3/s) line 4 plut SIDENCE TIME (s) line 2 of EA OF IMPOUNDMENT (r	Me           1           2         2           3         1.           4         5           5-A         6           6         s           7         59           8         38           8-A         23           9         5.           10         11           12         12	thanol 50372.98 0878333 1.116 0.054 1.170 ee table .511413 08.7177 31.34146 0982378 1.170 214000 230157	2.48 days		
	Lines 13 through 15 Not Use	d	Estimate of KL			
Zone	Concentration for zone,	Area of the	in the zone	AIR STR	RIPPING	
Number	Ci (mg/L)	zone, A (m2)	(m/s)	KL A Ci	(g/s)	
1	63.5146271	87091.1501	3.54365E-06		19.6019	0.308621
2	36.70577636	67793.7816	2.39719E-06		5.9652	0.162515
3	11.47612174	70821.6825	1.37 <b>942E-0</b> 6		1.121	0.097693
4						
5						
6						
TOTALS -	sum for each zone.	15 225706.614		16	26.69	
Removal b	v air stripping (g/s). Line 1	6.		17	26.69	
Loading in	effluent (a/s). Line 9 times	line 10.		18	5.96	
Total loadin	ng (g/s). {(line 5*line 8)+(lin	e 4*line 7)} or {line	5-A*line 8-A}.	19	270.7	
Removal b	y biodegradation (g/s) Line	19 minus (line 17	+ line 18).	20	238.0	
Fraction bio	odegraded: Divide line 20	by line 19.	,	21	0.879	
Fraction air	emissions: Divide line 17	by line 19.		22	0.099	
Fraction re	maining in unit effluent. Di	vide line 18 by 19.		23	0.022	

# APPENDIX C -AIR DISPERSION MODELING DOCUMENTATION

# **Appendix C – Supporting Modeling Information**

New-Indy Catawba LLC (New-Indy Catawba) is submitting our updated ambient air dispersion modeling analysis for the proposed modification to the current foul condensate treatment system at the Mill, in support of the New Condensate Stripper Construction Permit Application (Application). The modification will install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper (existing steam stripper) strictly to backup operation during periods of downtime experienced by the new steam stripper. In support of the Application, New-Indy Catawba has conducted an ambient air dispersion modeling analysis of hydrogen sulfide (H<sub>2</sub>S), methyl mercaptan (MMC), and total reduced sulfur (TRS) and is providing additional information regarding the analysis below. The modeling files will be submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) electronically.

#### **Background**

On May 7, 2021, SCDHEC issued an Order to Correct Undesirable Level of Contaminants (Order) to New-Indy Catawba. Paragraph 5 of the Order required New-Indy to conduct a facility-wide air dispersion modeling analysis for sulfur dioxide (SO<sub>2</sub>),  $H_2S$ , and TRS. New-Indy submitted an analysis for these pollutants in August 2021. In response to comments from SCDHEC and the United States Environmental Protection Agency (U.S. EPA), an updated analysis was submitted in October 2021. SCDHEC made an additional request for the emissions of each TRS constituent for each emission point that had been previously modeled as part of the Order. SCHDEC used this information, which was provided to SCDHEC on June 30, 2022, to conduct a modeling analysis for MMC to address community concerns and to update  $H_2S$  and TRS modeling.

On September 26, 2022, SCDHEC concluded its modeling analysis. During the course of updating the modeling, SCDHEC identified a small number of anomalously high modeled concentrations at a few, isolated receptors. SCDHEC and U.S. EPA reviewed the source of the anomalously high concentrations and concluded they were a result of a bug in the AERMOD (American Meteorological Society/EPA Regulatory Model) code triggered by rare combinations of meteorological and topographic conditions. For the New-Indy Catawba modeling, SCDHEC concluded that only the 1-hour averaging period results from the DITCH2 modeled source were affected. SCDHEC implemented an alternate characterization methodology for the DITCH2 source by reorganizing the order of vertices of the source in the modeling, which eliminated the trigger for the model code bug. U.S. EPA Region 4 concurred that the alternate characterization was appropriate for the analysis.

As mandated by Item V of Appendix A of the November 16, 2022, Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New Indy Catawba, LLC (EPA Consent Decree), New-Indy Catawba must install, maintain, and operate a containment system to prevent any uncontrolled black liquor overflows or releases from reaching the Mill's Aeration Stabilization Basin (ASB). To meet this requirement, New-Indy Catawba submitted a construction permit application (Application) to add the Black Liquor Storage Tank Secondary Containment (Equipment ID 2490) system to the Mill.

On February 13, 2023, New-Indy Catawba received the following email from SCDHEC:

As was touched-upon in the recent pre-application meeting for the stripper project, we request that a modeling analysis be submitted to account for facility-wide increases of hydrogen sulfide, methyl mercaptan and total reduced sulfur (TRS - modeled as H2S) as a result of the addition of a secondary containment tank for black liquor storage at the facility.

The modeled emissions and stack parameters should reflect those used in the 9/26/2022 modeling conducted by DHEC as part of the Order to Correct Undesirable Level of Air

Contaminants (dated 5/7/2021). Both 24 hour and 1 hour averaging periods should be used, consistent with the previous modeling.

On February 15, 2023, SCDHEC provided the AERMOD files used in their September 26, 2022 modeling to ALL4 LLC (ALL4), who is conducting air dispersion modeling on behalf of New-Indy Catawba. As directed by SCDHEC, ALL4 used the SCDHEC-provided modeling, including the reorganized DITCH2 characterization only for the 1-hour analysis of  $H_2S$ , as the basis for modeling the addition of a secondary containment tank for black liquor storage.

Facility-wide modeling of H2S, MMC, and TRS was conducted using the emissions rates, source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK). New-Indy Catawba has not reviewed the emissions rates provided in any of the SCDHEC modeling files and makes no claims, promises, or guarantees about their accuracy, completeness, or adequacy. Results of the air dispersion modeling analysis, which demonstrate that ambient concentrations are below the relevant standards for  $H_2S$ , MMC, and TRS for each averaging period, were provided to SCDHEC on March 8, 2023.

#### Air Dispersion Modeling for the New Condensate Stripper

To comply with Part I of Appendix A of the EPA Consent Decree, New-Indy Catawba will install a new steam stripper to treat all foul condensate. During periods when the new steam stripper is offline, foul condensate will be routed to the existing steam stripper where TRS compounds will be stripped. Peroxide addition to the stripped foul condensate in the Hardpipe will take place prior to discharging the treated pulping condensates to the ASB.

Facility-wide modeling of  $H_2S$ , MMC, and TRS was conducted using the source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK) that were included in the March 8, 2023 modeling submitted to SCDHEC. New-Indy Catawba used the maximum actual emissions rates as submitted in the October 2021 analysis (for  $H_2S$  and TRS) and corresponding MMC emissions rates, with the exception of the additional secondary containment tank and the ASB. Emissions rates from the March 8, 2023 analysis were used for the secondary containment tank and refined emissions reflecting the new steam stripper operation and foul condensate flow for the ASB. Results of the air dispersion modeling analysis demonstrate that ambient concentrations are below the relevant standards for  $H_2S$ , MMC, and TRS for each averaging period.

## 2023 New Steam Stripper Application

Pollutant	Standard <sup>(a)</sup>	Averaging	Modeled Concentration	UTM Easting	UTM Northing	Rank <sup>(a)</sup>	Standard <sup>(a)(c)(d)</sup>
		Period	(µg/m <sup>3</sup> )	(m)	(m)		(µg/m <sup>3</sup> )
ЦŚ	MAAC	24-hour	14.83	511,348.28	3,856,641.25	1st High	140
1125	EPA Action Level	30-minute	67.00	511,298.99	3,856,643.04	1-hour 1st High	837
MMM	MAAC	24-hour	9.40	510,115.55	3,856,041.31	1st High	10
WIWIWI	EPA Action Level	30-minute	47.99	510,209.41	3,856,039,95	1-hour 1st High	57,000
TOC	MAAC	24-hour	70.67	511,249.70	3,856,644.83	1st High	140
TKS	EPA Action Level	30-minute	385.32	510,143.86	3.855.999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ\_SC%20Modeling%20Guidelines\_10.15.18\_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to H<sub>2</sub>S.

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.

# **Buckner**, Katharine

From:	Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Sent:	Friday, March 31, 2023 2:16 PM
То:	Buckner, Katharine
Cc:	Pete Cleveland; Golden, Rebecca; Hardee, Christopher; McCaslin, Steven
Subject:	RE: Draft PSD Applicability Calculations - Foul Condensate Stripper Project
Attachments:	Emissions References.pdf; Responses to DHEC (3-30-23).docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine

Good afternoon. Please find the attached responses to the questions below. Have a good weekend.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Wednesday, March 22, 2023 8:52 AM
To: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>
Cc: Pete Cleveland <pete.cleveland@new-indycb.com>; Golden, Rebecca <RebeccaG@thekraftgroup.com>; Hardee,
Christopher <hardeecd@dhec.sc.gov>; McCaslin, Steven <mccaslsd@dhec.sc.gov>
Subject: RE: Draft PSD Applicability Calculations - Foul Condensate Stripper Project

Hello Bob,

I have quickly reviewed the draft PSD analysis and calculations. I have some comments for you. Since there was such a short amount time to review and submit comments on the abbreviated draft analysis, you can address these comments separately from the application that is due on March 23, 2023. Some of these may already be addressed in the application so provide the specific location where the item is addressed in the application. Also, please send the electronic version of the emission calculations.

- 1. Please provide a narrative on the emission calculations that details the assumptions made, etc.
- 2. In the projected actual emissions, what is the basis for the operating time percentage of the new stripper, the backup stripper, and the time both strippers are offline?
- 3. Please provide complete reference citations for "Title V" and "Columbia" such as page number of the application, etc. Also, provide the complete AP-42 citations to include Chapter, Table, and any pertinent information to pinpoint the emission factor used. For information from stack tests used in the emission calculations, provide the date of the test and whether it is a Department approved test. If the stack test was performed at another facility, please provide the complete stack test report so the results can be reviewed for use as an emission factor. Where the H2SSIM/WATER9 programs were used, please provide the inputs and outputs for all.
- 4. Will the new stripper have its own steam generating system or will steam be supplied by the boilers? If steam will be provided by the boilers, please provide the steam balance for estimating the portion going to the new stripper and backup stripper.
- 5. How will the methanol be added to the Recovery Furnaces? Will a storage tank be needed for the methanol generated? Were emissions accounted for it in the PSD analysis? Is the condensed methanol further purified?
- 6. Please provide a detailed diagram of the foul condensate stripper system to at least show the liquid flows and the gaseous flows.
- 7. Was the 10% annual capacity factor for fossil fuels taken into account in the projected actual emissions for the Recovery Furnaces?
- 8. What happens to the scrubbing liquid from the LVHS caustic scrubber? Is this the existing scrubber or will a new one be installed?

- 9. During the baseline period, where you operating in compliance? If not, how were any limits accounted for in the baseline calculations?
- 10. Provide the vendor guarantee/certification for the emission factors supplied by the vendor.
- 11. For Footnote E, why was data from the entire baseline period not used in the PSD analysis.

Please provide responses by Friday, March 31, 2023.

### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Sent: Friday, March 17, 2023 11:37 AM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Hardee, Christopher <<u>hardeecd@dhec.sc.gov</u>>; McCaslin, Steven
<<u>mccaslsd@dhec.sc.gov</u>>
Cc: Pete Cleveland <<u>pete.cleveland@new-indycb.com</u>>; Golden, Rebecca <<u>RebeccaG@thekraftgroup.com</u>>
Subject: Draft PSD Applicability Calculations - Foul Condensate Stripper Project

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

#### Katharine

Please find attached the draft calculations for the New Indy foul condensate stripper project. I have also placed a copy in a Fedex package. A full application will be submitted by March 23, 2023. Let me know if you have questions.

NOTICE: This message and any attachments are solely for the intended recipient and may contain confidential or privileged information. If you are not the intended recipient, you are hereby notified that any review, dissemination, distribution or duplication of this message and any attachments is prohibited. If you have received this communication in error, please notify us by reply email and immediately and permanently delete this message and any attachments. Email transmission may not be secure and could contain errors. We accept no liability for any damage caused by any virus transmitted by this email. Please do not send to us by email any information containing personally identifiable information without appropriate encryption. Thank you.

- 1. Please provide a narrative on the emission calculations that details the assumptions made, etc. A narrative was submitted with the permit application submitted March 23, 2023. Emissions calculations are discussed in Section 3.2.2.3.
- In the projected actual emissions, what is the basis for the operating time percentage of the new stripper, the backup stripper, and the time both strippers are offline? The PSD calculations were very conservative and assumed "worst case scenarios" based on best engineering judgement. In practice, we expect the new low pressure stripper to be in operation greater than 90%. The worst case scenario of 90% new stripper operation is also consistent with §63.446(g).
- 3. Please provide complete reference citations for "Title V" and "Columbia" such as page number of the application, etc. Also, provide the complete AP-42 citations to include Chapter, Table, and any pertinent information to pinpoint the emission factor used. For information from stack tests used in the emission calculations, provide the date of the test and whether it is a Department approved test. If the stack test was performed at another facility, please provide the complete stack test report so the results can be reviewed for use as an emission factor. Where the H2SSIM/WATER9 programs were used, please provide the inputs and outputs for all.

Stack tests performed at another facility were not used. H2SSIM and WATER9 inputs and outputs are located starting on page B-26 of Appendix B of the permit application submitted March 23, 2023. Please see attached tables for more detailed citations for other emissions factors.

- 4. Will the new stripper have its own steam generating system or will steam be supplied by the boilers? If steam will be provided by the boilers, please provide the steam balance for estimating the portion going to the new stripper and backup stripper. Steam will be provided by the boilers. Emissions from generating steam required for the new stripper and backup stripper are based on preliminary design information from the vendors. The final steam balance for the project has not been developed.
- 5. How will the methanol be added to the Recovery Furnaces? Will a storage tank be needed for the methanol generated? Were emissions accounted for it in the PSD analysis? Is the condensed methanol further purified?

The methanol will be added to the recovery furnace black liquor feed per BLRBAC standards. Emissions from SRL methanol combustion in the recovery furnace are addressed in Section 3.2.2.3. A process tank for the methanol is proposed in the application on page 1-1 and throughout the application. The methanol tank will vent to the NCG system, which was accounted for in the analysis in Section 3.2.2.3 as the total NCG collection system. The condensed methanol will not be further purified.

- 6. Was the 10% annual capacity factor for fossil fuels taken into account in the projected actual emissions for the Recovery Furnaces? The annual capacity factor was evaluated, and there is no impact to the 10% annual capacity factor. The LVHC ignitor (1 MMBtu/hr) is approximately 0.1% of the total heat input capacity of the recovery furnace. Emissions from the LVHC ignitor are included in the emissions calculation tables in Appendix B.
- 7. What happens to the scrubbing liquid from the LVHS caustic scrubber? Is this this the existing scrubber or will a new one be installed? When the LVHC NCG's are being burned in the recovery boiler the existing LVHC scrubber will not be utilized, as explained on page 3-18 of the submitted permit application. The gases will be taken to the recovery boiler before the LVHC scrubber. When the backup combustion source is

used (combination boiler no. 1 or 2), the gases will go through the existing LVHC scrubber. The scrubbing liquid will be returned to the liquor cycle, consistent with current operation.

8. During the baseline period, where you operating in compliance? If not, how were any limits accounted for in the baseline calculations?

Yes. Note our baseline emissions for  $SO_2$  are based on the October 2021 performance test.

- Provide the vendor guarantee/certification for the emission factors supplied by the vendor. The treatment efficiencies presented in Section 3.2.2.3 and Appendix B are based on preliminary design information. Documentation can be supplied once the vendor is selected.
- For Footnote E, why was data from the entire baseline period not used in the PSD analysis. Steam data for the existing steam stripper (Backup Stripper) was based on January 1 – December 16, 2022, which was readily available at the time the permit application was developed.

#### SO2 EMISSIONS REFERENCES

					SO2 Sulfur				
					Emissions Factor	Capture <sup>c</sup>	SO2 Em	nissions	
Stripper Operating Scenario	Operating Configuration	Controls	UOM	lb/UOM	Reference	%	lb/hr	tpy	
	1	BASE	LINE ACTUAL E	MISSIONS (N	March 2021 - February 2023)				
Backup Stripper SOG <sup>A</sup>	NA	SOG to CB1/CB2	ADTP/day	1.06	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	63.1	252.5	
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	1.97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	117.0	512.4	
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B,E</sup>	NA	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.1	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B,E</sup>	NA	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	61.9	5.2	
SO2 BASELINE ACTUAL EMISSIONS (BAI	E)							770.2	
			PROJ	ECTED ACTU	AL EMISSIONS				
New Stripper Online	SRL Online	SRL Methanol to RF2/3 <sup>G</sup>	ADTP/day	0.56	Vendor / Preliminary Design Information	99%	0.6	2.4	
New Stripper Online	SRL Online	SRL LVHC to RF3 <sup>G</sup>	ADTP/day	0.84	Vendor / Preliminary Design Information	99%	0.9	2.7	
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2 <sup>G</sup>	ADTP/day	0.84	Vendor / Preliminary Design Information	50%	47.2	44.2	
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	31.0	
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	55.1	
No Stripper Online	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	NA	NA	NA	NA	NA	NA	
LVHC Collection System	NA	LVHC to RF3	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	5.9	19.4	
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	295.2	323.3	
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>1</sup>	NA	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.00	0.0	
New Stripper Steam - Natural Gas	Natural Gas <sup>D,F</sup>	NA	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D,F</sup>	NA	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D,F</sup>	NA	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.004	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D,F</sup>	NA	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	53.1	3.4	
SO2 PROJECTED ACTUAL EMISSIONS (P	AE)							628.84	
			NET EM	ISSIONS CHA	NGE (PAE - BAE)				
NET EMISSIONS CHANGE (PAE - BAE)								-141.35	

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

#### H2SO4 EMISSIONS REFERENCES

			H2SO4		Sulfur					
				Emissions Factor	Capture	H2SO4 E	missions			
Stripper Operating Scenario	Operating Configuration	Controls	lb/ADTP	Reference	%	lb/hr	tpy			
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)										
LVHC Collection System	NA	LVHC to CB1/CB2	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.3	1.3			
H2SO4 BASELINE ACTUAL EMISSIONS (BAE)										
		PROJECTED ACTUAL EMISSIO	NS							
LVHC Collection System	NA	LVHC to RF3	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	1.82			
LVHC Collection System	NA	LVHC to CB1/CB2	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	0.61			
H2SO4 PROJECTED ACTUAL EMISSIONS	(PAE)						2.43			
		NET EMISSIONS CHANGE (PAE -	BAE)							
NET EMISSIONS CHANGE (PAE - BAE)							1.15			

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

#### NOX EMISSIONS REFERENCES

					NOX				
					Emissions Factor	Increase <sup>C</sup>	NOX Er	nissions	
Stripper Operating Scenario	Operating Configuration	Controls	UOM	Ib/UOM Reference			lb/hr	tpy	
		BASELINE	ACTUAL EMIS	SIONS (March	2021 - February 2023)				
Backup Stripper SOG <sup>A</sup>	NA	SOG to CB1/CB2	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	24.7	98.7	
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B,E</sup>	NA	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	8.3	32.4	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B,E</sup>	NA	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	8.8	0.7	
NOX BASELINE ACTUAL EMISSIONS								131.8	
PROJECTED ACTUAL EMISSIONS									
New Stripper Online	SRL Online	SRL Methanol to RF2/3 <sup>G</sup>	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	1.8	6.7	
New Stripper Online	SRL Online	SRL LVHC to RF3 <sup>G</sup>	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	0.2	0.6	
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2 <sup>G</sup>	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4	
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2	
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	16.4	
No Stripper Online	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	NA	NA	NA	NA	NA	NA	
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>1</sup>	NA	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	0.3	0.1	
New Stripper Steam - Natural Gas	Natural Gas <sup>D,F</sup>	NA	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	27.1	87.2	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D,F</sup>	NA	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	28.9	20.9	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D,F</sup>	NA	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.1	2.0	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D,F</sup>	NA	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.5	0.5	
NOX PROJECTED ACTUAL EMISSIONS								147.9	
			NET EMISSIO	ONS CHANGE	(PAE - BAE)				
PAE - BAE								16.1	

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC).

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

#### CO EMISSIONS REFERENCES

				CO		CO		
					Emissions Factor	Control	CO Em	issions
Stripper Operating Scenario	Operating Configuration	Controls	UOM	lb/UOM	Reference	%	lb/hr	tpy
		BASELINE ACTU	JAL EMISSION	IS (March 202	1 - February 2023)	-		
Backup Stripper SOG <sup>A</sup>	NA	SOG to CB1/CB2	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.3	17.3
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	NA	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.5	9.7
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	NA	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.9	0.1
CO BASELINE ACTUAL EMISSIONS								27.1
		F	PROJECTED A	CTUAL EMISSI	ONS			
New Stripper Online	SRL Online	SRL Methanol to RF2/3	NA	NA	NA	NA	NA	NA
New Stripper Online	SRL Online	SRL LVHC to RF3	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	2.9
No Stripper Online	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>i</sup>	NA	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	0.1	0.0
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	NA	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	NA	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	NA	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.1	0.6
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	NA	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS								64.2
		NE		CHANGE (PAE	- BAE)			
PAE - BAE								37.1

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### VOC EMISSIONS REFERENCES

					VOC			
					Emissions Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scenario	Operating Configuration	Controls	UOM	lb/UOM	Reference	%	lb/hr	tpy
		BASELINE ACT	UAL EMISSION	S (March 202	1 - February 2023)			
Backup Stripper SOG <sup>A</sup>	NA	LVHC to CB1/CB2	ADTP/day	4.37	Average daily methanol stripped based on daily Subpart S compliance.	98.0%	5.19	20.78
Aerated Stabilization Basin (ASB)	Foul Condensate to Hard Pipe	NA	ADTP/day	8.73E-01	WATER9 Inputs and Outputs Provided.	NA	51.88	227.21
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.81
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	NA	mmBtu/hr	5.39E-03	AP-42 Table 1.4-2.	NA	0.2	0.6
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	NA	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.1	0.0
VOC BASELINE ACTUAL EMISSIONS								249.43
PROJECTED ACTUAL EMISSIONS								
New Stripper Online	SRL Online	SRL Methanol to RF2/3 <sup>G</sup>	ADTP/day	14.40	Vendor / Preliminary Design Information	99.9%	1.62	6.07
New Stripper Online	SRL Online	SRL LVHC to RF3 <sup>G</sup>	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	10.11
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2 <sup>G</sup>	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	3.37
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	7.10
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	12.61
ASB - New Stripper Online	No Foul Condensate to Hard Pipe	NA	ADTP/day	0.29	WATER9 Inputs and Outputs Provided.	NA	32.40	127.72
ASB - Backup Stripper Online	TRS Stripped From Foul Condensate	NA	ADTP/day	1.42	WATER9 Inputs and Outputs Provided.	NA	159.98	56.06
ASB - No Stripper Online	Foul Condensate to Hard Pipe	NA	ADTP/day	2.20	WATER9 Inputs and Outputs Provided.	NA	247.05	21.64
LVHC Collection System	NA	LVHC to RF3	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>1</sup>	NA	mmBtu/hr	5.39E-03	AP-42 Table 1.4-2.	NA	0.0	0.0
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	NA	mmBtu/hr	5.39E-03	AP-42 Table 1.4-2.	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	NA	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	NA	mmBtu/hr	5.39E-03	AP-42 Table 1.4-2.	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	NA	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS								248.05
		NE		CHANGE (PAE	- BAE)			
PAE - BAE								-1.38

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

#### TRS EMISSIONS REFERENCES

				TRS Sulfur					
					Emissions Factor	Capture <sup>C</sup>	TRS Em	nissions	
Stripper Operating Scenario	Operating Configuration	Controls	UOM	lb/UOM	Reference	%	lb/hr	tpy	
		BASELIN	E ACTUAL EM	ISSIONS (Mai	rch 2021 - February 2023)				
Backup Stripper SOG <sup>A</sup>	NA	LVHC to CB1/CB2	ADTP/day	2.88E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.17	0.68	
Aerated Stabilization Basin (ASB)	NA	NA	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.42	10.61	
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.48	2.09	
TRS BASELINE ACTUAL EMISSIONS				13.38					
PROJECTED ACTUAL EMISSIONS									
New Stripper Online	SRL Online	SRL Methanol to RF2/3 <sup>G,H</sup>	ADTP/day	0.33	Vendor / Preliminary Design Information	99.9%	0.04	0.14	
New Stripper Online	SRL Online	SRL LVHC to RF3 <sup>G,H</sup>	ADTP/day	0.49	Vendor / Preliminary Design Information	99.9%	0.05	0.15	
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2 <sup>G</sup>	ADTP/day	0.49	Vendor / Preliminary Design Information	99%	0.55	0.51	
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.18	
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.32	
ASB - New Stripper Online	No Foul Condensate to Hard Pipe	NA	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74	
ASB - Backup Stripper Online	TRS Stripped From Foul Condensate	NA	ADTP/day	2.72E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	3.06	1.07	
ASB - No Stripper Online	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	0.72	
LVHC Collection System	NA	LVHC to RF3	ADTP/day	1.75E+00	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65	
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08	
TRS PROJECTED ACTUAL EMISSIONS								15.56	
			NET EMISS	IONS CHANG	ie (PAE - BAE)				
PAE - BAE								2.18	

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

#### H2S EMISSIONS REFERENCES

				H2S Sulfur				
					Emissions Factor	Capture <sup>C</sup>	H2S Em	nissions
Stripper Operating Scenario	Operating Configuration	Controls	UOM	lb/UOM	Reference	%	lb/hr	tpy
		BASELIN	E ACTUAL EM	ISSIONS (Ma	rch 2021 - February 2023)			
Backup Stripper SOG <sup>A</sup>	NA	LVHC to CB1/CB2	ADTP/day	4.13E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.10
Aerated Stabilization Basin (ASB)	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	ADTP/day	1.36E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.81	3.54
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	5.03E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS							3.77	
			PROJEC	TED ACTUAL	EMISSIONS			
New Stripper Online	SRL Online	SRL Methanol to RF2/3 <sup>G,H</sup>	ADTP/day	0.24	Vendor / Preliminary Design Information	99.9%	0.03	0.10
New Stripper Online	SRL Online	SRL LVHC to RF3 <sup>G,H</sup>	ADTP/day	0.37	Vendor / Preliminary Design Information	99.9%	0.04	0.12
New Stripper Online	SRL Online	SRL LVHC to CB1/CB2 <sup>G</sup>	ADTP/day	0.37	Vendor / Preliminary Design Information	99%	0.41	0.39
New Stripper Online	SRL Offline	SOG to CB1/CB2	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
Backup Stripper Online	NA	SOG to CB1/CB2	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.24
ASB - New Stripper Online	No Foul Condensate to Hard Pipe	NA	ADTP/day	9.27E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
ASB - Backup Stripper Online	H2S Stripped From Foul Condensate	NA	ADTP/day	9.81E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.39
ASB - No Stripper Online	Foul Condensate to Hard Pipe	Hydrogen Peroxide Addition	ADTP/day	9.54E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.09
LVHC Collection System	NA	LVHC to RF3	ADTP/day	1.17E-01	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
LVHC Collection System	NA	LVHC to CB1/CB2	ADTP/day	5.87E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS								5.69
			NET EMISS	SIONS CHANG	GE (PAE - BAE)			
PAE - BAE								1.92

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

			PM		PM				
				Emissions Factor	Control	PM Em	nissions		
Stripper Operating Scenario	<b>Operating Configuration</b>	UOM	lb/UOM	Reference	%	lb/hr	tpy		
	BASE	LINE ACTUAL	EMISSIONS (N	March 2021 - February 2023)					
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.9		
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.5	0.4		
PM BASELINE ACTUAL EMISSIONS							1.3		
PROJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>1</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03		
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4		
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8		
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1		
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	3.9	0.3		
PM PROJECTED ACTUAL EMISSIONS 13.4									
		NET EN	IISSIONS CHA	NGE (PAE - BAE)					
PAE - BAE							12.2		

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

			PM10					
				Emissions Factor	Control	PM10 E	missions	
Stripper Operating Scenario	<b>Operating Configuration</b>	UOM	lb/UOM	Reference	%	lb/hr	tpy	
	BASE	LINE ACTUAL	EMISSIONS (N	1arch 2021 - February 2023)				
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.9	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	3.3	0.3	
PM10 BASELINE ACTUAL EMISSIONS	M10 BASELINE ACTUAL EMISSIONS 1.2							
PROJECTED ACTUAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>I</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03	
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.8	0.2	
PM10 PROJECTED ACTUAL EMISSIONS								
		NET EN	IISSIONS CHA	NGE (PAE - BAE)				
PAE - BAE							9.3	

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

- E Actual steam usage January 1 December 16, 2022.
- F Projected steam usage at 850 gpm from vendor design.
- G reserved.
- H reserved.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

		PM2.5			PM2.5			
				Emissions Factor	Control	PM2.5 E	missions	
Stripper Operating Scenario	<b>Operating Configuration</b>	UOM	lb/UOM	Reference	%	lb/hr	tpy	
	BASEL	INE ACTUAL E	MISSIONS (M	arch 2021 - February 2023)				
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.9	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.5	0.2	
PM2.5 BASELINE ACTUAL EMISSIONS	M2.5 BASELINE ACTUAL EMISSIONS 1.1							
PROJECTED ACTUAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>i</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03	
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.1	0.1	
PM2.5 PROJECTED ACTUAL EMISSIONS 8.4								
		NET EM	ISSIONS CHAN	IGE (PAE - BAE)				
PAE - BAE							7.4	

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

				Lead	Lead			
				Emissions Factor	Control	Lead Er	nissions	
Stripper Operating Scenario	Operating Configuration	UOM	lb/UOM	Reference	%	lb/hr	tpy	
	BASEL	INE ACTUAL E	MISSIONS (N	1arch 2021 - February 2023)				
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.48E-05	5.78E-05	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	7.87E-04	6.63E-05	
LEAD BASELINE ACTUAL EMISSIONS	LEAD BASELINE ACTUAL EMISSIONS							
PROJECTED ACTUAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>1</sup>	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07	
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	4.84E-05	1.56E-04	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	2.58E-03	1.87E-03	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.27E-05	3.62E-06	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	6.75E-04	4.35E-05	
LEAD PROJECTED ACTUAL EMISSIONS							2.08E-03	
		NET EM	ISSIONS CHA	NGE (PAE - BAE)				
PAE - BAE							1.95E-03	

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### CO2 EMISSIONS REFERENCES

			CO2					
				Emissions Factor	Control	CO2 Em	nissions	
Stripper Operating Scenario	<b>Operating Configuration</b>	UOM	lb/UOM	Reference	%	lb/hr	tpy	
	BASE	LINE ACTUAL	EMISSIONS (I	March 2021 - February 2023)				
Backup Stripper Steam <sup>A</sup>	Natural Gas <sup>B</sup>	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,448.9	13,512	
Backup Stripper Steam <sup>A</sup>	No. 6 Oil <sup>B</sup>	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,655.3	392	
CO2 BASELINE ACTUAL EMISSIONS	O2 BASELINE ACTUAL EMISSIONS 13,90						13,904	
PROJECTED ACTUAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	Natural Gas <sup>i</sup>	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58	
New Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392	
New Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076	
Backup Stripper Steam - Natural Gas	Natural Gas <sup>D</sup>	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	2,958.3	846	
Backup Stripper Steam - No. 6 Oil	No. 6 Oil <sup>D</sup>	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	3,993.0	257	
CO2 PROJECTED ACTUAL EMISSIONS	CO2 PROJECTED ACTUAL EMISSIONS 48,629							
	NET EMISSIONS CHANGE (PAE - BAE)							
PAE - BAE	AE - BAE 34,725							

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

# **Buckner**, Katharine

Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Wednesday, April 5, 2023 3:43 PM
Buckner, Katharine
Hardee, Christopher
RE: confidential page in stripper app

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine

Good afternoon. There is nothing in the application that is confidential. As you surmised, the "confidential" marking was just part of a file name. The box marked "no" to indicate confidentiality is correct. Have a good Easter.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Tuesday, April 4, 2023 11:53 AM
To: Tourville, Bob <Bob.Tourville@new-indycb.com>
Cc: Hardee, Christopher <hardeecd@dhec.sc.gov>
Subject: RE: confidential page in stripper app

**External Email** 

Hey Bob,

I checked the app for other possible confidential information. The word "confidential" appears throughout the WATER9 results, beginning on page B-28. It appears to be just a filename. Please comment if the Water9 information should be treated as confidential along with page B-17. If so, please send a public version of the application as soon as possible with a cover letter indicating the original app should be treated as confidential.

Also, the box on the application form to indicate if confidential information is enclosed in the app was marked "no", page 2 of 9.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Buckner, Katharine
Sent: Tuesday, April 4, 2023 11:43 AM
To: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: Hardee, Christopher <<u>hardeecd@dhec.sc.gov</u>>
Subject: confidential page in stripper app

### Hey Bob,

There is a page marked confidential in the stripper application. It is B-17. Is this supposed to be confidential? Confidential information is supposed to be submitted under separate cover and clearly marked and separated from public versions of applications.

Please let me know.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



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# **Buckner**, Katharine

From:	Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Sent:	Tuesday, April 4, 2023 3:41 PM
To:	Buckner, Katharine
Subject:	RE: Xcel sheet for new stripper app
Attachments:	FINAL Emissions Calculations (3-22-23).xlsx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email.

Katharine

Here you go. Working answers to your other questions.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Tuesday, April 4, 2023 2:00 PM
To: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>
Subject: Xcel sheet for new stripper app

### **External Email**

Hey Bob,

Can you please send the Xcel spreadsheets for the new stripper app so that I can verify the calculations and emission rates?

#### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



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### NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operating Time			
Stripper Operating Scenario	%	hrs		
New Stripper Online	90%	7,884.0		
Backup Stripper Online	8%	700.8		
No Stripper Online	2%	175.2		

LVHC Control	Operating Time				
Operating Scenario	%	hrs			
RF3 Available for LVHC	75%	6,570.0			
LVHC to CB1/CB2	25%	2,190.0			

#### Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	со	H2SO4	TRS	voc	Pb	H <sub>2</sub> S	Total CO <sub>2</sub> e
Baseline Actual Emissions	1.26	1.16	1.09	132	770	27.1	1.28	13.4	249	1.24E-04	3.77	13,904
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.2	9.28	7.36	16.1	-141.35	37.1	1.15	2.18	-1.4	1.95E-03	1.92	34,725
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

#### SO2 EMISSIONS CALCULATIONS

	Stripper	Scenario		Operating C	onfiguration		Con	trols			S	02	Sulfur		
	Operati	ng Time		Time		Operati	ig Time Production Rate		Emissions Factor		Capture <sup>C</sup>	SO2 Emissions			
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	-			BASE	LINE ACTUAL	EMISSIONS (March 2021 - Februa	ry 2023)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	1.06	Stack Test	NA	63.1	252.5
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	1.97	Stack Test	NA	117.0	512.4
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	6.00E-04	AP-42	NA	0.02	0.1
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	2.20E+00	AP-42	NA	61.9	5.2
SO2 BASELINE ACTUAL EMISSIONS (BAE	:)														770.2
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor	99%	0.6	2.4
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor	99%	0.9	2.7
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor	0%	157.4	31.0
Backup Stripper Online	8.0%	700.8	NA	100%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	1.40	Vendor	0%	157.4	55.1
No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.25	Stack Test	99%	5.9	19.4
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	Stack Test	50%	295.2	323.3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>l</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42	NA	0.00	0.0
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	6.00E-04	AP-42	NA	0.02	0.004
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	2.20E+00	AP-42	NA	53.1	3.4
SO2 PROJECTED ACTUAL EMISSIONS (PAE) 628.1										628.84					
					NET EN	/ISSIONS CHANGE (PAE - BAE)									
NET EMISSIONS CHANGE (PAE - BAE)										-141.35					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

				Foul	Methanol <sup>G</sup>	LVHC <sup>G</sup>
				UNCTRL	UNCTRL	UNCTRL
				lb/ADTP	lb/ADTP	lb/ADTP
TRS as S		MW	AHL	0.70	0.28	0.42
sulfur	S	32.065				
sulfur dioxide	SO <sub>2</sub>	64.064		1.40	0.56	0.84
### H2SO4 EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	ating		Con	trols				H2SO4	Sulfur				
	Operati	ng Time		Configura	ition Time		Operati	ing Time	Product	tion Rate	1	Emissions Factor	Capture	H2SO4 E	missions		
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/ADTP	Reference	%	lb/hr	tpy		
					BASELINE	ACTUAL EMISSIONS (March 2021 -	February 202	23)									
IV/HC Collection System	100%	9 760 0	NA	100%	8 760 0	IVEC to CR1/CR2	100.0%	8 760 0	1.426	ADTR/day	4 925-02	NCASI Technical Bulletin	NA	0.2	12		
Line conection system	100%	8,700.0	NA NA	100%	8,700.0	EVITE to CB1/CB2	100.078	8,700.0	1,420	ADTF/day	858, Table 10						
H2SO4 BASELINE ACTUAL EMISSIONS (B	AE)														1.3		
						PROJECTED ACTUAL EMISSION	IS										
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	1.82		
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	0.61		
H2SO4 PROJECTED ACTUAL EMISSIONS	(PAE)														2.43		
						NET EMISSIONS CHANGE (PAE - E	BAE)										
NET EMISSIONS CHANGE (PAE - BAE)															1.15		

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

### NOX EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	ating		Con	trols			N	OX	Ammonia		
	Operat	ing Time		Configura	ition Time		Operati	ing Time	Produc	tion Rate	Emissio	ns Factor	Increase <sup>C</sup>	NOX Er	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	_			BAS	ELINE ACTUA	L EMISSIONS (March 2021 - Februar	y 2023)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,426	ADTP/day	0.415	Columbia	NA	24.7	98.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100%	7,835.7	29.5	mmBtu/hr	2.80E-01	AP-42	NA	8.3	32.4
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100%	168.3	28.1	mmBtu/hr	3.13E-01	AP-42	NA	8.8	0.7
NOX BASELINE ACTUAL EMISSIONS														-	131.8
				1	PR	DJECTED ACTUAL EMISSIONS	-	1			-				
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500	Title V	1.0%	1.8	6.7
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500	Title V	1.0%	0.2	0.6
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415	Columbia	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	Columbia	NA	46.7	9.2
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	0.415	Columbia	NA	46.7	16.4
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>l</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	2.80E-01	AP-42	NA	7.1	2.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	3.13E-01	AP-42	NA	7.5	0.5
NOX PROJECTED ACTUAL EMISSIONS															147.9
					NET E	MISSIONS CHANGE (PAE - BAE)									
PAE - BAE															16.1

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC).

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

### CO EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	ating		Con	trols			C	0	CO		
	Operati	ing Time		Configura	ition Time		Operati	ng Time	Product	tion Rate	Emissior	ns Factor	Control	CO Em	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	•			BAS	ELINE ACTUA	L EMISSIONS (March 2021 - February 20	)23)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	0.0728	Columbia	NA	4.3	17.3
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	8.40E-02	AP-42	NA	2.5	9.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	3.33E-02	AP-42	NA	0.9	0.1
CO BASELINE ACTUAL EMISSIONS															27.1
					PR	OJECTED ACTUAL EMISSIONS									
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	Columbia	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	Columbia	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	Columbia	NA	8.2	1.6
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.0728	Columbia	NA	8.2	2.9
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>I</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	8.40E-02	AP-42	NA	2.1	0.6
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	3.33E-02	AP-42	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS															64.2
					NET	MISSIONS CHANGE (PAE - BAE)									
PAE - BAE															37.1

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

### VOC EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	ating		Con	trols			V	C			
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Produc	tion Rate	Emissio	ns Factor	Removal <sup>C</sup>	VOC En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BAS	ELINE ACTUA	L EMISSIONS (March 2021 - February 20	23)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4.37	Stripped	98.0%	5.19	20.78
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,426	ADTP/day	8.73E-01	WATER9	NA	51.88	227.21
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	3.10E-03	Columbia	NA	0.18	0.81
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	5.39E-03	AP-42	NA	0.2	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	1.87E-03	AP-42	NA	0.1	0.0
VOC BASELINE ACTUAL EMISSIONS															249.43
	1		1		PR	OJECTED ACTUAL EMISSIONS	1	1		1 1					
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40	Vendor	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60	Vendor	98%	3.60	10.11
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60	Vendor	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor	98%	36.00	7.10
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	16.00	Vendor	98%	36.00	12.61
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9	NA	32.40	127.72
ASB - Backup Stripper Online	8%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100%	700.8	2,700	ADTP/day	1.42	WATER9	NA	159.98	56.06
ASB - No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	NA	100%	175.2	2,700	ADTP/day	2.20	WATER9	NA	247.05	21.64
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.39E-03	AP-42	NA	0.0	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.39E-03	AP-42	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	5.39E-03	AP-42	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	1.87E-03	AP-42	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS															248.05
					NET	MISSIONS CHANGE (PAE - BAE)									
PAE - BAE															-1.38

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

### TRS EMISSIONS CALCULATIONS

	Strinner	Scenario		One	ating		Cor	trols				TRS	Sulfur		
	Operati	ng Time		Configura	tion Time		Operat	ing Time	Produc	tion Rate	Emi	ssions Factor	Canture <sup>C</sup>	TRS En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value		Ib/UOM	Reference	capture %	lb/hr	tov
	70	1115		,,,	BASELINE AC	TUAL EMISSIONS (March 2021 - Februa	rv 2023)	1.1.5	Value	00111	10/00111	Reference	70	10/111	cp y
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	2.88E-03	Stack test	NA	0.17	0.68
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,426	ADTP/day	4.08E-02	H2SSIM/WATER9	NA	2.42	10.61
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	8.01E-03	Stack test	NA	0.48	2.09
TRS BASELINE ACTUAL EMISSIONS								•							13.38
						PROJECTED ACTUAL EMISSIONS									
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.33	Vendor	99.9%	0.04	0.14
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor	99%	0.91	0.18
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.81	Vendor	99%	0.91	0.32
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9	NA	2.72	10.74
ASB - Backup Stripper Online	8.0%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9	NA	3.06	1.07
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9	NA	8.19	0.72
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	Stack test	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	Stack test	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															15.56
					N	ET EMISSIONS CHANGE (PAE - BAE)									
PAE - BAE															2.18

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

					Foul	Methanol <sup>G</sup>	LVHC <sup>G</sup>
					UNCTRL	UNCTRL	UNCTRL
					lb/ADTP	Ib/ADTP	lb/ADTP
TRS as S		MW		AHL	0.70	0.28	0.42
sulfur	S	32.065					
hydrogen sulfide	H <sub>2</sub> S	34.081	82.3%		0.61	0.24	0.37
methyl mercaptan	CH₄S	48.107	6.4%		0.07	0.03	0.04
dimethyl sulfide	$C_2H_6S$	62.134	5.2%		0.07	0.03	0.04
dimethyl disulfide	$C_2H_6S_2$	94.199	6.1%		0.06	0.03	0.04
TRS as TRS	TRS				0.81	0.33	0.49

### H2S EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	ating		Cor	ntrols			Н	25	Sulfur		
	Operati	ng Time		Configura	ation Time		Operat	ing Time	Product	tion Rate	Emissio	ns Factor	Capture <sup>C</sup>	H2S Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BASE	LINE ACTUAL	EMISSIONS (March 2021 - February 2	2023)								
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4.13E-04	Stack test	NA	0.02	0.10
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,426	ADTP/day	1.36E-02	H2SSIM	NA	0.81	3.54
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	5.03E-04	Stack test	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS															3.77
					PRO	JECTED ACTUAL EMISSIONS									
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.24	Vendor	99.9%	0.03	0.10
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.14
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.24
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM	NA	1.04	4.11
ASB - Backup Stripper Online	8.0%	700.8	H2S Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	9.81E-03	H2SSIM	NA	1.10	0.39
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	9.54E-03	H2SSIM	NA	1.07	0.09
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	Stack test	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	Stack test	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															5.69
					NET EN	/ISSIONS CHANGE (PAE - BAE)									
PAE - BAE															1.92

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

				Foul	Methanol <sup>G</sup>	LVHC <sup>G</sup>
				UNCTRL	UNCTRL	UNCTRL
				lb/ADTP	Ib/ADTP	lb/ADTP
TRS as S		MW	AH	IL 0.70	0.28	0.42
sulfur	S	32.065				
hydrogen sulfide	H <sub>2</sub> S	34.081	82.3%	0.61	0.24	0.37
methyl mercaptan	CH <sub>4</sub> S	48.107	6.4%	0.07	0.03	0.04
dimethyl sulfide	$C_2H_6S$	62.134	5.2%	0.07	0.03	0.04
dimethyl disulfide	$C_2H_6S_2$	94.199	6.1%	0.06	0.03	0.04
TRS as TRS	TRS			0.81	0.33	0.49

### PM EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	rating		Con	trols			Р	M	PM		
	Operati	ng Time		Configura	ation Time		Operati	ng Time	Product	tion Rate	Emissio	ns Factor	Control	PM En	nissions
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BAS	SELINE ACTUA	L EMISSIONS (March 2021 - Fe	bruary 2023)								
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.61E-01	AP-42	NA	4.5	0.4
PM BASELINE ACTUAL EMISSIONS															1.3
					PR	OJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.61E-01	AP-42	NA	3.9	0.3
PM PROJECTED ACTUAL EMISSIONS															13.4
					NET E	MISSIONS CHANGE (PAE - BAE	)								
PAE - BAE															12.2

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

### PM10 EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	rating		Con	trols			PN	110	PM10		
	Operati	ing Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate	Emissio	ns Factor	Control	PM10 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BA	SELINE ACTU	AL EMISSIONS (March 2021 - Febr	uary 2023)								
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.17E-01	AP-42	NA	3.3	0.3
PM10 BASELINE ACTUAL EMISSIONS															1.2
					P	ROJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.17E-01	AP-42	NA	2.8	0.2
PM10 PROJECTED ACTUAL EMISSIONS															10.4
					NET	EMISSIONS CHANGE (PAE - BAE)									
PAE - BAE															9.3

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

### PM2.5 EMISSIONS CALCULATIONS

	Stripper	Scenario		Oper	rating		Cont	trols			PN	12.5	PM2.5		
	Operati	ng Time		Configura	ation Time		Operati	ng Time	Product	tion Rate	Emissio	ns Factor	Control	PM2.5 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
			-	B	ASELINE ACTU	AL EMISSIONS (March 2021 - Februa	ry 2023)								
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	8.80E-02	AP-42	NA	2.5	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															1.1
			_		P	ROJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>l</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42	NA	8.1	5.9
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	8.80E-02	AP-42	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.4
					NET	EMISSIONS CHANGE (PAE - BAE)									
PAE - BAE															7.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

### LEAD EMISSIONS CALCULATIONS

	Stripper	Scenario		Ope	rating		Con	trols			Le	ead	Lead		
	Operati	ng Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate	Emissio	ns Factor	Control	Lead Er	missions
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BAS	ELINE ACTUAL	EMISSIONS (March 2021 - Feb	ruary 2023)								
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	5.00E-07	AP-42	NA	1.48E-05	5.78E-05
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	2.80E-05	AP-42	NA	7.87E-04	6.63E-05
LEAD BASELINE ACTUAL EMISSIONS															1.24E-04
					PRC	DJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42	NA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	AP-42	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	5.00E-07	AP-42	NA	1.27E-05	3.62E-06
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	2.80E-05	AP-42	NA	6.75E-04	4.35E-05
LEAD PROJECTED ACTUAL EMISSIONS															2.08E-03
					NET E	MISSIONS CHANGE (PAE - BAE)									
PAE - BAE															1.95E-03

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

### CO2 EMISSIONS CALCULATIONS

Í.	Stripper	Stripper Scenario		Ope	rating		Con	trols			C	02	CO2		
	Operati	ng Time		Configura	ation Time		Operati	ing Time	Product	tion Rate	Emissio	ns Factor	Control	CO2 Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BAS	ELINE ACTUA	LEMISSIONS (March 2021 - Febr	uary 2023)								
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	1.17E+02	AP-42	NA	3,448.9	13,512
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.66E+02	AP-42	NA	4,655.3	392
CO2 BASELINE ACTUAL EMISSIONS															13,904
					PR	OJECTED ACTUAL EMISSIONS									
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	AP-42	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	AP-42	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	AP-42	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	1.17E+02	AP-42	NA	2,958.3	846
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.66E+02	AP-42	NA	3,993.0	257
CO2 PROJECTED ACTUAL EMISSIONS															48,629
					NET E	EMISSIONS CHANGE (PAE - BAE)									
PAE - BAE															34,725

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## SUMMARY OF ASB EMISSIONS FACTORS

			ASB Em	issions Factors (Ik	D/ODTP)		
Scenario	H <sub>2</sub> S	DMDS	DMS	MMC	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	0.92	0.97	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	0.30	0.32	0.0269
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	1.53	1.58	0.0302
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

			Con	centration (pp	m)	
		Hydrogen	Methyl	Dimethyl	Dimethyl	
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	<b>Total TRS</b>
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 or 6/25		146.7	16.0	17.0	15.0	194.7

		MW	
H2S	Hydrogen Sulfide	34.08 g/mol	
Ch4S	Methyl Mercaptan	48.11 g/mol	
C2H6S	Dimethyl Sulfide	62.13 g/mol	
C2H6S2	Dimethyl Disulfide	94.20 g/mol	
S	Sulfur	32.07 g/mol	

## Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl
Sulfide	Mercaptan	Sulfide	Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AHL)
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.70

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

## Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

### CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination		
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total	Total
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil			
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252
Total	996,766			3,237,544				69,553
Annual Average	498,383							
				97.9%				2.1%

1,041,075 520,537

## October 2021 SO2 Testing - Weston

	Combina	tion Boiler No	. 1 Stack	Combinat	mbination Boiler No. 2		
	NCG+SOG	NCG	SOG	NCG+SOG	NCG		
ODTP/hr	77.3	79.0		91.1	92.9		
ADTP/hr	85.9	87.8		101.2	103.2		
lb SO2/hr	342.8	230.7		380.9	309.9		
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00		

	Controlled	Emissions	Sulfu	Uncontrolle		
	Average	Maximum	Bark Ash <sup>C</sup>	LVHC Scrubber	Average	
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP	
SOG	1.06	1.36	20%	NA	1.33	
NCG	2.82	3.00				
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92	
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06	

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

# WESTER

RESULTS AND DISCUSSION

Combination Boiler #1

Average:

- 2

# TABLE 2-2 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	0844	1029	1206	
Time Ended	0944	1129	1306	
Stack Gas Data				
Temperature, °F	430	435	438	434
Velocity, ft/sec	64	63	63	63
Moisture, %	17	17	17	17
CO <sub>2</sub> Concentration, %	8.8	9.0	8.6	8.8
O2 Concentration, %	10.5	10.5	10.8	10.6
VFR, x 10 <sup>5</sup> dscfin	1.46	1.45	1.44	1.45
Sulfur Dioxide				
Concentration, ppm	280	227	204	237
Emission Rate, lb/hr	407.4	328.3	292.6	342.8

Conditio	n 1 21	With NCGs	with SOGs												
Run N		Start Time	Steam Rate	Bark Rate	Gas Flow (10 <sup>4</sup> SCF/H/)	TOF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condénsate Flow (GPM)	LVHC Flow to Boilers (SCFM)	SOG Flow ta Boilers (SCFM)	HVLC Flow to Bailers (SCFM)	Puip Production (ODT/Hr)	Рир ХАРРА
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	1407	1103	10851	77.3	82,7
	2	1029	265.3	33.0	109.1	1.23	40	10.9	505	213	1409	1200	10885	77.3	85.7
	3	1206	257.7	32.6	100.4	1.23	40	10.9	504	2	1443	1205	10963	77.3	84.8
Average:	:		261.9	31.8	112.1	1.23	40	10.9	507	148	1420	1170	10900	77.3	84.4

#### Condition 2: With NCGs, without SOGs 13-Oct-21

							NCG			Hard Pipe						
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Productio	n	
Run #	3	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPP/	A,
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	1416		11071		/9.0	83.9
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	1414	教授的問題意思	10976	i T	79.0	81.6
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	1430		11061	. 7	79.0	80.3
Average			265.8	33.0	106.4	1.23	40	10.9	505	146	1420		11036	F 7	79.0	81.9
													-			

# TABLE 2-3 No. 1 Combination Boiler Condition 2: NCG Gases Only Summary of SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	1407	1544	1714	
Time Ended	1507	1644	1814	
Stack Gas Data				
Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, %	17	18	16	17
CO2 Concentration, %	9.6	9.9	8.9	9.5
O2 Concentration, %	10.1	9.8	10.7	10.2
VFR, x 105 dscfm	1.37	1.39	1.43	1.40
Sulfur Dioxide				
Concentration, ppm	140	176	180	165
Emission Rate, lb/hr	191.3	243.6	257.0	230.7

K 115730 NEW IND YOOT CATAWIA SCOOPJEE/ORTNEW-IND/Y CATAWIA OCT 2021 1-2 CB 502 EMISSION TEST REPORT.DOCM 28 Onsider 2021 1-50 p.m. Vension

15730.001.009 #1-2 CBs SO, Emission Report

# WESTON

RESULTS AND DISCUSSION

#### Combination Boiler #2

14-Oct-21

Condition 1: With NCGs, with SOGs

#### TABLE 2-4 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	
Time Began	0830	1026	1222	
Time Ended	0930	1126	1322	
Stack Gas Data				
Temperature, °F	463	477	465	469
Velocity, fl/sec	63	68	61	64
Moisture, %	17	19	16	17
CO <sub>2</sub> Concentration, %	8.2	9.5	7.5	8.4
O2 Concentration, %	10.8	10.1	11.5	10.8
VFR, x 10 <sup>5</sup> dscfm	1.40	1.43	1.35	1.39
Sulfur Dioxide				
Concentration, ppm	275	262	286	274
Emission Rate, lb/hr	383.7	373.7	385.4	380.9

14-Oct	-21														
							NCG			Hard Pipe					
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Run		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209	1409	1203	11071	91.1	94.5
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200	1420	1179	11160	91.1	88.2
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199	1429	1157	11090	91.1	80.7
Average			234	33.8	158.6	1.23	40	10.9	505	203	1419	1180	11107	91.1	87.8

Condition 2:	With NCGs	, without SOGs
14-Oct-21		

						NCG			Hard Pipe						
						Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
		Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
	Start Time	(103 lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
1	1410	198	21.7	174.8	1.23	40	10.9	505	209	1438		11109	92.9	78.8	
2	1547	218	35.4	206.4	1.23	40	10.9	505	224	1435		11060	92.9	78.7	
3	1725	214	49.6	220.6	0.65	40	10.9	505	262	1453		10977	92.9	79.3	
		210	35.6	200.6	1.04	40	10.9	505	232	1442		11049	92.9		
	1 2 3	Start Time 1 1410 2 1547 3 1725	Steam Rate           Start Time         (10 <sup>3</sup> lbs/hr)           1         1410         198           2         1547         218           3         1725         214           :         210         210	Steam Rate         Bark Rate           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)           1         1410         198         21.7           2         1547         218         35.4           3         1725         214         49.6           ::         20         35.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> )           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)           1         1410         198         21.7         174.8           2         1547         218         35.4         206.4           3         1725         214         49.6         220.6           ::         210         35.6         200.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TDF (TPH)           1         1410         198         21.7         174.8         1.23           2         1547         218         35.4         2006.4         1.23           3         1725         214         49.6         220.6         0.65	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strubber           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)           1         1410         198         21.7         174.8         1.23         40           2         1547         218         35.4         206.4         1.23         40           3         1725         214         49.6         220.6         0.65         40	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strart Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)         (GPM)         (SU)           1         1410         198         21.7         174.8         1.23         40         10.9           2         1547         21.8         35.4         206.4         1.23         40         10.9           3         1725         21.4         49.6         220.6         0.65         40         10.9	NCG         Stream Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG         Stripper Fault           Start Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Ster Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STER Time (10 <sup>3</sup> Ibs/hr)         STER Time (10 <sup>3</sup> Ibs/Hr)	Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         NCG         Stripper Foul         Foul           Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         Flow         Scrubber / Scrubber         Condensate         Condensate           1         1410         198         21.7         174.8         1.23         40         10.9         505         209           2         1547         218         35.4         206.4         1.23         40         10.9         505         224           3         1725         214         49.6         220.6         0.65         40         10.9         505         262	Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow Scrubber         NCG         Stripper Foul         Foul         LVHC Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         209         1438           3         1725         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Stripper Foul         Four         Hard Pipe           Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow         Scrubber / Scrubb	NCG         Hard Pipe           NCG         Stripper Fault         Four         NCG         Stripper Fault         Stripper Fault         Stripper Fault         Stripper Fault         Kore Stripper Fault         Stripper Fault <th colspa="6" fault<="" stripper="" td=""><td>NCG         NCG         Net definition of the set of th</td></th>	<td>NCG         NCG         Net definition of the set of th</td>	NCG         NCG         Net definition of the set of th

#### TABLE 2-5 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	·
Time Began	1410	1547	1725	
Time Ended	1510	1647	1825	
Stack Gas Data				
Temperature, °F	457	461	460	459
Velocity, ft/sec	59	59	58	59
Moisture, %	15	15	15	15
CO <sub>2</sub> Concentration, %	7.2	7.6	7.0	7.3
O2 Concentration, %	11.9	11.2	11.7	11.6
VFR, x 10 <sup>5</sup> dscfm	1.33	1.33	1.33	1.33
Sulfur Dioxide				
Concentration, ppm	235	234	232	234
Emission Rate, lb/hr	311.3	311.0	307.4	309.9

K 11579 NEW PROVINE CATAWIDA, SCOOPALIPORTINEW (BODY CATAWIDA OCT 2021 1-3 CIS SO2 3PARISSION TEST REPORT DOCM 8 28 Okuber 2021 1:00 p.m. Vennim

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### June 2021 TRS\_H2S Testing - Weston

	Comb	ination Boiler No	. 1 Stack	Combin	ation Boiler No.	2 Stack		Combin	nation Boiler No.	1 Stack	combination Boiler No. 2 Stack		2 Stack
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG	H2S	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG
ODTP/hr	55.9	76.0		88.3	85.2		ODTP/hr	55.9	76.0		88.3	85.2	
ADTP/hr	62.1	84.4		98.1	94.7		ADTP/hr	62.1	84.4		98.1	94.7	
lb TRS (as H2S)/hr	0.75	0.68		0.85	0.92		lb H2S/hr	0.07	0.05		0.07	0.04	
lb TRS (as TRS)/hr	1.07	0.97		1.22	1.32								
Ib TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02	1.39E-02	-1.51E-03	Ib H2S/ADTP	1.13E-03	5.92E-04	5.35E-04	7.13E-04	4.23E-04	2.91E-04
	Controller	Emissions	Sulfur Co	nversion	Uncontrolle	d Emissions		Controlled	Emissions	Sulfur C	onversion	Uncontrolle	d Emissions
	Average	Maximum	Combustion	IVHC Scrubber	Average	Maximum			Maximum	Combustion	IVHC Scrubber		Maximum
TRS as TRS	Ib TRS/ADTP	Ib TRS/ADTP	%	%	Ib TRS/ADTP	Ib TRS/ADTP	H2S	Ib H2S/ADTP	Ib H2S/ADTP	%	%	Ib H2S/ADTP	Ib H2S/ADTP
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA	0.29	0.58	SOG	4.13E-04	5.35E-04	99%	NA	4.13E-02	5.35E-02
NCG	1.27E-02	1.39E-02					NCG	5.07E-04	5.92E-04				
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%	1.60	1.75	LVHC <sup>A,C</sup>	5.03E-04	5.87E-04	99%	50%	1.01E-01	1.17E-01
LIN / CA-B							A.C.						

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HVLC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C). C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and HVLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1			CB1			CB2			CB2						
TRS as S		MW	NCG+SOG			NCG			NCG+SOG			NCG						
sulfur	S	32.065	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	AVG		PLC Cross C	heck back to TRS as H2S
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08	0.07	0.1	0.07	0.07	0.07	0.08	0.08	0.08	0.05	0.05	0.05	0.07	8.0%		0.085742 0.085742
methyl mercaptan	CH <sub>4</sub> S	48.107	0.55	0.53	0.49	0.52	0.52	0.53	0.77	0.63	0.64	0.94	0.91	0.69	0.64	72.6%		0.778738 0.55169
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62.134	0.16	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.08	0.07	0.07	0.12	13.5%		0.144248 0.079121
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.04	0.04	0.03	0.03	0.03	0.05	5.9%		0.06355 0.045984
															0.89	Total TRS		1.072278 0.762538
															84.8%			

10^6 ACFM Flowrate Basis to Ib/min												
H <sub>2</sub> S	0.007081766	0.006196545	0.008852208	0.006196545	0.006196545	0.006196545	0.007081766	0.007081766	0.007081766	0.004426104	0.004426104	0.004426104
CH <sub>4</sub> S	0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S	0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182

CH <sub>4</sub> S		0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S		0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>		0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182
	TRS as H2S	0.082325532	0.07966987	0.078784649	0.078784649	0.078784649	0.080555091	0.089407299	0.077014208	0.077899429	0.100029948	0.096489065	0.077014208
	TRS as TRS	0.118755065	0.115370779	0.113028312	0.114121247	0.114121247	0.116984649	0.125993636	0.108500182	0.109749714	0.142133299	0.136770831	0.109281117

Ratio TRS as H2s/TRS a 0.693238074 0.690555015 0.697034647 0.690359171 0.690359171 0.68859596 0.709617575 0.709807177 0.70979163 0.703775603 0.705479846 0.704734816 0.69944568 1.43



RESULTS AND DISCUSSION

### Combination Boiler #1

Condition 1: With NCGs, with SOGs 23-Jun-21

#### TABLE 2-11 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1158	1400	1541	
Time Ended	1258	1500	1641	
Stack Gas Data				
Temperature, *F	415	418	415	416
Velocity, fl/sec	59	57	57	57
Moisture, %	17	18	16	17
CO <sub>2</sub> Concentration, %	7.8	8.4	7.7	8.0
O2 Concentration, %	12.1	11.4	12.0	11.8
VFR, x 105 dscfm	1.35	1.31	1.33	1.33
Hydrogen Sulfide				
Concentration, ppm	0.09	0.08	0.12	0.10
Emission Rate, Ib/hr	0.07	0.06	0.08	0.07
Total Reduced Sulfur				
Concentration, ppm	1.09	1.07	1.03	1.06
Emission Rate, Ib/hr	0.78	0.74	0.73	0.75
Sulfur Dioxide				
Concentration, ppm	195	278	344	272
Emission Rate, Ib/hr	262.7	362.5	457.4	360.9

							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	<b>Pulp Production</b>	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	S	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(lbs/ODT Pulp)	(lbs/hr)
	1	1158	208	25.1	80.8	1.37	40	10.9	458	146	1585	621	11575	49.7	262.7	5.29	0.56
	2	1400	225	29.3	68.8	1.37	40	10.9	491	152	1595	1219	11048	54.0	362.5	6.71	0.49
	3	1541	207	24.8	81.2	1.37	40	10.9	491	45	1578	1136	11009	64.0	457.4	7.15	0.50
Average:			213	26.4	76.9	1.37	40	10.9	480	114	1586	992	11211	55.9	360.9	6.46	0.52

# Condition 2: With NCGs, without SOGs 23-Jun-21

								NCG			Hard Pipe							
								Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Ra	te	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	5	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/H	ir)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/OOT Pulp)	(lbs/hr)
	1	1824	23	30	26.3	94.9	1.37	40	10.9	489	123	1587		10515	74.1	404.4	5.46	0.43
	2	2019	21	16	23.7	97.5	1.37	40	10.9	491	184	1593		10377	74.7	7 452.9	6.06	0.42
	з	2202	22	20	25.2	92.4	1.37	40	10.9	490	152	1570		10573	79.3	450.8	5.69	0.46
Average	21		22	22	25.1	94.9	1.37	40	10.9	490	153	1583		10488	76.0	436.1	5.74	0.44

TABLE 2-12
NO. 1 COMBINATION BOILER
CONDITION 2: NCG GASES ONLY
SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, "F	416	411	415	414
Velocity, fl/sec	56	56	56	56
Moisture, %	16	16	17	17
CO <sub>2</sub> Concentration, %	8.3	7.8	8.1	8.1
O <sub>2</sub> Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>8</sup> dscfin	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, Ib/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, Ib/hr	0.67	0.68	0.68	0.68
Sulfer Diaxide				
Concentration, nem	313	348	349	337
Emission Rate, Ib/hr	404.4	452.9	450.8	436.1

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> 15730.001.0 Pulp Dryer, 43 Paper Machia #2-3 SDTV1, & #1-2 C Emission Repo



RESULTS AND DISCUSSION

### Combination Boiler #2

Average:

16

235

32.4

140.7

1.37

40

10.9

481

Condition 1: With NCGs, with SOGs 24-Jun-21

# TABLE 2-13 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/24/21	6/24/21	6/24/21	
Time Began	1445	1630	1806	
Time Ended	1545	1730	1906	
Stack Gas Data				
Temperature, *F	475	474	479	476
Velocity, ft/sec	69	69	69	69
Modelham, %6	14	14	15	14
CO <sub>2</sub> Concentration, %	6.6	6.9	7.3	6.9
O2 Concentration, %	13.1	12.7	12.3	12.7
VFR, x 10 <sup>5</sup> dscfm	1.57	1.56	1.54	1.56
Hydrogen Sulfide				
Concentration, ppm	0.09	0.09	0.09	0.09
Emission Rate, Ib/hr	0.07	0.07	0.07	0.07
Total Reduced Sulfur				
Concentration, ppm	1.13	0.97	0.97	1.02
Emission Rate, Ib/hr	0.94	0.80	0.80	0.85
Sulfur Dioxide				
Concentration, ppm	324	327	322	324
Emission Rate Ibbr	508.7	507.2	496.1	504.0

# TABLE 2-14 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF H<sub>2</sub>S, TOTAL TRS, AND SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, "F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> discfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide				
Concentration, ppm	0.05	0.05	0.05	0.05
Emission Rate, Ib/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				
Concentration, perm	1.22	1.18	0.94	1.11
Emission Rate, Ib/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, Ib/hr	383.2	380.0	366.2	376.4

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24-2011	. 2. 7																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>#</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	N	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1445	219	39.0	125.3	1.37	40	10.9	491	190	1572	1231	10253	87.8	508.7	5.79	0.77
	2	1630	224	31.1	146.4	1.37	40	10.9	490	186	1576	1231	10277	88.6	507.2	5.72	0.63
	3	1806	241	33.6	146.4	1.37	40	10.9	490	190	1580	1231	10300	88.6	496.1	5.60	0.63
Average	£0		228	34.6	139.4	1.37	40	10.9	490	189	1576	1231	10277	88.3	504.0	5.71	0.68
Conditio	on 2	: With NCG	s, without SOG:														
25-Jun-	-21																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boiters	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1000	234	35.7	132.7	1.37	40	10.9	482	155	1579		10475	87.2	383.2	4.39	0.86
	2	1135	225	30.8	147.8	1.37	40	10.9	479	252	1573		10425	84 3	380.0	4.51	0.82
	3	1315	245	30.6	141.7	1.37	40	10.9	482	97	1571		10500	84.2	366.2	4.35	0.63

168

1574

10467

85.2

376.4

4.42

0.77

# **Buckner**, Katharine

From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Monday, April 24, 2023 3:23 PM
То:	Buckner, Katharine; Robert Tourville; Steven Moore
Cc:	Hardee, Christopher
Subject:	RE: WATER9 input files
Attachments:	BAE TRS WATER9.zip; BAE VOC WATER9.zip; PAE Hardpipe Scenario WATER9.zip; PAE
	New Stripper Scenario WATER9.zip; PAE Old Stripper Scenario WATER9.zip

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Good afternoon, Katharine. Attached are the WATER9 files that are the underlying basis for the TRS and VOC emissions factors and emissions calculations for the new steam stripper construction permit application submitted to DHEC on March 23, 2023. We have organized them into 5 separate zip files corresponding to the baseline emissions and the projected actual emissions operating scenarios (old stripper, new stripper, and Hardpipe). Let us know if you have any questions or any problems with the files. Thanks!



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn

www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Thursday, April 20, 2023 12:35 PM
To: Robert Tourville <BOB.TOURVILLE@NEW-INDYCB.COM>; Steven Moore <smoore@all4inc.com>; Sheryl Watkins
<swatkins@all4inc.com>
Cc: Hardee, Christopher <hardeecd@dhec.sc.gov>
Subject: RE: WATER9 input files

Hello Bob,

I was checking on the status of the WATER9 files for Christopher. Will these be coming soon?

## Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> <u>Facebook</u> <u>Twitter</u>



From: Buckner, Katharine
Sent: Wednesday, April 12, 2023 11:21 AM
To: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>; Steve Moore (<u>smoore@all4inc.com</u>)
<<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Cc: Hardee, Christopher <<u>hardeecd@dhec.sc.gov</u>>
Subject: WATER9 input files

Hey All,

Christopher would like the WATER9 input files. He said he was able to run the example as seen on EPAs website and felt he would be able to handle the WATER9 input files themselves.

## Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> <u>Facebook</u> <u>Twitter</u>



# **Buckner**, Katharine

From:	Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Sent:	Monday, May 22, 2023 10:00 AM
То:	Buckner, Katharine
Cc:	Pete Cleveland; Hardee, Christopher
Subject:	Stripper Application Comments
Attachments:	2440-0005.RE-comments on stripper app 3 (5-17-23) (003).docx; Attachment A
	(5-22-23).pdf; 2440-0005.RE-comments on stripper app 1 (5-18-23) (003).docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email.

## Katharine

Please find the response to the questions on the stripper application. Let me know if you have any additional questions.

Bob

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## SCDHEC BAQ comments/questions for New-Indy (2440-0005) on the new Stripper construction application, sent April 20, 2023 Emission Calculations

Steam	balance
-	When the final steam balance for using the new stripper has been derived, please submit for
	review, along with revised calculations.
	The revised steam balance is under development and currently does not include the steam
	savings projects which are currently being evaluated. The steam savings projects will reduce
	the incremental steam required for the Project (i.e. operation of the new or existing steam
	stripper as back up) and thus will reduce the projected actual emissions. The Mill will provide
	the final steam balance with the undeted emissions calculations when sucilable. The
	the final steam balance with the updated emissions calculations when available. The
	conclusions of the emissions calculations are not expected to change.
-	Please provide the steam balance for the existing operations where the existing stripper is
	being used.
	A revised steam balance for baseline is provided with this submittal (Attachment A). The
	revised analysis includes steam used by the existing stripper for the baseline period (i.e., May
	3, 2021 to February 28, 2023).
-	Please justify why approximately one year of steam data is representative of the 24
	consecutive months data that should be used for the baseline actual emissions. Why is a 24
	consecutive month average not used? How would the emission calculations be affected if a
	24 consecutive month average were used?
	The Mill will update the baseline actual emissions for operation of the existing stripper during
	the baseline period (i.e., May 3, 2021 restart of the stripper, to February 28, 2023) with the
	undated emissions calculations. The conclusions of the emissions calculations are not
	expected to change
Curron	t stripper
curren	Dease provide a justification why the surrent stripper should be considered as an existing
-	Please provide a justification why the current stripper should be considered as an existing
	source rather than a new source.
	The current stripper was installed in 2000 and is included in the current Title V Operating
	Permit (No. 1V-2440-0005). The current stripper treated foul condensates consistent with
	bleached papermaking operations until bleached operations ceased on September 5, 2020.
	The current stripper has been treating foul condensates generated from the post-project
	Columbia equipment/operations since May 3, 2021, as required by the Consent Order to
	Correct Undesirable Levels of Air Contaminants. There are no physical modifications planned
	for the current stripper with the proposed New Condensate Stripper Project ("Project"),
	although the current stripper will be demoted to operate strictly as a backup to the new
	condensate stripper and will be operated to process all of the foul condensate, with an
	expected removal of the total reduced sulfur (TRS) and methanol compounds of 98% and
	45%, respectively. Note: Further methanol treatment through biological destruction will be
	accomplished by routing the stripped condensates to the existing Hardnine system that
	discharges the foul condensates below the liquid surface of the existing ASR. Since the
	existing steam stripper has been in operation since 2000 and was not shutdown for more than
	2 years [1] S. Environmental Protection Agency (EDA) procumptive guidance <sup>1</sup> it is considered
	2 years [0.3. Environmental Frotection Agency (EFA) presumptive guidance ] it is considered

<sup>&</sup>lt;sup>1</sup> October 9, 1979 Letter from William A. Spratlin, Jr. U.S. EPA Region VII Chief, Air Support Branch Air and Hazardous Materials Division. Note: This guidance has also been upheld in more recent policy letters, with additional guidance on what factors to address if a unit has been shutdown for greater than 2 years but the shutdown was not intended to be permanent.

an "existing source" for the purposes of evaluating prevention of significant deterioration (PSD).	
Current stripper (Cont.)	
And include any information on the activities that occurred prior to the stripper being returned to service on May 3, 2021.	
When ordered by SC DHEC to restart the existing stripper in April 2021, the Mill performed	d
general cleaning and maintenance activities as well as general startun activities (e.g.	<b>^</b>
connections to steam and foul condensate lines) prior to the startup on May 3, 2021. The	ro
were no other activities performed between cossation of bloached exercises and May 2	
were no other activities performed between cessation of bleached operations and May 5,	
2021.	
/endor specifications	
- FYI, in the permit it will be required that prior to start of construction the vendor	
guarantee/certification shall be provided for the design specifications of the new stripper	
along with the caveats or assumptions on which the guarantees are based	
The Mill will provide the information requested/documented in the air construction permi	it
issued for the Droject prior to startup of the new condensate stripper	it.
IOv Eroch Start TAP	
Power 14 and 15, place evolution the reason behind splitting the ten RLS rate between the	
- Rows 14 and 15, please explain the reason benind splitting the ton BLS rate between the	
The new condensate stripper will be designed to concentrate 90% of the stripped methan	al
into a liquid called stripper will be designed to concentrate 50% of the stripped methanel	
through the condensor and be conted into the lower line birth concentration (10%) will pass	
through the condenser and be vented into the low volume, high concentration (LVHC) Syst	tem.
Ammonia, which is the precursor to $NO_X$ emissions is assumed to follow methanol. The ne	W
stripper will operate in SRL mode 95% of the time and when in this mode, the SRL liquid w	/ill
be combusted 100% of the time in the Nos. 2 and 3 Recovery Furnaces (row 14 - emission	S
factor is 1.5 lbs NOx/TBLS and using 90% (0.9) of the total TBLS rate). During the SRL	
operating mode, the LVHC gases from the SRL condenser system, stripper feed tank, and S	RL
methanol tank will be combusted in the No. 3 Recovery Furnace 75% of the time (row 15 -	
emissions factor is 1.5 lbs NOx/TBLS and using 10% (0.10) of the total TBLS rate). The	
remaining 25% of the time, the SRL LVHC will be combusted in the Nos. 1 or 2 Combination	n
Boilers (row 16 - emissions factor is 0.415 lb NOx/air dried tons of pulp (ADTP) and using 1	.0%
(0.1) of the total ADTP).	
Does footnote G explain the reduced production rate used?	
See response above	
The footnote G statement is different from that under the SO2 Fresh Start TAB, where 40%	6 of
methanol is condensed and 60% to IVHC Please explain the difference	501
The emissions calculation for the generation of NOx from combustion of the SBL and SBL	инс
is explained above (i.e. based on the assumption that the ammonia in the SPL and SPL IVE	
will increase NOx emissions no more than 1%). The emissions calculation for the generati	ion
of CO2 from computing of the CPL and CPL 1/1/C is based on the mass of TPS compounds	in
the feul condensate and how these compounds are distributed into the CDL (4000) and CDL	
the four condensate and now those compounds are distributed into the SRL (40%) and SRL	-
LVHC (60%) when stripped from the condensate and then condensed. Please note that it	IS
expected that 90% of the methanol in the foul condensates will be concentrated in the SR	L,
with 10% going to the SRL LVHC. The SRL feed to each recovery furnace is limited to a	
maximum of 1% of the black liquor feed rate for safety reasons by the Black Liquor Recove	ery
Boiler Advisory Committee (BLRBAC). NCASI examined the impact of burning stripper off	
gases (SOG) in recovery furnaces (Special Report SR-03, October 2003, Section 7.1) and	

concluded introducing SOG below the liquor guns results in no change to NOX emissions. As a conservative assumption, the NOX emissions from the recovery furnaces were assumed to increase by 1% from blending the SRL with the black liquor and introduction the LVHC gases (both of which include ammonia from the SOG) below the liquor guns.

## VOC Fresh Start TAB

- In the baseline calculations, Row 8, the reference for the emission factor says "Stripped".
   Please provide the data used, calculations, etc. to arrive at this factor.
   The emissions factor is the average amount removed by the steam stripper using all the available data at the time the calculations were initially performed (June 23, 2021 through January 28, 2023). The emissions factor will be updated using all available data through February 28, 2023 when revised calculations are provided, but the conclusions are not expected to change.
- The natural gas emission factors were derived from the AP-42 factor. But to arrive at the factor in the TAB, the AP-42 factor was divided by 1,020 Btu/scf, which is not consistent with the other tabs SO2, NOx, etc. Those divided the AP-42 factor by 1,000 Btu/scf heat content for natural gas.

Although AP-42 provides instruction to convert emissions factors reported in lb/MMscf to lb/mmBtu by dividing by 1,020 mmBtu/mmscf [per footnote a to Tables 1.4-1 and 1.4-2], the Mill has historically converted the AP-42 lb/mmscf factors using 1,000 mmBtu/mmscf since calendar year 2000 or earlier, which is a more conservative approach. The Mill will revise the AP-42 VOC emissions factor to use the 1,000 mmBtu/mmscf conversion. Revised calculations will be provided once all DHEC comments have been received and addressed. The conclusions of the emissions calculations are not expected to change.

The VOC factor for No. 6 fuel oil is for sources between 10-100 mmBtu/hr. The VOC emission factor for sources >100 million Btu/hr should be used to calculate the VOC emission factor used in the TAB. This is consistent with how it was done in the other TABs.
 The AP-42 VOC emissions factor from Table 1.3-3 for Industrial boilers does not list the size; however, review of the SCC codes listed shows that the 0.28 lb VOC/1000 gal factor applies to industrial boilers <100 mmBtu/hr. There are no VOC emissions factors presented for industrial</li>

boilers >100 mmBtu/hr in Table 1.3-3.

## Lead Fresh Start TAB

- How did you arrive at the emission factor of 2.8E-05 mmBtu/hr? Using Table 1.3-11 in AP-42, the lead factor is 1.51E-03 lb/1000 gal. Converting this using 150,000 Btu/scf (which is consistent with other areas in the calculations), I get 1.01E-05 lb/mmBtu.

The lead emissions factor is from the U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2-89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1). This emissions factor has been used in air emissions inventories and air permit applications since calendar year 2000 or earlier.

## CO2 Fresh Start

The AP-42 factor for CO2 for natural gas was divided by a heat input of 1,020 Btu/scf. Most of the other combustion calculations divided by 1,000 for the heat content of natural gas. Please fix to be consistent with the other combustion calcs and that of the TV.
 Similar to the AP-42 VOC factor, the Mill will revise the AP-42 CO2 emissions factor to use the 1,000 mmBtu/mmscf conversion, consistent with the historical conservative approach. Revised calculations will be provided once all DHEC comments have been received and addressed. The conclusions of the emissions calculations are not expected to change.

<ul> <li>The CO2 rates calculated (and presented in the PSD analysis table) are for CO2 and not CO2e emissions. The CO2 emissions along with methane and nitrous oxide and including the global</li> </ul>
warming potential for each will need to be calculated and then totaled in order for these to be CO2e rates.
As the project does not trigger PSD for any new source review (NSR) pollutant, quantification
of GHG emissions is not required. We have provided the CO <sub>2</sub> emissions calculations for
completeness and do not believe adding methane and nitrous oxide emissions will not change
the magnitude of the CO <sub>2</sub> e emissions. We will update the PSD summary table to indicate that
only $CO_2$ (and not $CO_2e$ ) emissions have been provided.
TRS_H2S Stack Test Factors TAB
- The controlled factor derived for SOG, controlled, average (cell B16) was derived by averaging
D10 and G10. G10 is a negative value and was treated in the "average" as 0. Why was the
D10 value "averaged" (divided by 2) and so half the value used as the factor? Isn't the result
in G10 suspect? Why would you not use the entire D10 value? Please explain the reasoning
behind this. However, using the "averaged" value is more conservative.
The emissions from burning SOG were determined by subtracting the emissions burning NCG
only from the emissions burning NCG + SOG. The emissions from NCG were higher than NCG +
SOG from Combination Boiler No. 2. The SOG emissions are not expected to be negative, so a
value of zero (no impact from SOG from Combination Boiler No. 2) was substituted for the
negative result.
Application
PSD Analysis
<ul> <li>Provide a discussion on the baseline actual emissions whether any excess emissions and/or</li> </ul>
any out of compliance emissions occurred. Baseline emission rates are to be adjusted
downward for any emissions out of compliance. Please elaborate with the applicable
emission limitations, etc.
The baseline actual emissions do not include excess emissions and/or any emissions that were
out of compliance. Site-specific test data that were used to develop BAE were from approved
test data that demonstrated compliance with any applicable air emissions limits. For example,
Costable emissions limit of SO2 emissions from NCG compusition is 10.1 ID/ADTP. The
the TPS_H2S_ and MMC data used for PAE was used by DHEC to demonstrate compliance with
the MAAC. There are no air emissions limitations on the WAATD
NEDE Subpart DR and DRa
INSPS Subpart DB allu DBa Under c/p DE it was determined that the Director System, the No. 1 Evaporator System, and
- Onder C/p-DF, it was determined that the Digester System, the NO. 1 Evaporator System, and the existing Condensate Stripper System were being modified. A modification under NSDS
regulations is any physical or operational change to an existing facility which results in an
increase in the emission rate TRS emissions are regulated by Subnart BB and BBa, changes
in the method of operation were occurring with increases in emissions. These sources are
now subject to NSPS Subnart BBa, not Subnart BB as discussed on pages 3-1 and 3-2 of the
application. The limits between the two Subpart BB ds discussed on pages 5 1 dia 5 2 of the
slightly more rigorous monitoring record keeping and reporting
The June 2019 Project Columbia construction permit application correctly identified the
sources listed above as becoming subject to 40 CFR Part 60. Subpart BBa following the
completion of Project Columbia, as specified in c/p-DF.
SC Std No. 4

 FYI, there is no "cut off" date in Std No. 4. Sources which commenced construction prior to Sept 24, 1976 are subject to the TRS requirements in Section XI of SC Std No. 4 regardless if they were modified or reconstructed or become subject to NSPS BB or BBa. Therefore, requirements from this regulation will be included in the construction permit for any of the sources covered under SC Std No. 4. SC Std No. 4 is very similar to NSPS BB and BBa. In addition to the sources listed in the application, we understand that the Nos. 1-2 Evaporators Sets with Concentrators will be subject to Standard No. 4, Section XI requirements for TRS because these sources commenced construction prior to September 24, 1976.

## Page 3-16, 2<sup>nd</sup> paragraph

Why were biomass emissions not estimated in the BAE and PAE scenarios?
 New-Indy Catawba operates the two recovery furnaces as base-loaded steam generators with the combination boilers handling most swings in steam load. New-Indy Catawba burns all the biomass available in the combination boilers because biomass is the most cost-effective fuel on an MMBtu basis. Additional steam is generated from burning natural gas and No. 6 fuel oil as needed and it was assumed that any steam used in the current/existing stripper and any steam needed to operate the new stripper would be generated from fossil-fuel firing.

## SCDHEC BAQ comments/questions for New-Indy (2440-0005)

# on the new Stripper construction application, sent May 8, 2023, responses due May 22, 2023

## Application

 The current Title V operating permit lists the current, existing stripper at 800 gpm. Also, the application for the conversion (c/p-DF revision) lists the existing stripper at 800 gpm and the hardpipe at 1,200 gpm. The application for the new stripper lists the existing stripper at 850 gpm and the hardpipe at 850 gpm. Please explain these differences. What is the maximum gpm of foul condensate generated from the processes?

The new condensate stripper is designed to process 100% of the foul condensate generated at a maximum pulp production of 2,400 to 2,700 ADTP (equivalent to a maximum foul condensate flow of 850 gpm).

2. The latest MACT S reports on condensate collection and treatment show that the current stripper handles 350 gpm of foul condensate with the rest of the foul condensate going to the ASB. When this stripper operates as the backup stripper, what will happen to the rest of the foul condensate (not the stripped condensate from the stripper)? Why are the projected actual emissions when the backup stripper operates using 850 gpm (page B-76)?

The backup stripper was originally designed for stripping methanol from 800 gpm of foul condensate. Issues with fouling have hampered the ability to continuously operate at the design rate. As a backup operating unit, the existing stripper will operate in "TRS only mode". The stripper will operate at lower effective steam ratios which will allow all the condensate to run through the column. Methanol stripping will be minimal in this mode. Therefore, the stripped condensate will then be pumped to the wastewater treatment cell for further treatment.

3. On page B-130, the "Fraction biodegraded" is blurred or marked out. What is the number supposed to be here?

Fbio = 87.9 on pg B-130

4. On pages B-122, B-126, and B-130, a wind speed of 3.8 mph is shown. This value is different than that used in the H2SSIM model input/output sheets and that used in the WATER9 models. Should the wind speeds be consistent within each scenario, from model to model?

Wind speed of 3.8 mph was used for the Form XII calculations as a representative value from the July 2021 IPT. Wind speed of 3.55 mph was used for the H2SSIM model based on August 2022 onsite wind speed data to be representative of the May and July 2022 tests. The ambient temperature of 79 F has been the Mill's default value for H2SSIM runs and is based on National Oceanic and Atmospheric Administration (NOAA) data from Greenville-Spartanburg, SC. The difference in wind speed is minor and is not believed to have an impact on the conclusions of the calculations.

The ambient temperature and wind speed in WATER9 are the default values for the model. Per page 187 of the document for air emission models for hazardous waste treatment, storage, and disposal facilities (TSDF) that documents the basis for the WATER9 emissions calculations ("AIR EMISSIONS MODELS FOR WASTE AND WASTEWATER EPA-453/R-94-080A, U.S. EPA Contract No. 68D10118, November 1994"):

Two meteorological parameters required in the models are temperature and windspeed. The emission estimates are based on a standard temperature of 25 °C and a windspeed of 4.47 m/s (10 mi/h). These standard values were evaluated by estimating emissions for windspeed/temperature combinations at actual sites based on their frequency of occurrence. Over a 1-yr period, the results from site-specific data on windspeed and temperature were not significantly different from the results using the standard values. Consequently, the standard

values were judged adequate to estimate annual emissions. For short-term emissions, the actual temperature and windspeed over the short-term interval should be used to avoid underestimating emissions during high-windspeed /high-temperature conditions.

5. On Page B-55, Baseline Methanol Emission Factor – the factor developed, 0.92 lb/ODTP, is from averaging the two averages. Baseline emissions should be based on the 24 month average. I believe the entire column of lb/ODTP should be averaged to arrive at the factor to be used in the calculations for the baseline.

We believe that the July and October 2021 performance test results and associated air emissions from the aerated stabilization basin (ASB) are representative of the operations and emissions from March 2021 through mid-February 2022 [air emissions presented on page B-55 range from 1.22 to 1.9 lb methanol per oven dried tons of pulp (lb/ODTP)] and the four performance test results in 2022 and associated air emissions from the ASB are representative of operations and emissions from mid-February 2022 through February 2023 emissions (air emissions range from 0.02 to 0.19 lb methanol/ODTP, except for the February 2022 test which ranged from 1.03 to 1.36 lb/ODTP). Therefore, averaging the average of these two periods is representative of the 24-month baseline period for March 2021 through February 2023.

- 6. Pg B-55, Baseline Methanol Emissions Factor I understand there were some issues during the August 2022 testing and a re-test was conducted in September 2022. Should the data from the August 2022 testing be included in the calculations for the methanol emission factor? Yes, both the August and September 2022 testing at the ASB was representative of normal operations. The required treatment of 6.6 lb hazardous air pollutants (HAP)/ODTP was not met due to low collection and lower than typical methanol removal in the existing condensate stripper.
- On the Foul Cond Sulfur spreadsheet, duplicate sample results (6/24/2021, 15:10) are reported and used in the calculation. Is it appropriate to include the duplicate? Yes, unless the samples are invalidated, protocol is to average and report the original and duplicate sample results.
- Please provide the data that was used to arrive at the "stripped" VOC emission factor for the baseline scenario. Please point to where it is in the application if I have overlooked it.
   See response to question on VOC Fresh Start tab under comments on stripper application 1.

## WATER9 and H2SSIM inputs

- 9. There is a source called "Open Hub Drain" in the WATER9 results. What is this and why are the emissions from it not counted in with the emission rates from the 3 zones of the ASB? The open hub drain is an open drain that discharges into a closed conduit. In this case, the open hub drain is an element of WATER9 used to connect the ASB Inlet stream into the ASB Zone 1.
- 10. The Backup Stripper Scenario projected actual emissions (pg B-76) lists the stripped condensate flow at 850 gpm. According to the MACT S periodic condensate collection and treatment reports, the backup stripper seems to only handle up to 350 gpm. Please explain why the Backup Stripper Scenario projected actual emissions appears to use 850 gpm. Plus, this is not the same design capacity listed in the TV OP for this stripper. See response to Question 2 in this document.
- 11. Please comment on the changing residence time in the various zones of the ASB for the different projected actual emissions scenarios and the baseline actual emissions scenario. Different residence times were calculated in Form XIII for the existing and no stripper scenarios than those calculated in the WATER9 models.

The residence times that appear in Form XIII documents are estimated based on the inputs that were determined to be representative, but do not affect the calculations. The Mill believes that the different estimated residence times between WATER9 and Form XIII are of no consequence.

12. The temperatures of the wastewater for the different zones of the ASB are different than those used in the Appendix C Forms – calculating fraction biodegraded, pages B-122, B-126, and B-130. Temperatures used in the H2SSIM and WATER9 models were based on data from the May and July 2022 TRS testing to coincide with the concentration data/flows used. The temperatures used in the Form XIII calculations were from the August 2022 Subpart S performance test to representative worst-case temperatures.

13. Page B-114 – PAE H2S Factor, Summary of H2SSIM inputs and outputs, the Backup Stripper scenario shows that 850 gpm (1.22 MGD) goes to the hardpipe. If some of the foul condensate flow is stripped would this amount be reduced that goes to the hardpipe? The MACT S periodic foul condensate treatment reports show the average foul condensate stripped at 350 gpm. In the Backup Stripper Scenario, the Mill estimated the stripped condensate flow was equal to the foul condensate flow to the stripper since the TRS concentrations in the stripped condensate were based on the 98% reduction in the foul condensate concentrations. The same flow basis was needed to estimate the reduction in concentrations as a result of stripping TRS in the Backup Stripper. The stripped condensate flow could be different due to steam condensing or mass transfer, but the

concentrations would also be affected by the change in flow.
14. July 2021 Initial Performance Test (IPT) results and the Baseline Methanol Emissions Factor, pg B-55

The air stripping g/s on pg B-55 listed for July 2021 does not seem to match up to those in the Form XIII in the IPT results from July 2021.
The results of the July 2021 IPT were considered to be the calculations that were updated at DHEC's

request as part of the Mill's October 5, 2021 response to comments.15. Please provide the supporting data for calculating the VOC emissions from acetaldehyde, methyl ethyl ketone, and propionaldehyde.

See supporting information below. BAE emissions of non-methanol VOC were based on the hardpipe concentrations during 2021 and 2022 Subpart S performance tests that were fairly constant. The non-methanol VOC emissions factor constitutes a very small fraction of the total BAE VOC emissions factor of 0.97 lb/ODTP. For PAE scenarios, non-methanol VOC were scaled by the relationship of the PAE methanol emissions factor each scenario as compared to the BAE methanol emissions factor.

Date of Subpart S Performance Testing	Acetaldehyde, ppm	MEK, ppm	Propionaldehyde, ppm
7/9/2021	24.3	7.7	1.1
7/10/2021	25.3	5.7	4.0
7/11/2021	25.0	6.5	7.0
10/26/2021	25.0	12.3	0.8
10/27/2021	27.5	13.3	1.0
10/28/2021	10.6	6.6	1.2
10/29/2021	15.0	8.6	0.9
2/14/2022	16.7	7.5	0.7
2/15/2022	17.0	9.5	0.6
2/16/2022	15.7	8.6	1.0
5/4/2022	20.7	7.1	1.0

5/5/2022	16.3	7.3	1.0
5/6/2022	15.0	6.8	1.0
8/9/2022	15.3	5.9	0.7
8/10/2022	25.0	7.2	1.1
8/11/2022	20.3	6.0	1.0
9/27/2022	14.3	5.3	0.7
9/28/2022	15.0	5.2	0.7
9/29/2022	18.0	5.6	0.9
10/18/2022	25.0	5.6	1.0
10/19/2022	23.7	5.5	1.1
10/20/2022	23.0	6.6	0.9
AVG ppm:	19.72	7.28	1.34
Lbs into ASB	55.48	20.49	3.78
Fair estimated from			
WATER9 properties	0.55	0.38	0.43
Lbs emitted	30.73	7.73	1.61
Average Pulp Production			
during Subpart S testing		1716	
Ib/ODTP	0.018	0.005	0.001

<b>Current Stripper Revised Baselir</b>	ne		
May 22 Response			
Average Actua	il (5/3/21-2/2	8/23)	
	MLb/hr	Mmbtu/h	
Steam In		50.0	42.8 (Latent heat of steam at measured pressure)
Steam Out		24.0	21.8 (Latent heat of steam at measured pressure)
		21.1	Steam Used by Existing Stripper in baseline period, MMBtu/hr
Steam			
	Latent Hea	it	
Gage Pressure	(Btu/lb)		
57	7.8	906.4	
	60	904.9	
10	50	857.6	
150	.5	857.6	
Source: TLV.cc	om/global/US	/calulator	

# **Buckner**, Katharine

Tourville, Bob < BOB.TOURVILLE@NEW-INDYCB.COM>
Monday, May 8, 2023 7:55 AM
Buckner, Katharine
RE: Additional comments on new Stripper app
Responses to DHEC (5-5-23) DRAFT.docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine

Happy Monday. Please find the attached comments to your questions.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Wednesday, April 26, 2023 4:13 PM
To: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>
Subject: Additional comments on new Stripper app

### **External Email**

Hello Bob,

Attached please find additional comments on the calculations and some discussions in the application. Please provide responses to these comments by May 10, 2023. If you should need additional time, please let me know prior to this date and provide a date when the information will be provided.

Feel free to call or email if you need clarification on anything.

## Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

### Connect: www.scdhec.gov Facebook Twitter



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# SCDHEC BAQ comments/questions for New-Indy (2440-0005) on the new Stripper construction application, sent April 26, 2023

## Application

- NSPS, Section 60.14: According to NSPS 60.14, a modification is "...any physical or operational change to an existing facility which results in an increase in the emission rate..." of any pollutant to which a standard applies. Please discuss whether the following changes would qualify as a modification or not under NSPS. If so, please detail the applicable regulatory changes that will result.
  - a. Combusting the methanol condensate in Nos. 2 and 3 Recovery Furnaces
  - b. Combusting the condenser LVHC in No. 3 Recovery Furnace
  - c. Addition of the 1.0 million Btu/hr natural gas ignitor in the No. 3 Recovery Furnace
  - d. Any other changes that are occurring that are "physical or operational" that increases emissions, please discuss those too.

The modifications or changes in the method of operation noted in items a through c above are not considered modifications for the purposes of evaluating new source performance standards (NSPS) applicability per §60.14(e)(5). The purpose for combustion of the rectified methanol (liquid) in the Nos. 2 and 3 Recovery furnaces, combustion of the low volume high concentration (LVHC) system gases in the No. 3 Recovery Furnace, and installation of the natural gas ignitor in the No. 3 Recovery Furnace is explicitly for the destruction of total reduced sulfur (TRS) and hazardous air pollutant (HAP) emissions for the new condensate stripper system and existing LVHC system gases as required under 40 CFR 60, Subpart BBa and 40 CFR 63, Subpart S.

§60.14(e) The following shall not, by themselves, be considered modifications under this part:
(5) The addition or use of any system or device whose primary function is the reduction of air pollutants, except when an emission control system is removed or is replaced by a system which the Administrator determines to be less environmentally beneficial.

The *Consent Oder to Correct Undesirable Levels of Air Contaminants* effective November 23, 2022, requires New-Indy Catawba to control methanol and sulfur compounds from the stripped condensate in the recovery furnaces.

"New-Indy must install, operate, and maintain a primary stripper that is adequately sized to collect and treat all foul condensate streams in accordance with applicable state and federal air quality regulations. The primary stripper shall use low pressure steam and must be designed for both methanol and sulfur compound removal with the off gases being treated in the recovery boilers to absorb the sulfur compounds in the stripper off gas."

Regarding item d, there are no other physical or operational changes proposed as part of the project that could increase the short-term emissions rates of regulated pollutants under 40 CFR 60, Subpart BBa [i.e., TRS or particulate matter (PM)].

## WATER9 and H2SSIM inputs

## ASB

- 2. The dimensions of the ASB are different than that used in the July 2021 model runs. Why?
  - a. Then ASB 225 x 225 meters
  - b. Now 295 x 295

The ASB zone dimensions were updated in 1Q2022 based on updated aerial imaging to represent progress of ongoing removal of solids. The updated zone dimensions were determined to be representative of the ASB during the majority of the baseline period and are also consistent with the Mill's quarterly Subpart S performance test calculations dating back to 1Q2022. Although future solids removal is expected, the Mill would need to perform additional sampling after the solids are removed to determine the emissions impact of a larger surface area and less solids. We believe that use of the 1Q2022 surface area is the most conservative approach for projected emissions with the new stripper (i.e. yields the highest air emissions). Please note that the actual performance test results were utilized for estimating the baseline methanol emissions.

3. The ambient temperature and wind speed used for the model runs of the H2SSIM model for the July 2022 data seems conservative and were also used in the May 2022 model runs. A temperature of 79 F was used and 3.55 mph. Also, the values used in the WATER9 model differ from those used in the H2SSIM model. WATER9 used Temperature of Air (C) of 25 (or 77F) and Wind speed (cm/s at 10 m) of 447 (or 9.91 mph). Please discuss whether these should be the same between the two models, why or why not. In the October 2021 Corrective Action Plan report, a wind speed of 3.79 mph was used in the H2SSIM model.

Wind speed of 3.55 mph was used for the H2SSIM model based on August 2022 onsite wind speed data to be representative of the May and July 2022 tests. The ambient temperature of 79 F has been the Mill's default value for H2SSIM runs and is based on National Oceanic and Atmospheric Administration (NOAA) data from Greenville-Spartanburg, SC.

The ambient temperature and wind speed in WATER9 are the default values for the model and have not been changed. Per page 187 of the document for air emission models for hazardous waste treatment, storage, and disposal facilities (TSDF) that documents the basis for the WATER9 emissions calculations ("AIR EMISSIONS MODELS FOR WASTE AND WASTEWATER EPA-453/R-94-080A, U.S. EPA Contract No. 68D10118, November 1994"):

Two meteorological parameters required in the models are temperature and windspeed. The emission estimates are based on a standard temperature of 25 °C and a windspeed of 4.47 m/s (10 mi/h). These standard values were evaluated by estimating emissions for windspeed/temperature combinations at actual sites based on their frequency of occurrence. Over a 1-yr period, the results from site-specific data on windspeed and temperature were not significantly different from the results using the standard values. Consequently, the standard values were judged adequate to estimate annual emissions. For short-term emissions, the actual temperature and windspeed over the short-term interval should be used to avoid underestimating emissions during high-windspeed /high-temperature conditions.
4. Pg B-27 appears to say a production rate of 2200 ODTP/day was used to figure the baseline emission factors. But it appears that the average of the 4 test runs (May 2021, and the 3 in July 2021) were used. Why mention the use of 2200 ODTP/day here?

You are correct. 2200 ODTP/day was not used to determine the baseline emissions factors on page B-27. It should not mention 2200 ODTP/day there.

5. Why are emissions from only the ASB being calculated and not the other sources in the Wastewater Treatment Plant? If emissions and such are changing at the ASB, wouldn't it be expected that emissions from the units that follow the ASB to be having changes too that should be accounted for?

The project-related emissions increase analysis includes only the new, modified and affected emissions units. There are no new or modified emissions units in the wastewater treatment plant (WWTP) area proposed as part of the project. In addition, the only portions of the WWTP that are affected by the project pertain to those portions whose emissions are impacted by the foul pulping condensates that are introduced into zone 1 of the aerated stabilization basin (ASB) through the Hardpipe. The affected portions of the WWTP whose emissions are impacted by the Hardpipe are zones 1-3 of the ASB where treatment and volatilization occurs.

The portions of the WWTP that pertain to the primary wastewater treatment (i.e., mix box, bar screen, primary clarifier, and ditches) and primary sludge treatment (i.e. settling pond), are not impacted by the Hardpipe, since the Hardpipe is introduced downstream of the primary treatment operations. The portions of the WWTP that are post-secondary treatment (i.e., the Holding Pond and the Post-aeration Basin) are not impacted by the Hardpipe since the effluent concentration of the ASB is negligible. The Holding Basin emits small amounts of hydrogen sulfide believed to be generated from anaerobic activity. The post-aeration basin is equipped with carbon adsorption control and also emits small amounts of hydrogen sulfide. Sludge Pond No. 4 emits small amounts of hydrogen sulfide that is generated from anaerobic activity from ASB sludge deposited and stored and is not impacted by the Hardpipe stream.

WWTP Factors TAB and TRS TAB

# **Emission Calculations spreadsheet**

6. The TRS emission factors on the WWTP Factors tab are given in terms of lb/ODTP. On the TRS Tab, this value is converted to lb/ADTP by multiplying by 0.9. Shouldn't it be converted by dividing by 0.9 to get lb/ADTP? ADTP is slightly heavier than ODTP. The value in the TRS tab for lb/ADTP is smaller (aka. lighter) than the lb/ODTP. Please check all your other spreadsheets for this too.

Due to the pulp production number being located in the denominator of the emissions factor, multiplying by 0.9 is correct to convert from Ib/ODTP to Ib/ADTP. See below.

On a weight basis, 1 ADTP weighs the same as 1 ODTP, but contains less pulp due to the moisture. Therefore, on a pulp basis, 1 ADTP is equivalent to only 0.9 ODTP.

 $\frac{lb}{ODT} x \frac{0.9 \ ODT}{1 \ ADT} = \frac{lb}{ADT}$ 

# **Buckner**, Katharine

From:	Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Sent:	Friday, May 26, 2023 3:16 PM
То:	Buckner, Katharine
Subject:	Fw: emission spreadsheet
Attachments:	REVISED Emissions Calculations (5-26-23).xlsx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Here you go. Have a good weekend.

From: Caleb Fetner <cfetner@all4inc.com>
Sent: Friday, May 26, 2023 2:27 PM
To: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>
Cc: Steven Moore <smoore@all4inc.com>; Sheryl Watkins <swatkins@all4inc.com>
Subject: RE: emission spreadsheet

# External Email

Bob, see revised calculations as of today that you can pass along to Katherine.

We think it's important to note that as of 5/26/23, we have revised baseline actual emissions calculations in the following ways (1) baseline pulp production was revised and (2) baseline net steam used by existing steam stripper which resulted in decreases in BAE for all pollutants. At this time, the projected actual emissions estimates for the steam required for the new steam stripper have not been revised, but are expected to decrease due to the original application not accounting for any steam offsets that the Mill is including in the project. Once the final scope of these projects are finalized, the decrease in net steam required by the new steam stripper will result in decreases in PAE emissions.

The 5/26/23 also included revisions to the VOC emissions factors for natural gas (1000 Btu/scf) to be consistent with other tabs.

Caleb



Caleb Fetner / Consulting Engineer <u>678.293.9431</u> / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>

Sent: Friday, May 26, 2023 9:19 AM To: Buckner, Katharine <bucknekk@dhec.sc.gov> Cc: Caleb Fetner <cfetner@all4inc.com> Subject: RE: emission spreadsheet

Katharine I have included Caleb Fetner on this email.

# Caleb Do we have the updated emission spreadsheet ready to send to Katharine?

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Friday, May 26, 2023 7:45 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Subject: emission spreadsheet

# **External Email**

Hey Bob,

Could you send the updated emissions spreadsheet? I would like to look at it over the weekend to see if there are any more questions.

Thank you. I am off today.

# Have a nice holiday weekend,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

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## NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operati	ng Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	8%	700.8
No Stripper Online	2%	175.2

LVHC ControlOperating TimeOperating Scenario%RF3 Available for LVHC75%LVHC to CB1/CB225%LVHC to CB1/CB20

Baseline

Existing Stripper Steam Demand21.1MMBtu/hr(Attachment A to May 22 Response to DHEC Comments on App 1)

was previously

23.9 MMBtu/hr

## Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	со	H2SO4	TRS	voc	Pb	H₂S	CO <sub>2</sub>
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	239	1.10E-04	3.61	12,275
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.3	9.41	7.49	24.2	-108.18	39.0	1.20	2.75	9.4	1.97E-03	2.09	36,354
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

### SO2 EMISSIONS REFERENCES

	Stripper	Scenario		Operating C	onfiguration		Con	trols				SO2	Sulfur		
	Operati	ng Time		Ti	me		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>c</sup>	SO2 Em	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE AG	CTUAL EMISSI	ONS (March	2021 - Febru	ary 2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.1
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
SO2 BASELINE ACTUAL EMISSIONS (BAI	E)														737.0
							PROJECTED	ACTUAL EMI	SSIONS						
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor / Preliminary Design Information	99%	0.6	2.4
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	99%	0.9	2.7
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	L LVHC to CB1/CB2 <sup>6</sup> 25.0%         1,872.5         2,700         ADTP/day         0.84         Vendor / Preliminary Design Information           SOG to CB1/CB2         100.0%         394.2         2,700         ADTP/day         1.40         Vendor / Preliminary Design Information					0%	157.4	31.0	
Backup Stripper Online	8.0%	700.8	NA	100%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	55.1
No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	5.9	19.4
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	295.2	323.3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.00	0.0
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.004
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	53.1	3.4
SO2 PROJECTED ACTUAL EMISSIONS (P	AE)														628.84
						1	NET EMISSION	NS CHANGE (F	PAE - BAE)						
NET EMISSIONS CHANGE (PAE - BAE)															-108.18

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

## H2SO4 EMISSIONS REFERENCES

Î.	Chainsan	Conneria		0	ation a		Car	tuele.				112504	Culture		
	Stripper	Scenario		Oper	ating		Con	trois				H2504	Sullur		
	Operati	ing Time		Configura	ition Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture	H2SO4	Emissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	Ib/ADTP	Reference	%	lb/hr	tpy
					BASELINI	EACTUAL EMISSIONS (March 202	1 - February 20	)23)							
11/11C Collection Custom	100%	0.700.0	NA	100%	0.700.0	1)///C to CD1/CD2	100.0%	0.700.0	1.205		4.035.03	NCASI Technical Bulletin 858,	NIA	0.2	1.2
EVHC Collection System	100%	8,700.0	NA	100%	8,760.0	LVHC 10 CB1/CB2	100.0%	8,760.0	1,505	AD IP/uay	4.95E-05	Table 10	NA	0.5	1.2
H2SO4 BASELINE ACTUAL EMISSIONS (B	AE)		-												1.2
						PROJECTED ACTUAL EMISSI	ONS								
IV/HC Collection System	100%	8 760 0	NA	100%	9 760 0	LV/HC to RE2	75.0%	6 5 70 0	2 700	ADTR/day	4 025 02	NCASI Technical Bulletin 858,	NIA	0.55	1 02
EVHC Collection system	100%	8,700.0	NA	100%	8,760.0	EVHC to KF3	75.0%	6,570.0	2,700	ADTP/uay	4.95E-05	Table 10	NA	0.55	1.02
11/11C Collection Custom	100%	0.700.0	NA	100%	0.700.0	1)////C to CB1/CB2	25.0%	2 100 0	2 700	A DTD /days	4 025 02	NCASI Technical Bulletin 858,	NIA	0.55	0.61
LVHC Collection system	100%	8,760.0	NA	100%	8,760.0	LVHC 10 CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	Table 10	NA	0.55	0.61
H2SO4 PROJECTED ACTUAL EMISSIONS (	PAE)														2.43
						NET EMISSIONS CHANGE (PAE	- BAE)								
NET EMISSIONS CHANGE (PAE - BAE)															1.20

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

### NOX EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				NOX	Ammonia		
	Operat	ing Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Increase <sup>c</sup>	NOX Er	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
			-			BASELINE ACTUA	L EMISSIONS	(March 2021	- February 2	023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.3	28.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100%	168.3	24.8	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.8	0.7
NOX BASELINE ACTUAL EMISSIONS			•												123.7
			-			PR	OJECTED ACT	UAL EMISSIO	NS						
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	1.8	6.7
New Stripper Online	90%	90%         7,884.0         SRL Online           90%         7,884.0         SRL Online           90%         7,884.0         SRL Online		95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	0.2	0.6
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	16.4
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.1	2.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.5	0.5
NOX PROJECTED ACTUAL EMISSIONS															147.9
						NET	EMISSIONS CH	ANGE (PAE -	BAE)						
PAE - BAE															24.2

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC).

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

### CO EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				CO	CO		
	Operati	ing Time		Configura	tion Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	CO Err	hissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EN	AISSIONS (Ma	rch 2021 - Fe	oruary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	8.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO BASELINE ACTUAL EMISSIONS															25.2
						PROJE	CTED ACTUAL	EMISSIONS							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	2.9
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.1	0.6
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS															64.2
						NET EMIS	SIONS CHANG	GE (PAE - BAE	)						
PAE - BAE															39.0

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## VOC EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				VOC			
	Operati	ng Time		Configura	tion Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EN	ISSIONS (Ma	rch 2021 - Fel	ruary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35	Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	8.73E-01	WATER9 Inputs and Outputs Provided.	NA	49.67	217.54
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC BASELINE ACTUAL EMISSIONS										·					238.69
						PROJEC	TED ACTUAL	EMISSIONS							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40	Vendor / Preliminary Design Information	99.9%	1.62	6.07
New Stripper Online	90%         7,884.0         SRL Online           90%         7,884.0         SRL Online				7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	10.11
New Stripper Online	90% 7,884.0 SRL Online				7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	7.10
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	12.61
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9 Inputs and Outputs Provided.	NA	32.40	127.72
ASB - Backup Stripper Online	8%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100%	700.8	2,700	ADTP/day	1.42	WATER9 Inputs and Outputs Provided.	NA	159.98	56.06
ASB - No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	NA	100%	175.2	2,700	ADTP/day	2.20	WATER9 Inputs and Outputs Provided.	NA	247.05	21.64
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.0	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS															248.09
						NET EMIS	SIONS CHANG	GE (PAE - BAE							
PAE - BAE															9.40

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

### TRS EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				TRS	Sulfur		
	Operati	ng Time		Configura	ation Time		Operat	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	TRS En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTU	AL EMISSION	S (March 202	1 - February	2023)					
Backup Stripper SOG <sup>A</sup>	BASELINE AUTIVE DESCRIPTION       VENERATIVE DESCRIPTION       VENERATIVE DESCRIPTION         opper SoC <sup>A</sup> 91.4%       8.04.0       NA       100.%       8.04.0       LVHC to CB1/CB2       100.%       8.04.0       1.36.       ADP/dag       2.88.63       June 2021 Stack Test, Combination Bollers No.1 and No.2 average. DHEC Approved Test.         bilization Basin (ASB)       100.%       8.7600       NA       100.%       8.7600       1.36.       ADP/dag       8.08.23       June 2021 Stack Test, Combination Bollers No.1 and No.2 average. DHEC Approved Test.         ction System       3.7600       NA       100.%       8.7600       1.36.6       ADP/dag       8.08.23       June 2021 Stack Test, Combination Bollers No.1 and No.2 average. DHEC Approved Test.         VENETURE STORE         VENETURE STORE <td>0.16</td> <td>0.65</td>													0.16	0.65
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
TRS BASELINE ACTUAL EMISSIONS															12.81
	1		-			Р	ROJECTED AC	TUAL EMISSI	ONS						
New Stripper Online	Stripper Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL Methanol to RF2/3 <sup>G,H</sup> 100.0%         7,489.8         2,700         ADTP/day         0.33         Vendor / Preliminary Design Information           tripper Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL Methanol to RF2/3 <sup>G,H</sup> 100.0%         7,489.8         2,700         ADTP/day         0.33         Vendor / Preliminary Design Information									Vendor / Preliminary Design Information	99.9%	0.04	0.14		
New Stripper Online	90.0% 7,884.0 SRL Online 90.0% 7,884.0 SRL Online				7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99.9%	0.05	0.15
New Stripper Online	Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL LVHC to RF3 <sup></sup> 7.5.0%         5,61.7.4         2,700         AUT7/day         0.49         Vendor / Prelimin           Jnline         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL LVHC to CB1/CB2 <sup>6</sup> 25.0%         1,872.5         2,700         ADTP/day         0.49         Vendor / Prelimin							Vendor / Preliminary Design Information	99%	0.55	0.51				
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.18
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.32
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
ASB - Backup Stripper Online	8.0%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	3.06	1.07
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	0.72
LVHC Collection System	100.0%	8,760.0	NĂ	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															15.56
						NET	EMISSIONS	CHANGE (PAE	- BAE)						
PAE - BAE															2.75

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

### H2S EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	rols				H2S	Sulfur		
	Operati	ng Time		Configura	ition Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Capture <sup>c</sup>	H2S En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	1	-		Operating Configuration Time         Operating Operating Time         Production Rate Operating Time         H25 Production Rate         H25 Emission Stator         Sulfur Capture <sup>6</sup> %         hrs         Controls         %         hrs         Value         UOM         Ib/UOM         Reference         %           100.0%         8,004.0         LVHC to C31/CB2         100.0%         8,004.0         1,365         ADTP/day         4.13E-04         june 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.         NA           Pipe         100.0%         8,760.0         Hydrogen Peroxide Addition         100.0%         8,760.0         1,365         ADTP/day         1.36E-02         H2SSIM/WATER9 Inputs and Outputs Provided.         NA           100.0%         8,760.0         LVHC to C81/CB2         100.0%         8,760.0         1,365         ADTP/day         5.08-04         june 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.         NA           95.0%         7,489.8         SRL Methanol to RF/3 <sup>6,17,4</sup> 75.0%         5,617.4         2,700         ADTP/day         0.37         Vendor / Preliminary Design Information         99.9%           95.0%         7,489.8         SRL Wethanol to RF/3 <sup>6,17,4</sup> 75.0%         5,617.4         2,700         ADTP/day											
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09								
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS															3.61
		_	-	_			PROJECTED AG	TUAL EMISSI	ONS			-			
New Stripper Online	Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL Methanol to RE7/3 <sup>SH</sup> 100.0%         7,489.8         2,700         ADTP/day         0.24         Vendor / Preliminary Design Information         99           Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL Lythc to RE3 <sup>GH</sup> 75.0%         5,617.4         2,700         ADTP/day         0.37         Vendor / Preliminary Design Information         99								99.9%	0.03	0.10				
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99.9%	0.04	0.12
New Stripper Online	90.0% 7,884.0 SRL Online 90.0% 7,884.0 SRL Online				7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14	
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.24
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
ASB - Backup Stripper Online	8.0%	700.8	H2S Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	9.81E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.39
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	9.54E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.09
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															5.69
						NE	T EMISSIONS	CHANGE (PAE	- BAE)						
PAE - BAE															2.09

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

## PM EMISSIONS REFERENCES

	Stripper	Scenario		Oper	rating		Con	trols				PM	PM		
	Operati	ng Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Control	PM Em	issions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIC	DNS (March 20	21 - February	2023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.3
PM BASELINE ACTUAL EMISSIONS															1.1
		PROJECTED ACTUAL EMISSIONS													
Recovery Furnace #3 LVHC Ignitor	PROJECTED ACTOAL EMISSIONS           75.0%         6,570.0         Natural Gas <sup>1</sup> 15.0%         985.5         100.0%         985.5         1.0         mmBtu/hr         7.60E-03         AP-42 Table 1.4-2. Filterable and Condensable.         NA         7.60E										7.60E-03	3.74E-03			
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	3.9	0.3
PM PROJECTED ACTUAL EMISSIONS															13.4
						NET EMISSION	S CHANGE (PA	E - BAE)							
PAE - BAE															12.3

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## PM10 EMISSIONS REFERENCES

(	Stripper	Scenario		Ope	rating		Con	trols				PM10	PM10		
	Operat	ing Time		Configura	ation Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	PM10 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	÷		•			BASELINE ACTUAL EMISSION	S (March 202:	L - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
PM10 BASELINE ACTUAL EMISSIONS															1.0
	PROJECTED ACTUAL EMISSIONS														
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.8	0.2
PM10 PROJECTED ACTUAL EMISSIONS	•							•							10.4
						NET EMISSIONS C	HANGE (PAE	- BAE)							
PAE - BAE															9.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## PM2.5 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				PM2.5	PM2.5		
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	PM2.5 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS	March 2021 -	February 202	!3)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															1.0
						PROJECTED ACTU	AL EMISSION	S							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.4
						NET EMISSIONS CH	ANGE (PAE - E	BAE)							
PAE - BAE															7.5

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## LEAD EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				Lead	Lead		
	Operat	ing Time		Configura	ation Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	Lead En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	IS (March 202	1 - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	5.10E-05
												U.S. EPA document "Estimating Air Toxic Emissions			
Packup Strippor Stoom <sup>A</sup>	91.4%	8 004 0	No. 6 Oil <sup>B</sup>	2 1%	168.3		100.0%	168 3	24.8	mmBtu/hr	2 80F-05	from Coal and Oil Combustion Sources" [EPA-450/2-	NΔ	6 95E-04	5 85E-05
backup stripper steam	51.470	0,004.0	140. 0 61	2.170	100.5		100.076	100.5	24.0	minbta/m	2.000 05	89-001] for Uncontrolled Residual Oil-fired Utility	110	0.552.04	5.052.05
												Boilers (Table 4-1)			
LEAD BASELINE ACTUAL EMISSIONS															1.10E-04
						PROJECTED AG	CTUAL EMISSI	ONS			-				
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.27E-05	3.62E-06
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" (EPA-450/2- 89-001) for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	6.75E-04	4.35E-05
LEAD PROJECTED ACTUAL EMISSIONS															2.08E-03
						NET EMISSIONS	CHANGE (PAE	- BAE)							
PAE - BAE															1.97E-03

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## CO2 EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				CO2	CO2		
	Operat	ng Time		Configura	ation Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	CO2 En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	IS (March 202	1 - February	2023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,044.8	11,929
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	346
CO2 BASELINE ACTUAL EMISSIONS															12,275
						PROJECTED A	CTUAL EMISS	IONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	2,958.3	846
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	3,993.0	257
CO2 PROJECTED ACTUAL EMISSIONS															48,629
						NET EMISSIONS	CHANGE (PAE	- BAE)							
PAE - BAE															36,354

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## SUMMARY OF ASB EMISSIONS FACTORS

			ASB Em	issions Factors (Ik	D/ODTP)		
Scenario	H <sub>2</sub> S	DMDS	DMS	MMC	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	0.92	0.97	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	0.30	0.32	0.0269
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	1.53	1.58	0.0302
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

			Con	centration (pp	m)	
		Hydrogen	Methyl	Dimethyl	Dimethyl	
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	<b>Total TRS</b>
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 of	or 6/25	146.7	16.0	17.0	15.0	194.7

		MW	
H2S	Hydrogen Sulfide	34.08 g/mol	
Ch4S	Methyl Mercaptan	48.11 g/mol	
C2H6S	Dimethyl Sulfide	62.13 g/mol	
C2H6S2	Dimethyl Disulfide	94.20 g/mol	
S	Sulfur	32.07 g/mol	

# Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl
Sulfide	Mercaptan	Sulfide	Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AHL)
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.70

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

# Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

## CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination			
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total	Total	
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil				
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu	
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309	1,3
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0	1,4
May-21	46,962	38,834	63,467	102,301	0	0	0	0	1,5
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180	1,4
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15	1,5
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0	1,4
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13	1,3
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0	1,5
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0	1,3
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0	1,2
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388	1,4
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112	1,3
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50	1,4
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0	1,3
May-22	38,896	39,982	73,918	113,900	0	0	0	0	1,2
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336	77
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0	1,2
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0	1,7
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4	1,5
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0	1,5
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0	1,3
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511	1,0
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384	1,1
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252	1,4
Total	996,766			3,237,544				69,553	
Annual Average	498,383								
				97.9%				2.1%	

996,766 498,383

	Combina	tion Boiler No.	1 Stack	Combinat	ion Boiler No. 2	Stack
	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG
ODTP/hr	77.3	79.0		91.1	92.9	
ADTP/hr	85.9	87.8		101.2	103.2	
lb SO2/hr	342.8	230.7		380.9	309.9	
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00	0.76

	Controlled	Emissions	Sulfu	r Capture	Uncontrolle	d Emissions
	Average	Maximum	Bark Ash <sup>C</sup>	LVHC Scrubber	Average	Maximum
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP	lb SO2/ADTP
SOG	1.06	1.36	20%	NA	1.33	1.70
NCG	2.82	3.00				
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92	5.25
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06	1.13

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (0.473 lb SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests  $\sim$ 32% capture).

# WESTER

RESULTS AND DISCUSSION

Combination Boiler #1

Average:

- 2

# TABLE 2-2 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	0844	1029	1206	
Time Ended	0944	1129	1306	
Stack Gas Data				
Temperature, °F	430	435	438	434
Velocity, ft/sec	64	63	63	63
Moisture, %	17	17	17	17
CO <sub>2</sub> Concentration, %	8.8	9.0	8.6	8.8
O2 Concentration, %	10.5	10.5	10.8	10.6
VFR, x 10 <sup>5</sup> dscfin	1.46	1.45	1.44	1.45
Sulfur Dioxide				
Concentration, ppm	280	227	204	237
Emission Rate, lb/hr	407.4	328.3	292.6	342.8

Conditio	n 1 21	With NCGs	with SOGs												
Run N		Start Time	Steam Rate	Bark Rate	Gas Flow (10 <sup>4</sup> SCF/H/)	TOF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condénsate Flow (GPM)	LVHC Flow to Boilers (SCFM)	SOG Flow ta Boilers (SCFM)	HVLC Flow to Bailers (SCFM)	Puip Production (ODT/Hr)	Рир ХАРРА
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	1407	1103	10851	77.3	82,7
	2	1029	265.3	33.0	109.1	1.23	40	10.9	505	213	1409	1200	10885	77.3	85.7
	3	1206	257.7	32.6	100.4	1.23	40	10.9	504	2	1443	1205	10963	77.3	84.8
Average:	:		261.9	31.8	112.1	1.23	40	10.9	507	148	1420	1170	10900	77.3	84.4

### Condition 2: With NCGs, without SOGs 13-Oct-21

							NCG			Hard Pipe						
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Productio	n	
Run #	3	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPP/	A,
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	1416		11071		/9.0	83.9
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	1414	教授的問題意思	10976	i T	79.0	81.6
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	1430		11061	. 7	79.0	80.3
Average			265.8	33.0	106.4	1.23	40	10.9	505	146	1420		11036	F 7	79.0	81.9
													-			

# TABLE 2-3 No. 1 Combination Boiler Condition 2: NCG Gases Only Summary of SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	1407	1544	1714	
Time Ended	1507	1644	1814	
Stack Gas Data				
Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, %	17	18	16	17
CO2 Concentration, %	9.6	9.9	8.9	9.5
O2 Concentration, %	10.1	9.8	10.7	10.2
VFR, x 105 dscfm	1.37	1.39	1.43	1.40
Sulfur Dioxide				
Concentration, ppm	140	176	180	165
Emission Rate, lb/hr	191.3	243.6	257.0	230.7

K 115730 NEW IND YOOT CATAWIA SCOOPJEE/ORTNEW-IND/Y CATAWIA OCT 2021 1-2 CB 502 EMISSION TEST REPORT.DOCM 28 Onsider 2021 1-50 p.m. Vension

15730.001.009 #1-2 CBs SO, Emission Report

# WESTON

RESULTS AND DISCUSSION

## Combination Boiler #2

14-Oct-21

Condition 1: With NCGs, with SOGs

## TABLE 2-4 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	
Time Began	0830	1026	1222	
Time Ended	0930	1126	1322	
Stack Gas Data				
Temperature, °F	463	477	465	469
Velocity, fl/sec	63	68	61	64
Moisture, %	17	19	16	17
CO <sub>2</sub> Concentration, %	8.2	9.5	7.5	8.4
O2 Concentration, %	10.8	10.1	11.5	10.8
VFR, x 10 <sup>5</sup> dscfm	1.40	1.43	1.35	1.39
Sulfur Dioxide				
Concentration, ppm	275	262	286	274
Emission Rate, lb/hr	383.7	373.7	385.4	380.9

14-Oct	-21														
							NCG			Hard Pipe					
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Run		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209	1409	1203	11071	91.1	94.5
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200	1420	1179	11160	91.1	88.2
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199	1429	1157	11090	91.1	80.7
Average			234	33.8	158.6	1.23	40	10.9	505	203	1419	1180	11107	91.1	87.8

Condition 2:	With NCGs	, without SOGs
14-Oct-21		

						NCG			Hard Pipe						
						Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
		Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
	Start Time	(103 lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
1	1410	198	21.7	174.8	1.23	40	10.9	505	209	1438		11109	92.9	78.8	
2	1547	218	35.4	206.4	1.23	40	10.9	505	224	1435		11060	92.9	78.7	
3	1725	214	49.6	220.6	0.65	40	10.9	505	262	1453		10977	92.9	79.3	
		210	35.6	200.6	1.04	40	10.9	505	232	1442		11049	92.9		
	1 2 3	Start Time 1 1410 2 1547 3 1725	Steam Rate           Start Time         (10 <sup>3</sup> lbs/hr)           1         1410         198           2         1547         218           3         1725         214           :         210         210	Steam Rate         Bark Rate           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)           1         1410         198         21.7           2         1547         218         35.4           3         1725         214         49.6           ::         20         35.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> )           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)           1         1410         198         21.7         174.8           2         1547         218         35.4         206.4           3         1725         214         49.6         220.6           ::         210         35.6         200.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TDF (TPH)           1         1410         198         21.7         174.8         1.23           2         1547         218         35.4         2006.4         1.23           3         1725         214         49.6         220.6         0.65	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strubber           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)           1         1410         198         21.7         174.8         1.23         40           2         1547         218         35.4         206.4         1.23         40           3         1725         214         49.6         220.6         0.65         40	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strart Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)         (GPM)         (SU)           1         1410         198         21.7         174.8         1.23         40         10.9           2         1547         21.8         35.4         206.4         1.23         40         10.9           3         1725         21.4         49.6         220.6         0.65         40         10.9	NCG         Stream Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG         Stripper Fault           Start Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Ster Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STER Time (10 <sup>3</sup> Ibs/hr)         STER Time (10 <sup>3</sup> Ibs/Hr)	Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         NCG         Stripper Foul         Foul           Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         Flow         Scrubber / Scrubber         Condensate         Condensate           1         1410         198         21.7         174.8         1.23         40         10.9         505         209           2         1547         218         35.4         206.4         1.23         40         10.9         505         224           3         1725         214         49.6         220.6         0.65         40         10.9         505         262	Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow Scrubber         NCG         Stripper Foul         Foul         LVHC Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         209         1438           3         1725         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Stripper Foul         Four         Hard Pipe           Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow         Scrubber pH         Condensate         Condensate         Sond Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         224         1435           3         172.5         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Hard Pipe           NCG         Stripper Fault         Four         NCG         Stripper Fault         Stripper Fault         Stripper Fault         Stripper Fault         Kore Stripper Fault         Stripper Fault <th colspa="6" fault<="" stripper="" td=""><td>NCG         NCG         Net definition of the set of th</td></th>	<td>NCG         NCG         Net definition of the set of th</td>	NCG         NCG         Net definition of the set of th

### TABLE 2-5 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	·
Time Began	1410	1547	1725	
Time Ended	1510	1647	1825	
Stack Gas Data				
Temperature, °F	457	461	460	459
Velocity, ft/sec	59	59	58	59
Moisture, %	15	15	15	15
CO <sub>2</sub> Concentration, %	7.2	7.6	7.0	7.3
O2 Concentration, %	11.9	11.2	11.7	11.6
VFR, x 10 <sup>5</sup> dscfm	1.33	1.33	1.33	1.33
Sulfur Dioxide				
Concentration, ppm	235	234	232	234
Emission Rate, lb/hr	311.3	311.0	307.4	309.9

K 11579 NEW PROVINE CATAWIDA, SCOOPALIPORTINEW (BODY CATAWIDA OCT 2021 1-3 CIS SO2 3PARISSION TEST REPORT DOCM 8 28 Okuber 2021 1:00 p.m. Vennim

> 15730,001,009 #1-2 CBs SO, Emission Report

1

## June 2021 TRS\_H2S Testing - Weston

	Comb	ination Boiler No	. 1 Stack	Combin	ation Boiler No.	2 Stack		Combin	nation Boiler No.	1 Stack	Combin	ation Boiler No.	2 Stack
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG	H2S	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG
ODTP/hr	55.9	76.0		88.3	85.2		ODTP/hr	55.9	76.0		88.3	85.2	
ADTP/hr	62.1	84.4		98.1	94.7		ADTP/hr	62.1	84.4		98.1	94.7	
lb TRS (as H2S)/hr	0.75	0.68		0.85	0.92		lb H2S/hr	0.07	0.05		0.07	0.04	
lb TRS (as TRS)/hr	1.07	0.97		1.22	1.32								
Ib TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02	1.39E-02	-1.51E-03	Ib H2S/ADTP	1.13E-03	5.92E-04	5.35E-04	7.13E-04	4.23E-04	2.91E-04
	Controller	Emissions	Sulfur Co	nversion	Uncontrolle	d Emissions		Controlled	Emissions	Sulfur C	onversion	Uncontrolle	d Emissions
	Average	Maximum	Combustion	IVHC Scrubber	Average	Maximum			Maximum	Combustion	IVHC Scrubber		Maximum
TRS as TRS	Ib TRS/ADTP	Ib TRS/ADTP	%	%	Ib TRS/ADTP	Ib TRS/ADTP	H2S	Ib H2S/ADTP	Ib H2S/ADTP	%	%	Ib H2S/ADTP	Ib H2S/ADTP
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA	0.29	0.58	SOG	4.13E-04	5.35E-04	99%	NA	4.13E-02	5.35E-02
NCG	1.27E-02	1.39E-02					NCG	5.07E-04	5.92E-04				
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%	1.60	1.75	LVHC <sup>A,C</sup>	5.03E-04	5.87E-04	99%	50%	1.01E-01	1.17E-01
LIN / CA-B							A.C.						

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HVLC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C). C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and HVLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1			CB1			CB2			CB2						
TRS as S		MW	NCG+SOG			NCG			NCG+SOG			NCG						
sulfur	S	32.065	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	AVG		PLC Cross C	heck back to TRS as H2S
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08	0.07	0.1	0.07	0.07	0.07	0.08	0.08	0.08	0.05	0.05	0.05	0.07	8.0%		0.085742 0.085742
methyl mercaptan	CH <sub>4</sub> S	48.107	0.55	0.53	0.49	0.52	0.52	0.53	0.77	0.63	0.64	0.94	0.91	0.69	0.64	72.6%		0.778738 0.55169
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62.134	0.16	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.08	0.07	0.07	0.12	13.5%		0.144248 0.079121
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.04	0.04	0.03	0.03	0.03	0.05	5.9%		0.06355 0.045984
															0.89	Total TRS		1.072278 0.762538
															84.8%			

10^6 ACFM Flowrate Basis to Ib/min												
H <sub>2</sub> S	0.007081766	0.006196545	0.008852208	0.006196545	0.006196545	0.006196545	0.007081766	0.007081766	0.007081766	0.004426104	0.004426104	0.004426104
CH <sub>4</sub> S	0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S	0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182

CH <sub>4</sub> S		0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S		0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>		0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182
	TRS as H2S	0.082325532	0.07966987	0.078784649	0.078784649	0.078784649	0.080555091	0.089407299	0.077014208	0.077899429	0.100029948	0.096489065	0.077014208
	TRS as TRS	0.118755065	0.115370779	0.113028312	0.114121247	0.114121247	0.116984649	0.125993636	0.108500182	0.109749714	0.142133299	0.136770831	0.109281117

Ratio TRS as H2s/TRS a 0.693238074 0.690555015 0.697034647 0.690359171 0.690359171 0.68859596 0.709617575 0.709807177 0.70979163 0.703775603 0.705479846 0.704734816 0.69944568 1.43



RESULTS AND DISCUSSION

## Combination Boiler #1

Condition 1: With NCGs, with SOGs 23-Jun-21

#### TABLE 2-11 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1158	1400	1541	
Time Ended	1258	1500	1641	
Stack Gas Data				
Temperature, *F	415	418	415	416
Velocity, fl/sec	59	57	57	57
Moisture, %	17	18	16	17
CO <sub>2</sub> Concentration, %	7.8	8.4	7.7	8.0
O2 Concentration, %	12.1	11.4	12.0	11.8
VFR, x 105 dscfm	1.35	1.31	1.33	1.33
Hydrogen Sulfide				
Concentration, ppm	0.09	0.08	0.12	0.10
Emission Rate, Ib/hr	0.07	0.06	0.08	0.07
Total Reduced Sulfur				
Concentration, ppm	1.09	1.07	1.03	1.06
Emission Rate, Ib/hr	0.78	0.74	0.73	0.75
Sulfur Dioxide				
Concentration, ppm	195	278	344	272
Emission Rate, Ib/hr	262.7	362.5	457.4	360.9

							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	<b>Pulp Production</b>	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	S	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(lbs/ODT Pulp)	(lbs/hr)
	1	1158	208	25.1	80.8	1.37	40	10.9	458	146	1585	621	11575	49.7	262.7	5.29	0.56
	2	1400	225	29.3	68.8	1.37	40	10.9	491	152	1595	1219	11048	54.0	362.5	6.71	0.49
	3	1541	207	24.8	81.2	1.37	40	10.9	491	45	1578	1136	11009	64.0	457.4	7.15	0.50
Average:			213	26.4	76.9	1.37	40	10.9	480	114	1586	992	11211	55.9	360.9	6.46	0.52

# Condition 2: With NCGs, without SOGs 23-Jun-21

								NCG			Hard Pipe							
								Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Ra	te	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	5	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/H	ir)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/OOT Pulp)	(lbs/hr)
	1	1824	23	30	26.3	94.9	1.37	40	10.9	489	123	1587		10515	74.1	404.4	5.46	0.43
	2	2019	21	16	23.7	97.5	1.37	40	10.9	491	184	1593		10377	74.7	7 452.9	6.06	0.42
	з	2202	22	20	25.2	92.4	1.37	40	10.9	490	152	1570		10573	79.3	450.8	5.69	0.46
Average	21		22	22	25.1	94.9	1.37	40	10.9	490	153	1583		10488	76.0	436.1	5.74	0.44

TABLE 2-12
NO. 1 COMBINATION BOILER
CONDITION 2: NCG GASES ONLY
SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, "F	416	411	415	414
Velocity, fl/sec	56	56	56	56
Moisture, %	16	16	17	17
CO <sub>2</sub> Concentration, %	8.3	7.8	8.1	8.1
O <sub>2</sub> Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>8</sup> dscfin	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, Ib/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, Ib/hr	0.67	0.68	0.68	0.68
Sulfer Diaxide				
Concentration, nem	313	348	349	337
Emission Rate, Ib/hr	404.4	452.9	450.8	436.1

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RESULTS AND DISCUSSION

## Combination Boiler #2

Average:

16

235

32.4

140.7

1.37

40

10.9

481

Condition 1: With NCGs, with SOGs 24-Jun-21

# TABLE 2-13 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/24/21	6/24/21	6/24/21	
Time Began	1445	1630	1806	
Time Ended	1545	1730	1906	
Stack Gas Data				
Temperature, *F	475	474	479	476
Velocity, ft/sec	69	69	69	69
Modelham, %6	14	14	15	14
CO <sub>2</sub> Concentration, %	6.6	6.9	7.3	6.9
O2 Concentration, %	13.1	12.7	12.3	12.7
VFR, x 10 <sup>5</sup> dscfm	1.57	1.56	1.54	1.56
Hydrogen Sulfide				
Concentration, ppm	0.09	0.09	0.09	0.09
Emission Rate, Ib/hr	0.07	0.07	0.07	0.07
Total Reduced Sulfur				
Concentration, ppm	1.13	0.97	0.97	1.02
Emission Rate, Ib/hr	0.94	0.80	0.80	0.85
Sulfur Dioxide				
Concentration, ppm	324	327	322	324
Emission Rate Ibbr	508.7	507.2	496.1	504.0

# TABLE 2-14 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF H<sub>2</sub>S, TOTAL TRS, AND SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, "F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> discfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide				
Concentration, ppm	0.05	0.05	0.05	0.05
Emission Rate, Ib/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				
Concentration, perm	1.22	1.18	0.94	1.11
Emission Rate, Ib/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, Ib/hr	383.2	380.0	366.2	376.4

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24-2011	. 2. 7																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>#</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	N	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1445	219	39.0	125.3	1.37	40	10.9	491	190	1572	1231	10253	87.8	508.7	5.79	0.77
	2	1630	224	31.1	146.4	1.37	40	10.9	490	186	1576	1231	10277	88.6	507.2	5.72	0.63
	3	1806	241	33.6	146.4	1.37	40	10.9	490	190	1580	1231	10300	88.6	496.1	5.60	0.63
Average	£0		228	34.6	139.4	1.37	40	10.9	490	189	1576	1231	10277	88.3	504.0	5.71	0.68
Conditio	on 2	: With NCG	s, without SOG:														
25-Jun-	-21																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boiters	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1000	234	35.7	132.7	1.37	40	10.9	482	155	1579		10475	87.2	383.2	4.39	0.86
	2	1135	225	30.8	147.8	1.37	40	10.9	479	252	1573		10425	84 3	380.0	4.51	0.82
	3	1315	245	30.6	141.7	1.37	40	10.9	482	97	1571		10500	84.2	366.2	4.35	0.63

168

1574

10467

85.2

376.4

4.42

0.77

# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Friday, June 16, 2023 12:36 PM
То:	Buckner, Katharine
Cc:	Tourville, Bob; Steven Moore; Sheryl Watkins
Subject:	RE: existing Foul Condensate Collection Tank (equip ID 9800) and other questions
Attachments:	Attachment A - Existing Stripper Methanol in SOG.xlsx; REVISED Emissions Calculations
	(6-13-23)_corrected_backup_stripper_VOC.xlsx; 2440-0005.RE-comments on stripper
	app 5 (6-16-23).docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katherine,

On behalf of the mill, please see attached responses to your questions sent June 12, 2023. I have also attached the latest version of the PSD emissions calculations spreadsheet, along with Attachment A (spreadsheet supporting development of VOC emissions factor for SOG).

Please let us know if you have any questions, and have a good weekend.

Caleb



From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Monday, June 12, 2023 2:33 PM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Subject: existing Foul Condensate Collection Tank (equip ID 9800) and other questions

## **External Email**

Hey Bob,

When we last spoke on June 2, there was some discrepancy on the size of the existing foul condensate collection tank, equipment ID 9800. The current TV has the size listed as 180,000 gallons. I think this was the tank there was a discrepancy about. Did you look into this to verify the size of this tank? If this was not the tank in question, what tank was it and was the size verified?

Additional comments:

- 1. Please provide the data, calculations, and assumptions used to derive the VOC emission factors for the new stripper.
- 2. Why do the design parameters/emission factors for the backup stripper match those for when the new stripper is operating with the SRL offline? If the backup stripper is operating to remove TRS and the new stripper is

operating to remove MeOH, how can the design values/emission factors be the same? This is for SO2, TRS, H2S, and VOC.

Please provide this information by Friday, June 16, 2023.

# Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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Mill Day	FC MeOH, ppm	FC to Stripper, Avg GPM	Pulp Production , ODT	15-day total ODT	MeOH to Steam Stripper, Ibs/day	15-day total MeOH to Steam Stripper Ib/day	15-day avg. MeOH to Steam Stripper Ib/ODT	ESFR	Use Default Removal %?	Stripped Condensate MeOH, ppm	Steam Feed Rate Ib/hr	Steam Stripper Removal Efficiency (%)	Methanol Leaving Stripper Ibs/ODT	Methanol Treated in Stripper Ib/ODT
6/23/2021	1700	487.4	1539.4		9,951			18.0	NO		69135.4			
6/24/2021	2400	487.6	2102.5		14,055			16.7	NO		64778.2			
6/25/2021	2600	480.7	2040.2		15,008			18.0	NO		66965.4			
6/26/2021	2400	476.9	1883.8		13,746			14.5	NO		54505.6			
6/27/2021	2500	426.6	1807.8		12,807			16.0	NO		46965.4			
6/28/2021	2500	475.7	1697.1		14,281			17.8	NO		63961.9			
6/29/2021	2400	411.5	1804.4		11,862			10.5	NO		36333.2			
6/30/2021	2050	359.0	1873.6		8,838			15.2	NO		38197.7			
7/1/2021	1900	475.2	1359.5		10,843			18.3	YES		66113.8		2,488.0	6.1
7/2/2021	1600	491.4	1165.8		9,442			16.9	NO		64901.2			
7/3/2021	2000	501.9	1749.2		12,055			18.3	YES		70422.8		2,766.0	5.3
7/4/2021	2200	450.8	1663.3		11,912			17.6	NO		59075.9			
7/6/2021	1600	451.5	1806.0		8,676			16.6	NO		54325.0			
7/7/2021	2200	499.9	1947.1		13,207			18.0	NO		67944.5			
7/8/2021	2300	499.9	1449.4	25889.3	13,809	180,491	6.97	18.3	YES		68947.4			
7/9/2021	2383	496.1	1694.2	26044.0	14,200	184,741	7.09	18.3	YES		68069.2			
7/10/2021	2267	491.5	1609.2	25550.7	13,381	184,067	7.20	18.2	YES		67717.2			
7/11/2021	2000	489.9	1355.9	24866.4	11,768	180,826	7.27	17.9	NO		67454.9			
7/12/2021	1700	475.5	1783.7	24766.3	9,707	176,788	7.14	17.4	NO	340	62953.1	75%	1.81	5.3
7/13/2021	1900	479.9	1476.9	24435.4	10,952	174,932	7.16	18.2	YES		65779.4		1.64	5.5
7/14/2021	1600	480.1	746.1	23484.4	9,224	169,875	7.23	18.2	YES		66859.8		1.66	5.6
7/15/2021	1400	312.9	1430.2	23110.2	5,261	163,274	7.07	18.2	YES		31714.6		1.62	5.4
7/16/2021	1600	275.3	1470.3	22706.9	5,289	159,726	7.03	17.4	NO	270	33140.2	79%	1.47	5.6
7/17/2021	2000	427.7	1604.5	22951.9	10,273	159,155	6.93	18.6	YES		55244.6		1.59	5.3
7/18/2021	2100	490.0	1926.0	23712.1	12,357	162,071	6.83	18.2	YES		67812.6		1.57	5.3
7/19/2021	2400	490.0	1826.6	23789.5	14,123	164,139	6.90	18.2	YES		68582.1		1.58	5.3
7/20/2021	2000	480.7	1949.4	24075.5	11,545	163,772	6.80	18.2	YES		67966.5		1.56	5.2
7/21/2021	2200	494.8	1771.3	24040.9	13,074	168,171	7.00	17.9	NO	480	69152.4	72%	1.95	5.0
7/22/2021	2000	487.4	1797.3	23891.1	11,706	166,669	6.98	18.9	YES		69986.4		1.60	5.4
7/23/2021	2100	480.0	1700.1	24141.8	12,106	164,966	6.83	19.0	YES		68185.9		1.57	5.3
7/24/2021	2000	480.0	1593.5	24041.2	11,529	162,295	6.75	19.0	YES		69160.5		1.55	5.2
7/25/2021	1800	480.0	1555.1	23987.1	10,376	159,290	6.64	19.0	YES		69398.3		1.52	5.1
7/26/2021	1700	474.9	1626.5	24257.7	9,697	157,219	6.48	19.0	YES		68701.2		1.49	5.0
7/27/2021	1800	424.8	1722.9	24196.9	9,182	156,694	6.48	19.0	YES		60261.5		1.49	5.0
7/28/2021	1700	425.0	1060.2	23780.2	8,676	154,419	6.49	19.0	YES		60/15.4		1.49	5.0
7/29/2021	1700	430.9	1/80.8	24814.9	8,797	153,992	6.21	19.0	YES		61849.2		1.42	4.8
7/30/2021	1900	439.3	1/43.1	25127.7	10,025	158,756	6.32	19.0	YES		63105.7		1.45	4.9
//31/2021	2000	440.0	1//9.6	25437.0	10,569	164,035	6.45	19.0	YES		63554.3		1.48	5.0
8/1/2021	1900	302.4	1632.4	25464.8	6,901	160,663	6.31	25.2	YES		41136.3		1.45	4.9
8/2/2021	1900	449.0	1331.5	24870.4	10,246	158,552	6.38	19.0	YES		63631.7		1.46	4.9
8/3/2021	950	443.1	206.7	23250.5	5,055	149,484	6.43	18.8	YES		58828.2		1.48	5.0
8/4/2021	1100	289.1	295.0	21596.1	3,819	141,758	0.56	28.9	YES		45853.7		1.51	5.1
8/5/2021	1200	203.5	448.7	20273.5	2,932	131,616	6.49	25.6			21488.8		1.49	5.0
8/6/2021	1300	381.7	1420.4	19896.6	5,959	125,869	0.33	20.5	TES		52829.5	750/	1.45	4.9
8/7/2021	1400	451.9	1253.1	19449.6	7,598	121,361	6.24	17.7		Enter Tested Value	60043.5	/5%	1.54	4./
8/8/2021	2000	455.0	1615.8	194/1.9	10,929	120,761	6.20	19.5	YES		60490.1		1.42	4.8
8/9/2021	970	454.9	1593.5	19510.4	5,299	115,684	5.93	18.8			58945.9		1.36	4.6
8/10/2021	2400	459.4	18/3.8	19/5/.0	0,009	112,056	5.07	19.1			61359.2		1.30	4.4
8/11/2021	2400	458.0	1899.8	19934.5	13,201	110,076	5.82	19.2			50010.7		1.34	4.5
8/12/2021	2700	433.9	1885.6	20760.0	14,071	121,470	5.85	20.0	I YES		56771.9		1.34	4.5

8/13/2021	2600	427.2	1645.9	20625.1	13,340	126,012	6.11	19.5	YES		53581.1		1.40	4.7
8/14/2021	2400	446.4	1592.0	20473.9	12,867	128.855	6.29	19.5	YES		55154.6		1.44	4.8
8/15/2021	2000	459.5	1697.7	20392.0	11.038	129.324	6.34	18.9	YES		64288.1		1.46	4.9
8/16/2021	1300	417.1	1866.8	20626.4	6 511	128,935	6.25	19.5	YES		54449.0		1 43	4.8
8/17/2021	1100	424.8	1871 1	21166.0	5 611	124 300	5.87	21.3	YES		55070.9		1 35	4.5
8/18/2021	1200	376.0	1830.2	22789.5	5 4 1 9	124 664	5 47	20.2	YES		44794 7		1.00	4.2
8/19/2021	1300	344.8	1899.9	24394.4	5 382	126 227	5.17	25.4	YES		45807.8		1 19	4.0
8/20/2021	1200	380.8	1559.3	25505.0	5 488	128 783	5.05	19.3	YES		47699.0		1 16	3.9
8/21/2021	1200	455.0	1743.8	25828.3	6,100	129,380	5.00	19.2	YES		60338.9		1.10	3.9
8/22/2021	1200	447.5	1538.5	26113.8	6 4 4 9	128,231	4 91	19.5	YES		58959.4		1 13	3.8
8/23/2021	860	454.9	956.3	25454.3	4 698	122,001	4 79	19.6	NO	480	60925.5	29%	3 30	1.4
8/24/2021	680	390.3	1124 7	24985.4	3 187	119 889	4 80	19.2	NO	370	47305.6	32%	3 24	1.1
8/25/2021	880	459.9	1400.0	24511.6	4 861	118,680	4 84	19.0	NO	510	60878.4	27%	3.55	1.3
8/26/2021	1300	460.0	1376.6	23988.4	7 181	112,660	4 70	19.0	YES		60887.7	2170	1.08	3.6
8/27/2021	1200	464.2	1698.1	23800.9	6 690	105 279	4.10	19.0	YES		61256.4		1.00	3.4
8/28/2021	1400	470.1	1557.3	23712.3	7 903	99.842	4 21	19.0	YES		62294.2		0.97	32
8/29/2021	1100	470.0	1588.0	23708.3	6 209	93 184	3.93	19.0	YES		62635.7		0.07	3.0
8/30/2021	2100	470.0	1444.2	23454.9	11 853	94 000	4 01	19.0	YES		62513.7		0.92	3.1
8/31/2021	1900	450.0	1236 1	22824 2	10.268	97,756	4.28	19.6	YES		60398 7		0.98	3.3
9/1/2021	1800	426.6	1415.2	22368.3	9.223	101.368	4.53	20.3	NO	520	58300.3	63%	1.67	2.9
9/2/2021	1800	388.1	1650.6	22188.7	8.389	104.338	4.70	21.0	NO	1400	53125.9	1%	4.66	0.0
9/3/2021	2100	385.0	1793 4	22082.2	9 709	108 665	4 92	20.3	NO	1400	51591 1	15%	4 16	0.8
9/4/2021	1900	417.5	1711.7	22234.5	9.527	112,704	5.07	20.0	NO	1300	56253.6	13%	4.40	0.7
9/5/2021	2100	282.3	1674.5	22165.3	7,119	113,266	5.11	27.6	NO	620	38245.0	62%	1.92	3.2
9/6/2021	1800	384.4	1482.5	22109.2	8.310	115,127	5.21	26.2	NO	640	52209.5	55%	2.35	2.9
9/7/2021	1400	293.4	1198.7	22351.6	4,934	115.363	5.16	20.6	NO	250	31205.6	78%	1.12	4.0
9/8/2021	1400	335.9	1273.5	22500.5	5.647	117.823	5.24	20.2	NO	390	36886.3	66%	1.78	3.5
9/9/2021	2400	463.7	1397.4	22497.9	13.364	126.326	5.61	18.9	YES		61740.5		1.29	4.3
9/10/2021	2500	446.7	1290.2	22411.6	13,411	132,556	5.91	18.7	YES		58439.3		1.36	4.6
9/11/2021	2300	440.0	1200.0	21913.5	12,155	138,021	6.30	19.0	YES		57808.1		1.45	4.9
9/12/2021	2300	426.8	1200.0	21556.1	11,789	141,907	6.58	19.8	YES		55897.7		1.51	5.1
9/13/2021	2700	440.0	1178.3	21146.3	14,267	149,965	7.09	19.0	YES		57857.0		1.63	5.5
9/14/2021	2400	449.7	1142.3	20844.4	12,962	151,074	7.25	19.0	YES		59477.3		1.66	5.6
9/15/2021	2000	439.5	638.6	20246.9	10,557	151,363	7.48	19.9	YES		57460.6		1.72	5.8
9/16/2021	2550	450.0	1200.1	20031.8	13,782	155,922	7.78	19.0	YES		59486.4		1.79	6.0
9/17/2021	2850	450.0	1200.1	19581.2	15,401	162,934	8.32	19.0	YES		58466.3		1.91	6.4
9/18/2021	2900	439.1	1199.9	18987.7	15,292	168,516	8.87	18.6	YES		57381.4		2.04	6.8
9/19/2021	2700	445.8	1441.7	18717.8	14,455	173,444	9.27	18.8	YES		57191.9		2.13	7.1
9/20/2021	2100	456.3	1721.7	18765.0	11,508	177,833	9.48	19.1	YES		59819.7		2.17	7.3
9/21/2021	2300	372.0	1260.5	18543.1	10,275	179,798	9.70	27.1	YES		48998.2		2.22	7.5
9/22/2021	1400		1068.8	18413.1	0	174,864	9.50				35931.4		9.50	0.0
9/23/2021	65		607.3	17746.9	0	169,217	9.53				11148.9		9.53	0.0
9/24/2021	1800		1102.2	17451.7	0	155,853	8.93				11120.1		8.93	0.0
9/25/2021	1900		1437.3	17598.9	0	142,442	8.09				10411.7		8.09	0.0
9/26/2021	2000		1600.2	17999.1	0	130,287	7.24				23394.8		7.24	0.0
9/27/2021	2200	502.3	1636.7	18435.8	13,272	131,769	7.15	20.0	YES		67410.0		1.64	5.5
9/28/2021	2500	499.5	1726.8	18984.3	14,996	132,498	6.98	20.0	YES		67066.5		1.60	5.4
9/29/2021	2100	505.1	1741.5	19583.5	12,738	132,274	6.75	20.0	YES		67763.5		1.55	5.2
9/30/2021	2300	478.5	1390.8	20335.8	13,217	134,934	6.64	19.9	YES		63595.4		1.52	5.1
10/1/2021	2100	422.2	1144.0	20279.6	10,648	131,801	6.50	21.1	YES		55259.3		1.49	5.0
10/2/2021	2300	441.7	1501.9	20581.4	12,200	128,599	6.25	18.8	YES		56397.4		1.43	4.8
10/3/2021	2500	445.8	1784.5	21166.0	13,385	126,692	5.99	20.0	YES		60420.6		1.37	4.6
10/4/2021	2300	443.8	938.6	20662.9	12,258	124,496	6.03	19.8	NO	85	60334.0	95.3%	0.28	5.7
10/5/2021	1400	395.7	1461.4	20402.6	6,653	119,641	5.86	20.0	NO	51	52598.3	95.4%	0.27	5.6
10/6/2021	2000	510.4	1755.1	20897.1	12,260	121,627	5.82	20.0	NO	81	69978.4	94.8%	0.30	5.5
10/7/2021	2300	446.6	1283.3	21111.6	12,335	133,962	6.35	19.2	YES		52357.0		1.46	4.9

10/8/2021	1400	193.8	703.4	21207 7	3 259	137 220	6 47	19 1	YES		31330.3		1 48	5.0
10/0/2021	410	04.8	181.0	20287.4	467	137,697	6 70	10.1	120		16667.0		6 70	0.0
10/3/2021	2000	54.0	1629.2	20207.4	10 107	140 704	7.24	10.6	VEC		60974.5		1.00	0.0
10/10/2021	2000	504.0	1030.2	20400.2	12,107	149,794	7.31	19.0			09074.0		1.00	5.0
10/11/2021	2300	511.0	1799.8	20687.8	14,114	163,908	7.92	20.0	YES		/1628.9		1.82	0.1
10/12/2021	2600	511.0	1799.6	20850.8	15,956	166,592	7.99	20.0	YES		72008.9		1.83	6.2
10/13/2021	2900	505.7	1752.9	20876.9	17,613	169,209	8.11	19.8	YES		70273.5		1.86	6.2
10/14/2021	2800	505.0	1800.1	20935.5	16,982	173,453	8.29	20.0	YES		71071.2		1.90	6.4
10/15/2021	3100	464.2	1340.1	20884.7	17,281	177,517	8.50	22.4	YES		64895.2		1.95	6.5
10/16/2021	1700	499.1	1323.1	21063.8	10,189	177,058	8.41	19.5	YES		70597.8		1.93	6.5
10/17/2021	3100	493.1	1798.1	21360.1	18,357	183,215	8.58	20.7	YES		70315.8		1.97	6.6
10/18/2021	2300	505.0	1730.6	21306.2	13,949	183.779	8.63	20.0	YES		72108.6		1.98	6.6
10/19/2021	2000	505.0	1649.9	22017 5	12 130	183 651	8 34	20.0	YES		72378.6		1 91	6.4
10/20/2021	2000	493.4	1848.3	22404.4	11 852	188 850	843	19.9	YES		70551.1		1 93	6.5
10/21/2021	22000	482.5	1850.3	22404.4	12 740	180,330	8 4 2	20.1	VES		68207.8		1.00	6.5
10/22/2021	2200	<u>402.3</u>	1707 /	22499.0	12,749	109,009	0.42	20.1	VES		71040 0		1.95	0.0
10/22/2021	2000	500.0	1707.4	23003.7	12,009	109,013	0.22	20.0	1E3		71940.0		1.09	0.3
10/23/2021	2200	500.0	1743.7	24043.9	13,210	198,965	8.28	20.0	YES		71905.4		1.90	6.4
10/24/2021	2000	399.5	1586.3	25448.3	9,596	208,094	8.18	29.1	YES		5/2/5.9		1.88	6.3
10/25/2021	2200	485.1	1498.2	25308.3	12,817	208,805	8.25	19.8	YES		70692.9		1.89	6.4
10/26/2021	2367	498.0	1523.2	25031.7	14,154	208,845	8.34	19.9	YES		67518.8		0.50	7.8
10/27/2021	1983	458.0	1463.4	24695.5	10,909	203,798	8.25	19.0	YES				0.58	7.7
10/28/2021	1533	466.1	1674.7	24617.3	8,583	194,769	7.91	19.8	YES				0.63	7.3
10/29/2021	2467	500.0	1749.2	24566.4	14,811	192,598	7.84	20.0	YES				0.63	7.2
10/30/2021	1000	500.0	1799.9	25026.2	6,005	181,322	7.25	20.0	YES				1.66	5.6
10/31/2021	2400	488.3	1799.9	25503.1	14,074	185,206	7.26	20.0	YES				1.67	5.6
11/1/2021	2800	483.1	1558.8	25263.7	16,244	183,094	7.25	19.5	YES				1.66	5.6
11/2/2021	1900	452.5	1491.5	25024.6	10.324	179,469	7.17	19.4	YES				1.65	5.5
11/4/2021	1600	205.8	797.4	22323.8	3.955	159,442	7.14	36.3	YES				1.64	5.5
11/5/2021	1500	266.8	946.3	21419.8	4,807	151,500	7.07	25.6	YES				1.62	5.4
11/6/2021	1400	335.1	1630.8	21263.2	5 635	145 125	6.83	21.0	YES				1 57	5.3
11/7/2021	1900	328.9	1550.7	21070.3	7 504	139 419	6.62	22.1	YES				1 52	5.0
11/8/2021	1900	152.0	1376 1	20860 1	3 467	133 290	6 39	26.5	YES				1 47	4 9
11/9/2021	1100	320.0	1202.7	20564.5	1 227	124 600	6.06	20.0	VES				1 30	4.7
11/10/2021	100	100.4	1202.7	20255.0	2 201	112,035	5.57	48.2	VES				1.00	4.7
11/11/2021	2150	86.7	1214.0	20235.5	2,231	104 167	5.07	31.7	VES				1.20	4.0
11/11/2021	2100	104.0	1203.2	20075.0	2,239	104,107	0.19	51.7	1E3				1.19	4.0
11/12/2021	2400	104.2	1776.7	20177.7	3,004	98,587	4.89	50.7	YES				1.12	3.8
11/13/2021	2400	404.1	1370.0	19798.5	11,647	95,422	4.82	20.9	YES				1.11	3.7
11/14/2021	2500	410.0	1282.2	19280.8	12,311	101,728	5.28	21.0	YES				1.21	4.1
11/15/2021	2600	296.6	1082.0	18562.9	9,262	96,917	5.22	28.3	YES				1.20	4.0
11/16/2021	1900	321.0	1294.2	18298.3	7,324	87,997	4.81	18.5	YES				1.10	3.7
11/17/2021	2100	350.1	961.5	17768.3	8,828	86,501	4.87	18.8	YES				1.12	3.8
11/18/2021	2200	339.2	1292.4	19060.7	8,961	95,462	5.01	11.3	NO	71	29388.3	96.2%	0.19	4.8
11/19/2021	1400	334.4	1578.4	19841.7	5,622	97,129	4.90	19.0	YES				1.12	3.8
11/20/2021	1700	335.0	1657.5	20552.9	6,839	99,162	4.82	19.0	YES				1.11	3.7
11/21/2021	2400	335.0	1600.0	20522.1	9,656	103,183	5.03	19.4	YES				1.15	3.9
11/22/2021	2100	335.0	1626.8	20598.2	8,449	104,127	5.06	19.5	YES				1.16	3.9
11/23/2021	44	333.4	1654.5	20876.7	176	100,836	4.83	18.5	YES				1.11	3.7
11/24/2021	2100	335.0	1714.0	21388.0	8,449	105,058	4.91	19.5	YES				1.13	3.8
11/25/2021	2100	335.0	1531.0	21704.5	8,449	111,216	5.12	19.5	YES				1.18	3.9
11/26/2021	1800	335.0	1425.9	21847.3	7,242	116,219	5.32	19.5	YES				1.22	4.1
11/27/2021	2000	335.0	1458.6	21529.2	8,047	121.262	5.63	19.5	YES				1.29	4.3
11/28/2021	2100	330.9	1091.7	21250.9	8,346	,	5,55	19.8	YES				1.27	4.3
11/29/2021	1900	306.9	1051.6	21020.2	7 002	112 653	5 36	19.9	YES	1			1 23	4 1
11/30/2021	2200	326.0	1079.6	21017 8	8 613	112 003	5.33	19.0	YES				1 22	4 1
12/1/2021	2200	334 9	693.5	20417 1	8 848	113 527	5.56	19.2	YES				1 28	4.1
12/2/2021	600	300 5	583.5	20030 2	2 565	107.263	5 35	21.7	VES				1 22	4.5
12/2/2021	1700	309.0	774.0	10520.7	6 734	105.036	5.35	10 0	VES				1.23	4.1
12/0/2021	1700	529.0	114.0	19520.7	0,754	100,000	0.00	10.0	IL0				1.23	4.1

12/4/2021	1000	355.0	1380 7	10323.0	8 100	107 514	5 56	10.3	VES				1 28	13
12/5/2021	2100	255.0	1500.0	10265.4	0,100	100,629	5.60	10.0	VEQ				1.20	4.0
12/5/2021	2100	355.0	1599.9	19205.4	0,955	109,020	5.69	19.3					1.31	4.4
12/6/2021	1800	355.1	1614.0	19279.3	7,675	107,648	5.58	19.1	YES				1.28	4.3
12/7/2021	1700	401.8	1699.8	19352.4	8,203	107,402	5.55	19.3	YES				1.27	4.3
12/8/2021	1600	393.2	1095.7	18793.5	7,556	114,782	6.11	19.2	YES				1.40	4.7
12/9/2021	1700	385.8	1380.2	18459.7	7,877	114,210	6.19	19.0	YES				1.42	4.8
12/10/2021	1800	375.0	1275.4	18204.1	8,106	113,867	6.26	16.8	NO	420	44239.7	71.2%	1.80	4.5
12/11/2021	1700	375.0	1105.7	17883.9	7.656	114.281	6.39	18.2	YES				1.47	4.9
12/12/2021	2100	373.3	1514.2	17939 5	9 4 1 4	115 649	6 45	18.9	YES				1 48	5.0
12/13/2021	1500	375.0	1380.5	18228.3	6 755	114 058	6.26	19.0	YES				1 44	4.8
12/14/2021	1300	375.0	014.4	18001 1	5 854	112,010	6.24	10.0	VES				1 /3	1.0
12/14/2021	1900	275.0	207.4	17409.0	0 107	112,910	6.46	19.0	VES				1.43	4.0
12/15/2021	1800	375.0	397.4	17408.9	0,107	112,404	0.40	19.0	TES VEC				1.40	5.0
12/16/2021	580	375.0	986.7	17702.2	2,012	106,168	6.00	19.0	YES				1.38	4.0
12/17/2021	2000	374.7	1386.4	18505.1	8,999	112,602	6.08	20.0	YES				1.40	4.7
12/18/2021	2100	366.3	1398.7	19129.8	9,238	115,107	6.02	19.8	YES				1.38	4.6
12/19/2021	2000	375.0	1535.6	19284.7	9,008	116,014	6.02	20.5	YES				1.38	4.6
12/20/2021	2000	374.8	535.9	18220.6	9,003	116,064	6.37	20.5	YES				1.46	4.9
12/21/2021	1100	355.1	649.4	17256.1	4,692	113,080	6.55	19.8	YES				1.50	5.0
12/22/2021	1800	365.1	1409.7	16965.9	7,892	112,769	6.65	20.0	YES				0.48	6.2
12/23/2021	1900	374.9	1461.0	17331.3	8,556	113.769	6,56	20.5	YES				0.47	6 1
12/24/2021	2400	352.0	1687.8	17638.9	10 145	116.037	6.58	21.2	YES				0.47	6.1
12/25/2021	2000	375.0	1745.6	18100.0	9,007	116,007	6.00	20.2	VES				0.17	6.0
12/25/2021	2000	266 5	1750.1	10752 5	10 564	110,930	6.20	20.2					0.47	<u> </u>
12/20/2021	2400	300.3	1750.1	10/ 55.5	10,304	119,040	0.39	20.2	TES VEC				0.40	5.9
12/27/2021	2400	375.0	1740.7	18980.0	10,808	121,240	6.39	19.6	YES				1.47	4.9
12/28/2021	2300	344.9	1363.8	18963.3	9,526	124,011	6.54	21.4	YES				0.47	6.1
12/29/2021	2100	327.4	1360.5	19409.4	8,256	126,413	6.51	20.2	YES				0.47	6.0
12/30/2021	1900	345.1	1325.6	20337.5	7,873	126,179	6.20	21.0	YES				0.45	5.8
12/31/2021	2300	345.0	1378.3	20729.2	9,530	133,097	6.42	21.0	YES				0.46	6.0
1/1/2022	1900	345.0	1487.3	20830.0	7,872	131,970	6.34	21.0	YES				0.46	5.9
1/2/2022	2200	345.7	1657.6	21089.0	9,135	131,867	6.25	20.8	YES				0.45	5.8
1/3/2022	2500	347.4	1700.1	21253.5	10,429	133,289	6.27	21.0	YES				0.45	5.8
1/4/2022	2200	344.6	1700 1	22417 7	9 104	133,390	5 95	21.0	YES				0.43	5.5
1/5/2022	2200	345.0	1699.7	23468.0	9 1 1 4	137 812	5.87	20.3	YES				0.42	5.4
1/6/2022	1400	345.0	1670.6	23728.0	5,114	137,012	5.72	20.0	VES				0.42	5.4
1/0/2022	2200	245.0	1070.0	23720.9	0,5001	135,721	5.72	20.1					0.41	5.3
1/1/2022	2300	345.0	1004.7	23952.0	9,529	130,094	5.71	19.7	TES	000	47007.4	00.00/	0.41	5.3
1/8/2022	2300	339.7	1699.8	23964.6	9,384	135,934	5.67	17.4	NO	200	47087.1	88.9%	0.63	5.0
1/9/2022	2500	366.2	1641.6	23860.7	10,995	137,922	5.78	19.7	YES		37523.8		0.42	5.4
1/10/2022	1900	341.8	1546.9	23657.5	7,800	135,157	5.71	19.8	YES		36789.5		0.41	5.3
1/11/2022	360	0.0	1684.3	23601.1	0	124,349	5.27	48.8	YES		21952.2		0.38	
1/12/2022	1900	0.0	1666.9	23904.2	0	114,823	4.80	28.7	YES		15827.2		0.35	
1/13/2022	1400	0.0	1737.4	24281.1	0	106,567	4.39	26.0	YES		16081.2		0.32	
1/14/2022	865	265.2	1663.6	24619.1	2,755	101,449	4.12	20.6	YES		34575.0		0.30	3.8
1/15/2022	1500	399.9	1649.9	24890.6	7,204	99,124	3.98	20.7	YES		63500.0		0.29	3.7
1/16/2022	1800	400.0	1215.6	24619.0	8.647	99,899	4.06	20.7	YES		64454.5		0.29	3.8
1/17/2022	1500	400.0	1580 1	24541 5	7,206	97,969	3,99	21.5	YES		66211.5		0.29	37
1/18/2022	1600	320.6	1324 0	24166.2	6 161	93 701	3.88	27.4	YES		52897.3		0.28	3.6
1/10/2022	1/100	303.7	1387.0	23852 0	6 6 20	01 216	3.00	20.1	VES		57445.0		0.20	2 5
1/20/2022	1400	400.0	1241.0	20000.2	7,020	01,∠10 00,700	2.02	20.1	VES		57992 5		0.20	3.5
1/20/2022	1000	400.0	1541.0	23493.0	1,000	09,100	3.02	21.0	TEO VEO		3/002.5		0.28	3.5
1/21/2022	1500	3/3.2	1526.1	23350.5	0,723	90,710	3.88	19.8			45481.4		0.28	3.6
1/22/2022	1400	397.4	1674.4	23340.2	6,682	87,863	3.76	20.2	YES		52302.7		0.27	3.5
1/23/2022	1500	400.0	1656.8	23297.1	7,206	85,685	3.68	20.9	YES		59216.2		0.27	3.4
1/24/2022	1800	395.7	1268.9	22924.4	8,554	83,243	3.63	20.9	YES		57916.9		0.26	3.4
1/25/2022	745	526.3	504.4	21882.0	4,709	80,153	3.66	18.3	NO	74.5	72879.6	87.2%	0.47	3.2
1/28/2022	380	449.5	1005.2	21202.8	2,052	82,204	3.88	21.4	NO	4.8	69142.7	98.3%	0.06	3.8
1/29/2022	1000	449.9	1011.7	20547.7	5,403	87,607	4.26	21.7	YES		69190.4		0.31	4.0
1/30/2022	1800	450.0	1539.0	20349.2	9,727	97,334	4.78	21.4	YES		68556.1		0.35	4.4
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1/31/2022	2100	450.0	1282.6	19968.2	11,349	105,928	5.30	21.9	YES		69289.6		0.38	4.9
2/1/2022	1200	450.0	1000.2	19318.5	6.485	105,208	5.45	22.7	YES		68621.7		0.39	5.1
2/2/2022	1300	450.0	1001.7	19104.6	7.026	103,587	5.42	20.1	YES		62667.6		0.39	5.0
2/3/2022	1200	450.0	1000 4	18524.9	6 486	102 867	5 55	15.7	NO	410	54084.3	57.6%	2 35	3.2
2/4/2022	1800	435.5	1320.4	18520.4	9 4 1 4	106 120	5 73	18.3	NO	19	59307.8	98.7%	0.08	5.7
2/5/2022	1700	450.0	1458.1	18591 5	9 187	108,687	5.85	20.0	YES	10	67379.3	00.170	0.00	5.4
2/6/2022	1700	/38.0	1584 7	18834.6	8 960	100,007	5.84	10.0	VES		65712.0		0.42	5.4
2/7/2022	1500	415.2	1625.2	18033.7	7 470	110,301	5.85	20.4	VES		62155.5		0.42	5.4
2/1/2022	1500	415.2	1023.2	10933.7	7,479	111,717	5.00	20.4	VES		62505.0		0.42	5.4
2/0/2022	1700	424.5	17 14.0	10974.2	9,677	112,162	5.09	20.3	VES		62560.2		0.42	5.5
2/9/2022	1/00	425.0	1591.4	10900.7	0,077	113,102	5.90	20.6	TES		03500.3		0.43	5.6
2/10/2022	1600	425.0	11/3.1	18812.8	8,100	112,774	5.99	20.5	YES		03525.5		0.43	5.0
2/11/2022	1/00	442.4	922.4	19230.8	9,032	117,097	6.09	19.9	YES		00233.8		0.44	5.0
2/12/2022	1400	450.0	1522.1	19747.8	7,566	122,612	6.21	20.6	YES		68061.0		0.45	5.8
2/13/2022	1600	450.7	1272.9	20009.0	8,660	125,868	6.29	20.4	YES		68439.6		0.45	5.8
2/14/2022	2033	475.0	1612.2	20082.2	11,599	127,740	6.36	19.0	NO		69046.9		6.36	0.0
2/15/2022	1/6/	475.0	1441.2	20240.8	10,078	126,469	6.25	18.9	NO		69072.5		6.25	0.0
2/16/2022	2133	475.0	1423.8	20664.4	12,169	132,153	6.40	19.0	NO		68584.1		6.40	0.0
2/17/2022	2200	475.0	1002.6	20665.4	12,550	137,677	6.66	19.5	NO	140	70114.2	91.8%	0.55	6.1
2/18/2022	1600	475.0	1249.1	20914.0	9,127	140,319	6.71	19.5	NO	100	70280.4	91.9%	0.54	6.2
2/19/2022	2200	438.7	1576.8	21170.4	11,590	142,495	6.73	19.8	NO	150	65445.6	91.1%	0.60	6.1
2/20/2022	2200	420.0	1746.5	21458.7	11,096	144,404	6.73	20.3	NO	41	62966.1	97.6%	0.16	6.6
2/21/2022	2000	422.2	975.5	20849.6	10,140	145,584	6.98	20.0	NO	38	63230.1	97.5%	0.17	6.8
2/22/2022	2000	410.0	1230.4	20454.8	9,847	147,953	7.23	20.6	NO	31	61108.0	98.0%	0.15	7.1
2/23/2022	2000	410.5	1667.6	20407.6	9,860	150,157	7.36	20.5	NO	35	59241.7	97.7%	0.17	7.2
2/24/2022	2250	406.3	1584.0	20400.3	10,979	152,460	7.47	20.7	NO	24	60521.1	98.6%	0.10	7.4
2/25/2022	2300	382.9	1238.4	20465.6	10,575	154,869	7.57	20.3	NO	40	57324.8	97.7%	0.17	7.4
2/26/2022	2600	380.0	1503.2	21046.3	11,865	157,701	7.49	20.3	NO	180	56939.3	91.0%	0.67	6.8
2/27/2022	2900	374.6	1477.2	21001.5	13,045	163,180	7.77	20.3	NO	250	56059.9	88.8%	0.87	6.9
2/28/2022	2600	370.0	1201.1	20929.6	11,553	166,074	7.93	21.2	NO	230	57395.3	88.4%	0.92	7.0
3/1/2022	2600	370.0	1249.8	20567.3	11,552	166.027	8.07	21.7	NO	210	58653.5	89.4%	0.86	7.2
3/2/2022	2400	370.0	1082.9	20209.0	10.664	166.613	8.24	22.3	NO	130	59713.3	92.8%	0.59	7.7
3/3/2022	2300	370.0	1551.6	20336.9	10 220	164 664	8 10	21.2	NO	170	56886.8	90.3%	0.78	7.3
3/4/2022	2500	370.0	1800 1	21134.4	11 109	163 223	7 72	20.8	NO	200	56134.4	89.6%	0.81	6.9
3/5/2022	2600	297.4	912.5	20797 8	9 286	163 382	7.86	18.0	NO	220	35329.0	89.5%	0.82	7.0
3/6/2022	2100	362.7	1519.3	20740.3	9 147	160,938	7 76	20.5	NO	.33	54703.2	98.0%	0.16	7.6
3/7/2022	3000	360.9	1/13/1.6	20/ 40.0	13 002	162,845	7.70	10.0	NO	240	518/1 /	80.0%	0.10	7.0
3/8/2022	2400	370.0	1588 7	210420.4	10,665	163 370	7.76	20.5	NO	100	5/953.0	89.7%	0.02	7.2
3/9/2022	2500	387.2	1057.2	20868.3	11 624	165 147	7.70	20.8	NO	66	57940 7	96.6%	0.00	7.0
2/10/2022	2000	200.6	1176.5	20000.3	0.509	164 995	7.91 9.00	20.0		40	50702.5	90.076	0.27	7.0
3/11/2022	1500	/11 1	1448.0	20377.2	7 406	161 312	7 07	20.0		3/	60772.6	90.0% 07.1%	0.20	7.0
3/12/2022	1600	305.0	171/ 5	20241.2	7 607	158 244	7.67	20.9		16	58235 5	06 20/	0.23	7 /
2/12/2022	2200	412.0	1/ 14.3	20/17.3	11 201	150,544	7.04	21.9		40	54964.0	90.3%	0.20	7.4
3/13/2022	2300	412.0	1000.0	21049.9	0.609	157,001	7.30	19.9	NO	47	59610.7	97.4%	0.19	7.3
3/14/2022	2000	400.0	1001.1	21103.0	9,000	104,423	1.30	21.0		50	50012.7	90.8%	0.24	7.1
3/15/2022	1700	400.0	1800.3	21/03.0	0,100	101,037	0.94	21.0		54	50020.2	97.4%	0.18	0.8
3/16/2022	1700	400.0	1558.6	22061.8	8,167	147,652	6.69	21.0	NO	50	58802.0	96.2%	0.25	6.4
3/17/2022	1800	400.0	1417.4	22396.2	8,646	145,634	6.50	20.9	NU	50	58985.6	96.4%	0.23	6.3
3/18/2022	1400	400.0	1125.8	21970.3	6,725	142,139	6.47	20.9	NO	44	58880.0	95.9%	0.26	6.2
3/19/2022	1300	392.3	1036.8	21207.0	6,125	137,154	6.47	20.6	NO	40	58015.0	96.0%	0.26	6.2
3/21/2022	2200	354.6	1341.7	21636.3	9,370	137,239	6.34	20.6	NO	55	51089.7	96.8%	0.20	6.1
3/22/2022	1600	339.9	1623.2	21740.2	6,532	134,624	6.19	21.0	NO	79	48624.8	93.7%	0.39	5.8
3/23/2022	1700	386.0	1037.1	21342.7	7,881	129,502	6.07	20.8	NO	120	56280.7	90.9%	0.55	5.5
3/24/2022	1700	381.5	1839.3	21593.3	7,788	126,625	5.86	21.0	NO	57	55844.4	95.7%	0.25	5.6
3/25/2022	2000	365.6	1445.5	21981.6	8,781	123,783	5.63	21.0	NO	55	53200.9	96.5%	0.20	5.4
3/26/2022	1900	372.3	1690.0	22495.1	8,496	122,681	5.45	21.0	NO	77	54674.0	94.8%	0.29	5.2
3/27/2022	2100	353.8	1464.0	22511.1	8,922	124,197	5.52	20.8	NO	72	51326.1	95.6%	0.24	5.3
3/28/2022	2100	356.0	1540.0	22336.6	8,979	125,569	5.62	20.3	NO	71	49867.1	95.7%	0.24	5.4

3/29/2022	1500	340.7	1406.3	21907.1	6.137	120.325	5.49	20.1	NO	85	48820.7	92.7%	0.40	5.1
3/30/2022	2300	370.6	1371.0	21697.0	10 238	120,956	5.57	21.0	NO	64	546717	96.4%	0.20	54
3/31/2022	1600	363.8	1657.9	21554.6	6 990	110,300	5.56	21.0	NO	65	52118.0	01.8%	0.20	5.3
4/1/2022	1000	255.0	1900 5	21304.0	4 262	115,775	5.30	21.1		59 59	50496.2	02.6%	0.23	<u> </u>
4/1/2022	2000	300.0	1600.0	21790.4	4,203	110,070	5.32	21.0	NO	30	54000.0	92.0%	0.40	4.9
4/2/2022	2000	302.3	1590.2	21975.2	9,102	110,412	5.30	19.7	NO	<u> </u>	54000.9	95.0%	0.20	5.0
4/3/2022	1900	378.0	1600.1	22449.6	8,624	118,311	5.27	20.2	NO	51	54923.9	96.5%	0.18	5.1
4/4/2022	1600	359.4	1496.9	22909.8	6,905	119,092	5.20	20.8	NO	76	52193.2	93.9%	0.32	4.9
4/5/2022	1800	351.0	1755.6	23323.6	7,587	117,308	5.03	21.0	NO	59	51555.7	95.8%	0.21	4.8
4/6/2022	1500	365.0	1348.0	23048.4	6,575	117,351	5.09	19.2	NO	89.3	50949.4	92.4%	0.39	4.7
4/7/2022	1200	350.6	1406.0	23417.3	5,052	114,522	4.89	20.6	NO	77	51157.0	91.7%	0.41	4.5
4/8/2022	1600	350.0	1699.2	23277.2	6,726	113,460	4.87	21.0	NO	60	51935.8	95.1%	0.24	4.6
4/9/2022	1800	338.4	1850.1	23681.8	7,316	111,994	4.73	21.0	NO	64	50186.2	95.4%	0.22	4.5
4/10/2022	1800	335.0	1759.8	23751.5	7,241	110,739	4.66	21.0	NO	80	48021.7	94.3%	0.27	4.4
4/11/2022	1200	335.0	1833.0	24120.6	4,828	106,644	4.42	21.0	NO	53	47855.4	94.3%	0.25	4.2
4/12/2022	1100	335.0	1640.4	24221.0	4,426	102,090	4.21	21.0	NO	47	47925.6	94.5%	0.23	4.0
4/13/2022	1100	335.0	1543.2	24357.9	4,426	100,379	4.12	21.0	NO	57	48073.9	93.3%	0.27	3.8
4/14/2022	1100	329.0	1516.4	24503.2	4,347	94,487	3.86	21.0	NO	56	47202.4	93.4%	0.25	3.6
4/15/2022	1500	320.0	1603.9	24449.2	5,765	93,262	3.81	21.0	NO	66	47370.4	94.3%	0.22	3.6
4/16/2022	1500	320.0	1800.0	24448.7	5.764	94,763	3.88	21.0	NO	87	46076.2	92.5%	0.29	3.6
4/17/2022	1100	320.0	1698 1	24550.6	4 227	89,808	3 66	20.9	NO	60	45986.4	93.0%	0.26	34
4/18/2022	1400	320.0	1609.7	24560.2	5,380	86,563	3.52	21.0	NO	81	46462.9	92.5%	0.26	3.3
4/19/2022	1900	306.3	1651 7	24714.9	6,989	86 647	3 51	13.5	NO	98	31645 7	93.8%	0.22	3.3
4/20/2022	1700	302.3	1273 1	24232.5	6 171	85 232	3.52	17.5	NO	120	36197.9	91.3%	0.22	3.2
4/21/2022	1500	339.3	1401.4	24285.9	6 1 1 2	84 770	3.49	20.5	NO	100	50382.4	91.4%	0.01	3.2
4/22/2022	1300	345.1	230.5	23110 /	5 380	85 106	3.68	18.3	NO	31	/8518.8	96.9%	0.00	3.6
4/23/2022	380	315.3	600.0	22030.0	1 / 30	70,810	3.62	21.3	NO	4.7	45120.4	08.4%	0.11	3.6
4/23/2022	1500	207.0	1205.5	212050.0	5,004	79,019	2.67	21.3	NO	4.7	40120.4	90.470	0.00	3.0
4/24/2022	1700	327.0	1205.5	21303.5	6,904	70,400	3.07	20.2		37	40907.7	90.0%	0.12	3.0
4/25/2022	1/00	325.0	1199.7	20023.4	7,416	77,003	3.74	20.0		44 50	40003.9	90.0%	0.13	3.0
4/20/2022	1900	325.0	1101.3	20093.7	7,410	00,391	4.00	20.0	NO	33	49202.4	90.4%	0.15	3.9
4/27/2022	030	325.0	1061.3	19514.0	2,459	78,425	4.02	20.9	NO	21	49075.2	94.4%	0.22	3.8
4/28/2022	2300	325.0	1149.8	19121.1	8,976	82,974	4.34	20.9	NO	67	48964.2	96.2%	0.16	4.2
4/29/2022	2800	324.9	1102.2	18707.0	10,927	89,554	4.79	20.5	NO	60	49429.5	97.2%	0.13	4.7
4/30/2022	1900	325.0	1248.7	18351.8	7,416	91,206	4.97	20.7	NO	59	49457.7	96.0%	0.20	4.8
5/1/2022	1700	325.0	1602.5	18154.3	6,636	92,078	5.07	20.9	NO	55	49273.1	95.8%	0.21	4.9
5/2/2022	2000	330.1	1886.0	18342.2	7,929	95,780	5.22	20.2	NO	62	48853.9	96.0%	0.21	5.0
5/3/2022	2200	321.3	2106.6	18839.1	8,490	98,889	5.25	20.1	NO	94	47240.3	94.5%	0.29	5.0
5/4/2022	2267	332.1	2089.9	19277.3	9,041	100,941	5.24	19.6	NO	50	47798.7	97.2%	0.15	5.1
5/5/2022	1983	330.0	1954.4	19958.6	7,860	102,630	5.14	19.7	NO	50	47550.6	96.8%	0.17	5.0
5/6/2022	2133	322.6	2121.1	20678.3	8,266	104,783	5.07	19.8	NO	50	45588.1	97.0%	0.15	4.9
5/7/2022	2000	336.2	2065.2	22504.0	8,076	107,470	4.78	18.7	NO	61	47553.0	96.1%	0.19	4.6
5/8/2022	2400	314.0	2093.3	23987.4	9,051	115,083	4.80	20.1	NO	130	47646.5	92.9%	0.34	4.5
5/9/2022	2200	303.3	2099.4	24881.3	8,013	117,191	4.71	20.1	NO	180	43395.1	89.5%	0.50	4.2
5/10/2022	1900	324.3	2100.2	25781.9	7,401	117,956	4.58	19.5	NO	180	48482.7	87.7%	0.56	4.0
5/11/2022	1900	322.3	1873.7	26554.3	7,355	117,896	4.44	20.1	NO	260	46577.2	82.4%	0.78	3.7
5/12/2022	2000	307.3	2099.0	27592.0	7,380	122,817	4.45	17.3	NO	190	40124.8	88.0%	0.53	3.9
5/13/2022	2000	292.4	1897.8	28340.0	7,024	120,865	4.26	20.3	NO	240	41437.7	84.6%	0.66	3.6
5/14/2022	2000	315.0	1674.2	28912.1	7,567	117,505	4.06	20.7	NO	570	46727.3	63.1%	1.50	2.6
5/15/2022	1800	300.3	1656.9	29320.3	6,493	116.581	3.98	20.3	NO	51	43157.8	96.4%	0.15	3.8
5/16/2022	2100	303.7	1743.8	29461.6	7,659	117.604	3.99	21.0	NÖ	65	45337.8	96.0%	0.16	3.8
5/17/2022	2100	301.9	1722.8	29298.5	7,614	117.289	4,00	20.9	NO	62	44622.6	96.2%	0.15	3.9
5/18/2022	1900	300.0	354.4	27546.3	6 845	115 645	4 20	21.0	NO	56	44005.5	96.2%	0.16	4.0
5/24/2022	280	300.0	151 3	25607.7	1 009	107 612	4 20	18.0	NO	1.3	45593.0	99.4%	0.10	4.0
5/25/2022	530	300.0	1438.5	25001.0	1 909	101 661	4.05	21.7	NO	2.8	48596.6	00.4%	0.03	4.2
5/26/2022	1/100	300.0	1964.6	24035.3	5.047	98 // 2	3.05	21.7	NO	78	48450.3	02.6%	0.00	
5/27/2022	1600	300.2	1904.0	24300.0	5 76/	06 121	3.80	21.9	NO	/0	48033 0	92.070 06.10/	0.29	3.7
5/28/2022	1600	202.1	362.2	23010 1	5.613	02 602	1.09	21.0	NO	+/ 110	40033.0	90.1%	0.10	<u> </u>
0/20/2022	1000	292.1	302.3	23010.1	0,010	92,093	4.03	10.3	NU	110	40120.9	91.0%	0.30	J./

6/15/2022	1300	235.0	1010.7	21921.4	3,668	88,348	4.03	29.0	NO	110	27679.4	89.5%	0.42	3.6
6/16/2022	1200		1332.0	21153.1	0	80,947	3.83	34.6	NO		20805.4	94.1%	0.23	3.6
6/17/2022	1200		754.7	20034.1	0	73,592	3.67	68.8	NO		6249.0	94.1%	0.22	3.5
6/18/2022	1300		540.1	18475.2	0	66 212	3.58	80.4	NO		7499.0	94.1%	0.21	3.4
6/19/2022	1400		1469.0	18046.4	0	59 188	3.28	100.0	NO		8123.2	94.1%	0.19	3.1
6/20/2022	1400		1310.8	17683.0	0	51 621	2.92	57.9	NO		11710.0	94.1%	0.13	27
6/21/2022	1400		1424.8	17450.0	0	45 120	2.52	84.3	NO		0404.5	04.1%	0.17	2.1
6/22/2022	1400		1929.0	16061.0	0	43,123	2.09	77.6	NO		6227.6	94.170	0.13	2.4
6/22/2022	1400		1203.0	17024.0	0	37,470	2.21	27.6			11561.6	94.1%	0.13	2.1
0/23/2022	1000		1/00.0	1/024.9	0	29,000	1.75	57.0	NO		11001.0	94.1%	0.10	1.7
0/24/2022	1000		1999.9	10070.4	0	23,011	1.23	53.5	NO		10070.4	94.1%	0.07	1.2
6/25/2022	1800		1999.8	20518.9	0	22,002	1.07	54.1	NO		8573.3	94.1%	0.06	1.0
6/26/2022	1800		2014.3	21094.7	0	20,093	0.95	15.5	NO	10	30065.2	94.1%	0.06	0.9
6/27/2022	1900	395.0	1771.1	20901.2	9,014	24,060	1.15	20.4	NO	40	59087.3	97.3%	0.03	1.1
6/28/2022	1800	391.6	1723.5	20753.8	8,465	26,761	1.29	19.1	NO	96	56362.4	93.1%	0.09	1.2
6/29/2022	1900	370.0	1438.0	21829.6	8,442	29,589	1.36	21.1	NO	42	56218.7	97.1%	0.04	1.3
6/30/2022	850	353.1	73.5	20892.4	3,605	29,526	1.41	21.9	NO	28	53678.9	95.7%	0.06	1.4
7/1/2022	510	337.7	1067.0	20627.3	2,068	31,594	1.53	22.2	NO	21	51368.7	94.6%	0.08	1.4
7/2/2022	1800	345.0	999.9	20872.6	7,458	39,052	1.87	22.0	NO	50	53857.3	96.4%	0.07	1.8
7/3/2022	1600	328.0	966.5	21299.0	6,303	45,355	2.13	21.3	NO	46	50475.2	96.2%	0.08	2.0
7/4/2022	1900	330.0	886.0	20716.0	7,530	52,885	2.55	22.0	NO	4.6	51503.4	99.7%	0.01	2.5
7/5/2022	1700	345.7	857.3	20262.4	7,058	59,943	2.96	20.4	NO	49	51290.1	96.3%	0.11	2.8
7/6/2022	1600	340.7	144.2	18981.8	6,546	66,489	3.50	19.4	NO	48	48405.7	96.1%	0.13	3.4
7/7/2022	950	339.6	1069.2	18797.2	3,875	70,364	3.74	19.9	NO	66	49164.1	91.0%	0.34	3.4
7/8/2022	1900	342.5	1038.4	18048.8	7,815	78,180	4.33	20.1	NO	24	49955.6	98.4%	0.07	4.3
7/9/2022	1800	350.0	1203.6	17252.5	7,566	85,746	4.97	20.1	NO	59	50755.5	95.8%	0.21	4.8
7/10/2022	1600	350.0	1212.5	16465.2	6 725	92 471	5.62	20.1	NO	140	49126.4	88.8%	0.63	5.0
7/11/2022	1000	267.2	1112 7	15563.7	3 209	95,680	6.15	22.9	NO	62	32394.8	92.3%	0.00	5.7
7/12/2022	2000	236.1	1010.7	14803.3	5 670	92,336	6 24	28.3	YES	02	30157.3	94.0%	0.37	5.9
7/13/2022	640	200.1	1296.7	14376.4	2 2 5 9	86 129	5.99	22.5	NO	30	38964 5	92.3%	0.07	5.5
7/14/2022	1900	270.3	1681.6	1/620.0	6 167	83,855	5.74	20.8	VES	00	34550.3	94.0%	0.40	5.0
7/15/2022	2000	300.0	1700.2	16246.6	7 206	87.456	5 38	20.0	NO	120	41750.0	02.3%	0.04	5.4
7/16/2022	2000	200.0	1951.2	17020.0	7,200	07,450	5.30	20.0		120	41739.0	92.370	0.41	5.0
7/10/2022	2000	207.9	1651.2	17030.9	7,200	92,595	5.44	20.0		110	41000.0	93.0%	0.30	<u> </u>
7/19/2022	2100	297.0	1006.2	10405.7	7,011	92,040	5.20	20.4	NO	130	41001.7	92.1%	0.42	4.9
7/10/2022	2000	302.3	1906.3	10400.0	7,201	93,604	5.00	19.0	NO	90	41392.7	94.3%	0.29	4.0
7/19/2022	2100	270.8	1900.1	19499.8	6,830	92,905	4.76	24.4	NU	69	39493.2	95.8%	0.20	4.6
7/20/2022	2000	310.0	1900.2	20542.6	7,446	93,293	4.54	20.0	NO	100	44169.3	93.6%	0.29	4.2
7/21/2022	2000	310.0	939.8	21338.3	7,446	94,192	4.41	20.0	NO	93	43889.4	94.0%	0.26	4.2
7/22/2022	1100	309.9	529.2	20798.2	4,094	94,411	4.54	19.6	NO	53	44240.7	93.8%	0.28	4.3
7/23/2022	1300	305.3	1955.8	21715.6	4,767	91,363	4.21	19.3	NO	83	42740.0	91.8%	0.34	3.9
7/24/2022	2300	300.0	2035.2	22547.1	8,287	92,084	4.08	18.5	NO	170	40990.2	90.6%	0.38	3.7
7/25/2022	2300	300.0	802.9	22137.5	8,287	93,645	4.23	19.0	NO	300	42033.0	83.3%	0.71	3.5
7/26/2022	750	300.0	995.2	22020.0	2,702	93,138	4.23	20.5	NO	65	44111.5	88.8%	0.47	3.8
7/27/2022	2100	300.0	1546.3	22555.5	7,566	95,034	4.21	20.5	NO	66	43392.4	95.9%	0.17	4.0
7/28/2022	1250	300.0	1709.5	22968.3	4,504	97,279	4.24	19.9	NO	71	42722.7	92.7%	0.31	3.9
7/29/2022	2200	300.0	1046.6	22333.3	7,926	99,038	4.43	20.5	NO	67	44069.5	96.1%	0.17	4.3
7/30/2022	2000	300.0	1684.9	22318.0	7,206	99,038	4.44	20.5	NO	70	43766.9	95.5%	0.20	4.2
7/31/2022	1800	300.0	1728.0	22194.8	6,486	98,318	4.43	20.5	NO	72	43661.7	94.8%	0.23	4.2
8/1/2022	2100	300.0	1736.4	22416.3	7,566	98,373	4.39	20.5	NO	110	43555.0	93.2%	0.30	4.1
8/2/2022	1900	300.0	1133.7	21643.7	6,845	97,957	4.53	20.5	NO	85	42500.7	94.3%	0.26	4.3
8/3/2022	1600	300.0	1139.0	20882.6	5,765	96,892	4.64	20.4	NO	62	42633.8	95.0%	0.23	4.4
8/4/2022	1800	287.5	1592.2	20574.7	6,215	95,661	4.65	21.1	NO	100	40510.8	92.9%	0.33	4.3
8/5/2022	1900	300.0	1672.6	21307.5	6.845	95,060	4.46	20.5	NO	130	43970.9	91.2%	0.39	4.1
8/6/2022	2200	300.0	2039.0	22817.3	7.926	98.892	4.33	20.5	NÖ	240	44099.8	85.9%	0.61	3.7
8/7/2022	2300	300.0	2112.5	22974 1	8,287	102 412	4.46	20.5	NO	260	43960.7	85.4%	0.65	3.8
8/8/2022	2400	300.0	2095.0	23033.8	8 647	102 772	4 46	20.5	NO	220	44045.8	88.1%	0.53	3 0
8/9/2022	2133	300.0	2103.0	24334 8	7 686	102,772	4 20	20.5	<u>NO</u>	200	44473.2	87.8%	0.00	3.3
0/0/2022	2100	0.000	2100.0	24004.0	1,000	102,112	7.20	20.0		200	77710.2	07.070	0.01	5.7

8/10/2022	2033	300.0	1987 0	25326.7	7 326	106 796	4 22	20.5	NO	195	45071 1	87 5%	0.53	37
0/10/2022	2000	200.0	1621.0	25020.7	7,020	106,135	4.10	20.0	NO	100	40071.1	07.0%	0.50	2.7
0/11/2022	2000	300.0	1031.0	20411.4	7,200	100,435	4.19	20.5	NO	190	44004.0	07.7%	0.52	3.7
8/12/2022	1900	300.0	1734.3	25436.2	6,846	108,777	4.28	20.5	NO	180	45074.0	87.7%	0.53	3.7
8/13/2022	2000	300.0	1835.5	26225.2	7,206	108,057	4.12	20.5	NO	200	45312.1	87.0%	0.54	3.6
8/14/2022	2000	300.0	1880.9	26421.2	7,206	108,057	4.09	20.5	NO	230	45504.5	85.0%	0.61	3.5
8/15/2022	2100	300.0	1748.6	26441.7	7,566	109,138	4.13	20.4	NO	220	45364.0	86.4%	0.56	3.6
8/16/2022	2000	300.0	1551.4	26256.7	7,206	108,778	4.14	20.5	NO	190	45527.5	87.6%	0.51	3.6
8/17/2022	2000	300.0	1568.6	26691.6	7,206	109,138	4.09	20.5	NO	180	45785.0	88.3%	0.48	3.6
8/18/2022	2100	300.0	1413.3	26965.9	7,566	110,939	4 11	20.5	NO	190	45599.1	88.2%	0.49	3.6
8/10/2022	1000	207.1	1058.8	27332 /	1,000	109,450	4.00	20.6	NO	100	28007.9	87.3%	0.51	3.5
0/19/2022	2100	150.0	2120.0	27302.4	2 7 0 2	106,450	2.00	20.0	NO	060	20007.3	41.2%	2.25	1.6
0/20/2022	2100	150.0	2139.0	27759.0	3,703	100,300	3.03	21.4		900	21000.2	41.270	2.20	1.0
0/21/2022	2000	150.0	1991.7	21152.3	3,003	102,064	3.00	21.5	NO	1150	21071.2	25.7%	2.73	0.9
8/22/2022	2200	150.0	1632.9	2/2/2./	3,963	97,741	3.58	21.5	NO	1150	22059.6	32.4%	2.42	1.2
8/23/2022	2100	150.0	1341.6	26519.3	3,783	92,877	3.50	21.5	NO	230	23021.7	85.7%	0.50	3.0
8/24/2022	1600	150.0	1195.9	25611.3	2,882	88,073	3.44	21.5	NO	200	23085.9	83.7%	0.56	2.9
8/25/2022	1600	210.6	1219.1	24843.4	4,046	84,793	3.41	19.8	NO	230	30791.5	81.4%	0.63	2.8
8/26/2022	1600	284.2	1919.6	25131.9	5,461	83,048	3.30	20.2	NO	37	42218.5	97.0%	0.10	3.2
8/27/2022	2100	293.8	2088.3	25485.9	7,409	83,612	3.28	20.0	NO	86	43799.8	94.7%	0.17	3.1
8/28/2022	2100	333.9	1310.0	24960.3	8,420	84,826	3.40	20.2	NO	310	52230.2	80.6%	0.66	2.7
8/29/2022	2200	335.0	2099 5	25178 9	8 851	86 471	3 4 3	20.3	NO	59	50120 7	96.5%	0.12	33
8/30/2022	2200	327.6	2000.0	25472.7	9.001	87 953	3.45	20.0	NO	59	40002.4	96.7%	0.12	3.3
0/30/2022	2300	225.0	2072.4	26001.0	0,040	90,106	2.42	20.0		42	40651.9	07.4%	0.12	2.0
0/31/2022	2100	335.0	2079.0	20001.0	0,440	09,190	3.43	20.1	NO	42	49001.0	97.4%	0.09	3.3
9/1/2022	2300	335.0	2100.3	26532.7	9,253	91,243	3.44	20.3	NO	4/	50234.3	97.3%	0.09	3.3
9/2/2022	2200	335.0	1799.3	26918.7	8,851	92,528	3.44	20.3	NO	64	50330.7	96.2%	0.13	3.3
9/3/2022	1800	335.0	2100.2	27060.1	7,242	95,045	3.51	20.3	NO	44	50477.8	96.8%	0.11	3.4
9/4/2022	2100	335.0	2099.7	27020.0	8,449	99,711	3.69	20.2	NO	66	50383.6	95.9%	0.15	3.5
9/5/2022	2100	335.0	1427.3	26455.5	8,449	104,556	3.95	20.2	NO	62	50626.1	96.2%	0.15	3.8
9/6/2022	1200	309.8	1527.7	26350.3	4,465	105,057	3.99	22.8	NO	47	45328.3	94.9%	0.20	3.8
9/7/2022	1800	335.0	1207.7	26216.4	7,242	108,516	4.14	20.3	NO	37	51986.0	97.3%	0.11	4.0
9/8/2022	2100	335.0	1078.6	26099.2	8,449	114.083	4.37	20.3	NO	44	51200.9	97.3%	0.12	4.3
9/9/2022	2100	335.0	1013 7	25893.8	8 4 4 9	118 485	4.58	20.3	NO	46	50619.8	97.1%	0.13	4.4
9/10/2022	1600	335.0	13/18 7	25322.8	6/137	110,100	1.00	20.3	NO	38	50110.7	96.9%	0.10	4.6
0/11/2022	1000	225.0	1470 5	20022.0	7 0 4 0	110,401	4.02	20.0	NO	40	40762.2	07.10/	0.13	4.0
9/11/2022	1000	335.0	14/0.0	247 13.1	7,242	119,294	4.03	20.3	NO	40	49/02.3	97.1%	0.14	4.7
9/12/2022	1800	335.0	1972.2	25375.3	7,242	118,116	4.05	20.3	NO	37	49540.3	97.3%	0.12	4.5
9/13/2022	2200	335.0	1707.0	24982.8	8,851	118,115	4.73	20.3	NO	49	49893.0	97.1%	0.14	4.6
9/14/2022	1800	335.0	1226.4	24166.9	7,242	116,309	4.81	20.3	NO	37	50403.3	97.3%	0.13	4.7
9/15/2022	1600	305.2	1608.5	23695.7	5,865	113,726	4.80	24.3	NO	37	46407.0	97.0%	0.14	4.7
9/16/2022	2000	308.1	1871.4	23466.8	7,400	111,872	4.77	19.0	NO	450	42745.0	71.3%	1.37	3.4
9/17/2022	2000	287.8	1595.7	23263.2	6,913	109,934	4.73	20.6	NO	58	39842.6	96.3%	0.17	4.6
9/18/2022	1700	312.4	1251.8	22414.8	6,378	109,071	4.87	20.3	NO	52	46360.1	96.0%	0.19	4.7
9/19/2022	1800	315.0	1000.1	21315.2	6,810	107.432	5.04	20.3	NO	35	47783.7	97.5%	0.13	4.9
9/20/2022	1800	315.0	854 1	20742 0	6,809	105,792	5.10	20.3	NO	43	47944.9	96.9%	0.16	4.9
9/21/2022	1300	315.0	64.4	19278 7	4 918	106 246	5.51	20.0	NO	13	45235.4	98.7%	0.13	5.4
0/22/2022	1500	318.3	1250.3	10270.7	5 73/	104 738	5.01	20.4	NO	40	47284.2	96.5%	0.07	5.4
0/22/2022	1600	220.0	1402 5	10646.0	6 1 4 0	102 429	5.42	20.0	NO	+0	47559.0	04.00/	0.19	J.Z
9/23/2022	1000	320.0	1403.5	19040.2	0,149	102,438	0.21	20.4		03	47556.9	94.9%	0.27	4.9
9/24/2022	1500	320.0	1410.9	20043.5	5,765	99,754	4.98	20.4		45	47464.0	96.1%	0.19	4.8
9/25/2022	1600	320.0	1837.7	20532.6	6,149	99,466	4.84	20.4	NO	46	4/3/0.3	96.3%	0.18	4.7
9/26/2022	1800	313.5	1900.0	20954.1	6,777	99,002	4.72	21.4	NO	59	46100.9	95.8%	0.20	4.5
9/27/2022	1867	335.0	1601.7	20583.6	7,510	99,269	4.82	19.5	NO	41	48567.7	97.2%	0.14	4.7
9/28/2022	1800	335.0	1816.3	20692.9	7,242	97,660	4.72	20.3	NO	39.5	50358.1	97.1%	0.13	4.6
9/29/2022	1950	335.0	1944.2	21410.7	7,845	98,264	4.59	20.4	NO	69	50243.8	95.4%	0.21	4.4
9/30/2022	2100	335.0	2000.8	21802.9	8,449	100.848	4.63	20.4	NO	97	50239.1	94.0%	0.28	4.3
10/1/2022	2000	335.0	2000.8	21932.4	8,046	101.494	4,63	20.4	NO	76	50278.9	95.1%	0.23	4 4
10/2/2022	2000	335.0	1648 7	21985.4	8 047	102 627	4 67	20.4	NO	47	50583.4	96.9%	0.14	4 5
10/2/2022	12000	335.0	1532.6	22266.2	7 0/0	102,027	4.07	20.4	NO	63	50877.0	05.070	0.14	4.0
10/3/2022	1000	221.0	1032.0	22200.2	7 175	103,491	4.00	20.4		27	50077.9	90.4%	0.21	4.4
10/4/2022	1000	331.9	1943.8	23209.9	1,175	103,000	4.47	20.1	NU	31	50029.0	91.3%	0.12	4.4
10/5/2022	2000	330.0	1008 8	2/35/ 6	7 926	10/ 073	/ 31	20.0	NO	38	10111 1	97.5%	0 11	12
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10/3/2022	2000	330.0	1990.0	24334.0	7,920	104,973	4.31	20.0	NO	30	49444.4	97.370	0.11	4.2
10/6/2022	2000	330.0	1/6/.2	26057.4	7,927	107,982	4.14	20.0	NO	40	49422.9	97.4%	0.11	4.0
10/7/2022	1900	330.0	2092.3	26899.5	7,530	109,778	4.08	20.0	NO	47	49397.9	96.8%	0.13	3.9
10/8/2022	1900	330.0	1813.6	27309.6	7,529	111,159	4.07	20.0	NO	52	49853.3	96.4%	0.15	3.9
10/9/2022	1900	330.0	1716.7	27615.3	7,530	112,924	4.09	20.0	NO	21	52398.9	98.5%	0.06	4.0
10/10/2022	1900	330.0	1783.2	27560.8	7.530	114.305	4.15	19.3	NO	23	51104.3	98.4%	0.07	4.1
10/11/2022	1400	305.1	1809.3	27470 1	5 129	112 657	4 10	21.8	NO	29	46338.6	97.3%	0 11	4.0
10/12/2022	1800	236.3	031.0	26800.3	5 100	110.256	1.10	15.6	NO	17	24724.5	08.0%	0.05	1.0
10/12/2022	1800	230.3	1040 0	20000.0	1,626	104 641	2.00	10.0		17	14065.5	77.0%	0.00	
10/13/2022	1000	75.2	1040.0	20032.0	1,020	104,041	3.90	10.0	NO	400	14005.5	77.0%	0.90	3.0
10/14/2022	1800	315.5	1721.4	26609.1	6,819	103,615	3.89	15.9	NO	180	39037.4	87.5%	0.49	3.4
10/15/2022	1800	315.6	759.0	25367.4	6,823	101,989	4.02	20.5	NO	67	47974.4	95.1%	0.20	3.8
10/16/2022	1500	320.5	1672.2	25038.8	5,773	99,716	3.98	20.5	NO	67	48492.5	94.2%	0.23	3.8
10/17/2022	1900	322.0	1898.8	25288.9	7,347	99,017	3.92	20.5	NO	150	48812.1	89.7%	0.40	3.5
10/18/2022	1767	322.0	1608.7	25365.0	6,833	98,609	3.89	20.5	NO	94.7	48921.9	93.0%	0.27	3.6
10/19/2022	1633	322.0	1609.7	25030.9	6.315	97,749	3.91	20.5	NO	121.5	49069.4	90.3%	0.38	3.5
10/20/2022	1667	303.5	1738.3	24770 4	6 075	95 898	3.87	23.4	NO	116 7	46678 7	90.8%	0.35	3.5
10/21/2022	940	0.0	1106.2	2/100 /	0,010	87 071	3.64	100.0	NO	76	11151 3	00.070	3.64	0.0
10/22/2022	720	327.0	1165.2	23272.9	2 8 2 5	83 277	3 52	20.2	NO	/2	17101.5	0.0 20/	0.04	2.0
10/22/2022	120	321.9	1440.0	20212.0	2,000	77.045	0.00	20.2		40	47 121.0	92.3%	0.20	0.0
10/23/2022	000	305.0	1410.8	220/0.5	2,198	77,945	3.41	22.9	NU		29553.6	100.0%	0.00	3.4
10/24/2022	1600	48.3	1/30.3	22889.1	928	/1,343	3.12	98.8			83582.9		3.12	
10/25/2022	1700	29.2	1152.2	22258.0	597	64,409	2.89	100.0			102669.9		2.89	
10/26/2022	1500	6.7	1308.7	21757.4	120	59,401	2.73	100.0			102671.9		2.73	
10/27/2022	1200	35.0	493.2	21318.7	505	54,796	2.57	68.8			24009.5		2.57	
10/28/2022	1700	303.8	1578.2	21048.9	6,203	59,373	2.82	16.3	NO	46	38936.2	96.6%	0.10	2.7
10/29/2022	1600	350.0	1601.3	20928.9	6,725	59,278	2.83	20.5	NO	44	55741.3	96.4%	0.10	2.7
10/30/2022	1700	321.1	1176.8	21346.6	6,556	59,011	2 76	20.3	NO	37	47560.6	97.2%	0.08	27
10/31/2022	1700	350.3	1/13/	21040.0	7 152	60 380	2.70	20.0	NO	28	58364.0	07.8%	0.06	2.7
11/1/2022	1600	250.3	1204.2	21007.0	6 7 2 7	50,309	2.00	20.3		20	57220.2	67.7%	0.00	2.0
11/1/2022	1000	350.1	1304.2	20573.2	0,727	59,700	2.91	20.4	NO	390	57229.2	07.7%	0.94	2.0
11/2/2022	1800	350.0	624.8	19589.4	7,566	60,501	3.09	20.5	NO	140	54157.2	89.8%	0.31	2.8
11/3/2022	1400	340.1	855.1	18834.8	5,718	59,904	3.18	20.5	NO	32	53930.5	97.0%	0.10	3.1
11/4/2022	1800	328.7	1358.6	18455.2	7,105	60,934	3.30	18.7	NO	31	48486.6	97.8%	0.07	3.2
11/5/2022	1700	350.0	1707.6	18966.6	7,145	68,079	3.59	20.5	NO	43	56197.9	96.7%	0.12	3.5
11/6/2022	1900	350.0	1981.5	19782.8	7,986	73,231	3.70	20.5	NO	37	56282.6	97.4%	0.10	3.6
11/7/2022	2100	342.2	1095.0	19461.1	8.630	79.663	4.09	19.5	NO	38	54950.2	97.6%	0.10	4.0
11/8/2022	1600	342.1	1466 9	19197 7	6 574	85 309	4 44	19.1	NO	35	54104 1	97 1%	0.13	43
11/9/2022	1700	350.0	1247 9	19293 3	7 146	91 859	4 76	20.8	NO	40	56096.4	96.9%	0.15	4.6
11/10/2022	1700	350.0	1247.0	18406.3	7,140	08.884	5 37	20.0	NO	80	55046.2	03.8%	0.10	
11/10/2022	1700	350.0	421.0	10400.3	7,140	105 525	5.57	20.5		70	56102 7	93.070	0.33	5.0
11/11/2022	1700	350.0	1201.0	19174.0	7,145	105,525	5.50	20.5	NO	12	50103.7	94.4%	0.31	5.2
11/12/2022	1800	350.0	1214.5	18811.1	1,567	106,888	5.68	20.5	NU	99	55245.5	92.8%	0.41	5.3
11/13/2022	1900	350.0	1895.9	19105.7	7,986	108,149	5.66	20.5	NO	120	54005.0	91.7%	0.47	5.2
11/14/2022	2100	350.0	1720.3	19649	8,827	110,421	5.6	20.4	NO	140	53922.1	91.3%	0.5	5.1
11/15/2022	1700	350.0	1753.5	19989	7,145	110,414	5.5	20.0	NO	130	53431.4	90.0%	0.6	5.0
11/16/2022	2000	286.1	1985.9	20591	6,872	110,559	5.4	28.2	NO	120	41530.3	92.3%	0.4	5.0
11/17/2022	2100	290.6	1847.4	21814	7,328	110,321	5.1	26.0	NO	120	43182.4	92.6%	0.4	4.7
11/18/2022	2000	350.1	1332.7	22291	8,409	113.011	5.1	20.5	NO	110	54442.8	92.8%	0.4	47
11/19/2022	1400	350.0	1365.8	22298	5,885	111 791	5.0	20.5	NO	88	54269.3	91.8%	0.4	4.6
11/20/2022	1200	350.0	341.2	20033	5.044	100 680	5.0	20.5	NO	80	53006.7	00.30/	0.4	4.0
11/20/2022	1200	250.0	541.5	10514	2,044	105,009	5.4	20.5		66	51966.0	30.370	0.5	4.7
11/21/2022	940	350.0	590.1	19541	3,951	105,054	5.4	20.5		00	51800.8	90.9%	0.5	4.9
11/22/2022	1700	347.5	1343.8	19789	7,094	104,118	5.3	19.3	NU	66	50344.1	95.0%	0.3	5.0
11/23/2022	1700	350.0	1815.4	20138	7,146	104,690	5.2	20.5	NO	140	54299.9	89.2%	0.6	4.6
11/24/2022	2200	350.0	1910.6	20801	9,248	106,791	5.1	20.5	NO	190	54610.2	88.7%	0.6	4.6
11/25/2022	2100	350.0	1900.0	22279	8,827	108,472	4.9	19.8	NO	150	53860.0	90.7%	0.5	4.4
11/26/2022	2100	350.0	1815.3	22832	8,827	110,153	4.8	19.3	NO	170	53322.9	89.4%	0.5	4.3
11/27/2022	1900	350.0	1083.4	22701	7,986	110.573	4.9	20.5	NO	160	54036.7	89.0%	0.5	4.3
11/28/2022	1000	350.0	1000.0	21805	4 203	106 790	4.9	20.2	NO	92	51972 1	88.1%	0.6	4.3
11/20/2022	1600	3/8 6	1100.0	21276	6 608	104 661	4 0	18.2	NO	110	48152.7	01.7%	0.0	4.5
11/20/2022	1000	540.0	1190.0	21210	0,030	104,001	7.3	10.2	110	110	-0102.7	31.2/0	0.4	4.0

11/30/2022	1800	350.0	1575.2	21097	7 565	105 081	5.0	20.5	NO	140	54604 5	89.8%	0.5	4.5
12/1/2022	1500	350.0	1250.3	20362	6 306	104 515	5.0	20.0	NO	1/0	54467	87.8%	0.0	1.0
12/1/2022	1700	350.0	1230.3	20302	7 1 4 5	104,313	5.1	20.2		140	54440.7 E 4746 E	07.070	0.0	4.3
12/2/2022	1700	350.0	904.7	19479	7,145	104,333	5.4	20.5	NO	140	54740.5	09.2%	0.6	4.0
12/3/2022	1500	350.0	1572.5	19719	6,305	102,229	5.2	20.0	NO	120	53957.3	89.5%	0.5	4.6
12/4/2022	1900	350.0	1996.1	20349	7,987	104,331	5.1	19.9	NO	180	53258.3	87.6%	0.6	4.5
12/5/2022	2000	350.0	1999.8	22008	8,407	107,694	4.9	19.8	NO	180	52924.8	88.3%	0.6	4.3
12/6/2022	1900	345.7	1389.4	22807	7,889	111,631	4.9	20.0	NO	170	52773.6	88.3%	0.6	4.3
12/7/2022	1800	325.0	1033.5	22497	7,026	111,564	5.0	20.5	NO	99	49777.6	92.8%	0.4	4.6
12/8/2022	1500	325.0	1000.3	21681	5,855	110,272	5.1	20.5	NO	87	49844.2	92.4%	0.4	4.7
12/9/2022	1500	324.8	1000.4	20771	5,852	106,877	5.1	20.5	NO	96	49836.4	91.6%	0.4	4.7
12/10/2022	1500	331.0	1511.0	20382	5 963	104 013	51	20.5	NO	89	50787.9	92.2%	0.4	47
12/11/2022	1600	325.0	1808.0	20375	6 245	101 431	5.0	20.5	NO	99	49992.5	91.9%	0.4	4.6
12/12/2022	1800	325.0	1662.6	20954	7 026	100.471	4.8	20.5	NO	220	49993.6	84.0%	0.8	4.0
12/12/2022	1700	325.0	1122.0	21077	6.635	102,471	4.0	20.0	NO	120	40535.0	00.8%	0.0	4.0
12/13/2022	1700	325.0	1052.1	21077	6,035	102,902	4.9	20.5		120	49000	90.0%	0.4	4.4
12/14/2022	1700	325.0	1002.1	20936	0,030	102,040	4.9	20.5	NO	120	49242.0	90.6%	0.5	4.5
12/15/2022	1000	325.0	1030.5	20399	7,025	102,300	5.0	20.5	NO	130	49040.0	90.0%	0.5	4.5
12/16/2022	1400	325.0	1395.5	20545	5,465	101,460	4.9	20.5	NO	120	49567.6	88.8%	0.6	4.4
12/17/2022	1700	325.0	1372.7	20953	6,635	100,949	4.8	20.5	NO	110	50376.5	91.5%	0.4	4.4
12/18/2022	1600	325.0	1553.4	20934	6,245	100,889	4.8	20.5	NO	120	50311.7	90.2%	0.5	4.3
12/19/2022	2100	320.3	1508.6	20446	8,079	100,981	4.9	13.9	NO	110	37830.0	93.5%	0.3	4.6
12/20/2022	1700	325.0	1438.6	19885	6,635	99,210	5.0	20.5	NO	270	50243.0	79.2%	1.0	4.0
12/21/2022	1700	325.0	1414.5	19910	6,636	97,957	4.9	20.4	NO	130	50407.6	90.0%	0.5	4.4
12/22/2022	1900	325.0	1605.7	20482	7,416	98,347	4.8	20.5	NO	130	50439.6	91.0%	0.4	4.4
12/23/2022	1800	231.0	1278.5	20760	4,994	97,486	4.7	29.06	NO	140	44225.1	89.2%	0.5	4.2
12/29/2022	1200	349.4	619.5	20379	5.036	96.670	4.7	15.98	NO	170	42434.2	82.4%	0.8	3.9
12/30/2022	1200	313.4	872.9	19741	4,516	95,223	4.8	20.90	NO	470	41279.9	50.5%	2.4	2.4
12/31/2022	1200	341.0	567.2	18501	4 914	93 892	51	18 71	NO	470	45453.2	50.4%	2.5	2.6
1/1/2023	1300	350.0	688.2	17526	5 464	92,330	53	20.49	NO	340	49980.0	66.4%	1.8	3.5
1/2/2023	1200	350.0	1022.1	17426	5 045	90 740	52	20.50	NO	330	50060.9	64.6%	1.8	34
1/3/2023	1700	350.0	877.0	17251	7 146	91 250	53	20.49	NO	440	50685.8	66.6%	1.8	3.5
1/4/2023	1400	350.0	1185.2	17201	5 885	90 110	5.2	20.40	NO	380	51200.7	64.9%	1.0	3.4
1/5/2023	1800	350.0	1100.2	17204	7 565	02 211	5.4	20.00	NO	490	51055.0	64.8%	1.0	3.5
1/6/2023	1400	350.0	1100.0	16052	5 885	01.460	5.4	20.5	NO	380	50805.0	65.0%	1.0	3.5
1/7/2023	1400	350.0	121.4	16714	5,005	91,400	5.4	20.5		200	50241.2	65 10/	1.5	3.5
1/1/2023	1400	350.0	1010.2	107 14	0,000	91,100	5.5	20.5	NO	300	50241.5	05.1%	1.9	3.5
1/8/2023	1500	350.0	1287.9	16493	6,305	89,327	5.4	20.5	NO	400	51877.0	65.4%	1.9	3.5
1/9/2023	1600	328.1	1652.1	16707	6,304	88,996	5.3	20.2	NO	450	51886.3	63.0%	2.0	3.4
1/10/2023	2000	315.1	1776.5	17068.7	7,569	89,929	5.3	20.0	NO	600	50418.5	60.4%	2.1	3.2
1/11/2023	1900	319.7	1253.2	16716	7,295	89,809	5.4	20.5	NO	590	52439.7	58.8%	2.2	3.2
1/12/2023	1900	320.0	1676.5	17114	7,302	92,117	5.4	20.5	NO	560	52783.1	60.8%	2.1	3.3
1/13/2023	1800	319.5	1831.1	18326	6,907	93,988	5.1	20.6	NO	550	52750.2	59.4%	2.1	3.0
1/14/2023	1800	349.6	1290.3	18743	7,558	97,030	5.2	20.1	NO	610	58320.1	54.8%	2.3	2.8
1/15/2023	1700	350.0	1774.7	19951	7,145	99,261	5.0	20.5	NO	510	58439.9	60.0%	2.0	3.0
1/16/2023	2000	350.0	1927.3	21190	8,406	102,204	4.8	20.5	NO	600	58113.6	60.0%	1.9	2.9
1/17/2023	2000	350.0	1788.3	21956	8,408	105,567	4.8	20.5	NO	570	58165.5	62.0%	1.8	3.0
1/18/2023	1400	350.0	1636.2	22715	5,884	104,305	4.6	20.5	NO	520	58258.7	50.5%	2.3	2.3
1/19/2023	1700	350.0	1456.7	22987	7,146	105,566	4.6	20.5	NO	570	59062.4	55.2%	2.1	2.5
1/20/2023	1700	350.1	1010.2	22797	7,147	105.147	4.6	19.7	NO	560	58449.5	56.1%	2.0	2.6
1/21/2023	1200	350.0	799 7	22476	5.044	104 306	4.6	19.9	NO	390	59417.0	56.5%	2.0	2.6
1/22/2023	1600	350.0	846.5	22007	6 725	105 146	4.8	20.5	NO	490	61489.6	58.6%	2.0	2.0
1/23/2023	96	350.0	131.0	20851	403	99 244	4.8	20.5	<u>NO</u>	29	56704.8	60.0%	1 9	2.0
1/26/2023	120	3/0.0	871.5	20031	546	03/186	4.0	20.5	NO	36	577/1.8	63.2%	1.5	2.9
1/27/2023	065	354.0	1302.1	10507	1 113	00.030	7.7	20.3	NO	305	50630.1	57 90/	1.7	2.9
1/20/2022	1500	200.9	076.0	10224	5.014	90,030	4.0	20.3		470	53109.1	51.0% E0 E0/	1.9	2.1
1/20/2023	1400	520.5	310.0	10004	0,914	00,040	4.0	19.7		470	26527.0	56.5%	1.9	2.1
1/29/2023	1400		141.2	17400		01,340	4.4	13.7	NO		20537.0			
1/30/2023	1100		921.5	1/482	0	74,439	4.3	98.8	NO		6/55/.6			
1/31/2023	1300		1521.2	17713	0	66,881	3.8	100.0	NO		102656.8			

2/1/2023	1600		1539.4	17478	0	59,736	3.4	83.1	NO		46258.6			
2/2/2023	1500		1408.9	16959	0	51,329	3.0	27.1	NO		18442.5			
2/3/2023	1400	350.1	1577.0	16748	5,887	48,809	2.9	19.5	NO	23	55715.7	97.8%	0.1	2.9
2/4/2023	1600	350.0	1612.2	16724	6,725	49,650	3.0	19.5	NO	27	55802.6	97.8%	0.1	2.9
2/5/2023	1600	350.0	1652.8	16920	6,725	49,229	2.9	19.5	NO	28	55324.8	97.7%	0.1	2.8
2/6/2023	1800	309.3	1415.8	17326	6,686	48,769	2.8	19.5	NO	36	48587.1	97.4%	0.1	2.7
2/7/2023	1800	332.3	900.4	17426	7,184	50,909	2.9	19.8	NO	52	53585.5	96.2%	0.1	2.8
2/8/2023	880	350.0	999.2	17579	3,699	47,883	2.7	20.0	NO	15	56476.7	97.7%	0.1	2.7
2/9/2023	900	338.4	613.4	18061	3,657	51,137	2.8	19.5	NO	15	53873.5	97.8%	0.1	2.8
2/10/2023	930	350.0	1214.0	18403	3,910	54,500	3.0	20.0	NO	15	56799.2	97.9%	0.1	2.9
2/11/2023	1500	350.0	1776.2	18876	6,305	56,692	3.0	20.0	NO	26	56641.8	97.7%	0.1	2.9
2/12/2023	1700	350.0	1599.1	19498	7,146	57,923	3.0	20.0	NO	35	57081.5	97.3%	0.1	2.9
2/13/2023	1667	350.0	1618.3	20370	7,005	64,928	3.2	20.0	NO	32.67	57071.3	97.4%	0.1	3.1
2/14/2023	1650	350.0	1735.9	21184	6,936	71,864	3.4	19.8	NO	33.5	56289.4	97.3%	0.1	3.3
2/15/2023	1800	350.0	1499.9	21163	7,566	79,430	3.8	20.0	NO	36	56703.2	97.4%	0.1	3.7
2/16/2023	1800	350.0	1644.9	21268	7,567	86,997	4.1	19.0	NO	28	54266.4	98.0%	0.1	4.0
2/17/2023	2000	343.9	865.8	20725	8,260	95,257	4.6	16.5	NO	43	49527.4	97.2%	0.1	4.5
2/18/2023	1200	350.0	1778.4	20926	5,044	94,414	4.5	20.0	NO	39	57074.3	95.7%	0.2	4.3
2/19/2023	2000	350.0	1651.4	20966	8,407	96,095	4.6	20.0	NO	44	57410.6	97.1%	0.1	4.4
2/20/2023	1900	346.3	835.9	20149	7,903	97,273	4.8	20.1	NO	35	58357.2	97.5%	0.1	4.7
2/21/2023	1800	350.0	1234.1	19967	7,566	98,153	4.9	20.0	NO	21	57221.1	98.5%	0.1	4.8
2/22/2023	1800	350.0	1807.9	20874	7,566	98,535	4.7	20.0	NO	28	56703.4	97.9%	0.1	4.6
2/23/2023	1700	350.0	862.8	20738	7,146	101,982	4.9	19.9	NO	31	57150.3	97.6%	0.1	4.8
2/24/2023	1400	350.0	1845.4	21970	5,885	104,209	4.7	20.0	NO	28	56947.1	97.3%	0.1	4.6
2/25/2023	1900	350.0	1545.5	22302	7,986	108,286	4.9	20.0	NO	43	56720.7	97.0%	0.1	4.7
2/26/2023	1800	350.0	1900.2	22426	7,566	109,547	4.9	20.0	NO	40	56600.5	97.1%	0.1	4.7
2/27/2023	1800	350.0	1260.6	22087	7,567	109,968	5.0	20.0	NO	38	57078.5	97.2%	0.1	4.8
2/28/2023	1300	350.0	1277.0	21746	5,464	108,427	5.0	20.0	NO	22	56291.5	97.8%	0.1	4.9

## NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operati	ng Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	8%	700.8
No Stripper Online	2%	175.2

LVHC ControlOperating TimeOperating Scenario%RF3 Available for LVHC75%LVHC to CB1/CB225%LVHC to CB1/CB20

Baseline

Existing Stripper Steam Demand21.1MMBtu/hr(Attachment A to May 22 Response to DHEC Comments on App 1)

was previously

23.9 MMBtu/hr

## Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	со	H2SO4	TRS	voc	Pb	H₂S	CO <sub>2</sub>
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3.61	12,275
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	243	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.3	9.41	7.49	24.2	-108.18	39.0	1.20	2.75	10.2	1.97E-03	2.09	36,354
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

#### SO2 EMISSIONS REFERENCES

	Stripper	Scenario		Operating C	onfiguration		Con	trols				SO2	Sulfur		
	Operati	ng Time		Ti	me		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>c</sup>	SO2 Em	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE AG	CTUAL EMISSI	ONS (March	2021 - Febru	ary 2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.1
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
SO2 BASELINE ACTUAL EMISSIONS (BAI	E)														737.0
							PROJECTED	ACTUAL EMI	SSIONS						
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor / Preliminary Design Information	99%	0.6	2.4
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	99%	0.9	2.7
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	31.0
Backup Stripper Online	8.0%	700.8	NA	100%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	55.1
No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	5.9	19.4
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	295.2	323.3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.00	0.0
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.004
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	53.1	3.4
SO2 PROJECTED ACTUAL EMISSIONS (P	AE)														628.84
						1	NET EMISSION	NS CHANGE (F	PAE - BAE)						
NET EMISSIONS CHANGE (PAE - BAE)															-108.18

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

#### H2SO4 EMISSIONS REFERENCES

Î.	Chainsan	Conneria		0	ation a		Car	tuele.				112504	Culture		
	Stripper	Scenario		Oper	ating		Con	trois				H2504	Sullur		
	Operati	ing Time		Configura	ition Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture	H2SO4	Emissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	Ib/ADTP	Reference	%	lb/hr	tpy
					BASELINI	EACTUAL EMISSIONS (March 202	1 - February 20	)23)							
11/11C Collection Custom	100%	0.700.0	NA	100%	0.700.0	1)///C to CD1/CD2	100.0%	0.700.0	1.205		4.035.03	NCASI Technical Bulletin 858,	NIA	0.2	1.2
EVHC Collection System	100%	8,700.0	NA	100%	8,760.0	LVHC 10 CB1/CB2	100.0%	8,760.0	1,505	AD IP/uay	4.95E-05	Table 10	NA	0.5	1.2
H2SO4 BASELINE ACTUAL EMISSIONS (B	AE)		-												1.2
						PROJECTED ACTUAL EMISSI	ONS								
IV/HC Collection System	100%	8 760 0	NA	100%	9 760 0	LV/HC to RE2	75.0%	6 5 70 0	2 700	ADTR/day	4 025 02	NCASI Technical Bulletin 858,	NIA	0.55	1 02
EVHC Collection System	100%	8,700.0	NA	100%	8,760.0	EVHC to KF3	75.0%	6,570.0	2,700	ADTP/uay	4.95E-05	Table 10	NA	0.55	1.02
11/11C Collection Custom	100%	0.700.0	NA	100%	0.700.0	1)////C to CB1/CB2	25.0%	2 100 0	2 700	A DTD /days	4 025 02	NCASI Technical Bulletin 858,	NIA	0.55	0.61
LVHC Collection system	100%	8,760.0	NA	100%	8,760.0	LVHC 10 CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	Table 10	NA	0.55	0.61
H2SO4 PROJECTED ACTUAL EMISSIONS (	PAE)														2.43
						NET EMISSIONS CHANGE (PAE	- BAE)								
NET EMISSIONS CHANGE (PAE - BAE)															1.20

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

#### NOX EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				NOX	Ammonia		
	Operat	ing Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Increase <sup>c</sup>	NOX Er	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
			-			BASELINE ACTUA	L EMISSIONS	(March 2021	- February 2	023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.3	28.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100%	168.3	24.8	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.8	0.7
NOX BASELINE ACTUAL EMISSIONS			•												123.7
			-			PR	OJECTED ACT	UAL EMISSIO	NS						
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	1.8	6.7
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	1.0%	0.2	0.6
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	16.4
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D,F</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.1	2.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D,F</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.5	0.5
NOX PROJECTED ACTUAL EMISSIONS															147.9
						NET	EMISSIONS CH	ANGE (PAE -	BAE)						
PAE - BAE															24.2

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC).

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

#### CO EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				CO	CO		
	Operati	ing Time		Configura	tion Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	CO Err	hissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EN	AISSIONS (Ma	rch 2021 - Fe	oruary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	8.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO BASELINE ACTUAL EMISSIONS															25.2
						PROJE	CTED ACTUAL	EMISSIONS							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	2.9
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.1	0.6
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS															64.2
						NET EMIS	SIONS CHANG	GE (PAE - BAE	)						
PAE - BAE															39.0

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### VOC EMISSIONS REFERENCES

	Stripper	Scenario		Oper	rating		Con	trols				VOC			
	Operati	ng Time		Configura	ation Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EN	IISSIONS (Ma	rch 2021 - Fel	oruary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35	Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	8.51E-01	WATER9 Inputs and Outputs Provided.	NA	48.39	211.96
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC BASELINE ACTUAL EMISSIONS															233.11
						PROJEC	TED ACTUAL	EMISSIONS		1					
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40	Vendor / Preliminary Design Information	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	10.11
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	7.10
Backup Stripper Online <sup>H</sup>	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	7.20	Vendor / Preliminary Design Information	98%	16.20	5.68
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9 Inputs and Outputs Provided.	NA	32.85	129.50
ASB - Backup Stripper Online	8%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100%	700.8	2,700	ADTP/day	1.43	WATER9 Inputs and Outputs Provided.	NA	160.92	56.39
ASB - No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	NA	100%	175.2	2,700	ADTP/day	2.20	WATER9 Inputs and Outputs Provided.	NA	247.14	21.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.0	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS															243.27
						NET EMIS	SIONS CHAN	GE (PAE - BAE	)						
PAE - BAE															10.16

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - Backup Stripper in TRS Mode removes 45% of the methanol from the foul condensate. The stripped condensate is discharged to the hardpipe for additional methanol treatment in the ASB.

#### TRS EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				TRS	Sulfur		
	Operati	ng Time		Configura	ation Time		Operat	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	TRS En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTU	AL EMISSION	S (March 202	1 - February	2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.88E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
TRS BASELINE ACTUAL EMISSIONS															12.81
	1		-			Р	ROJECTED AC	TUAL EMISSI	ONS						
New Stripper Online         90.0%         7,88.0         SRL Online         95.0%         7,489.8         SRL Methanol to RF2/3 <sup>G,H</sup> 100.0%         7,489.8         2,700         ADTP/day         0.33         Vendor / Preliminary Design Information         99											99.9%	0.04	0.14		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.18
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.32
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
ASB - Backup Stripper Online	8.0%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	3.06	1.07
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	0.72
LVHC Collection System	100.0%	8,760.0	NĂ	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															15.56
						NET	EMISSIONS	CHANGE (PAE	- BAE)						
PAE - BAE															2.75

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

#### H2S EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	rols				H2S	Sulfur		
	Operati	ng Time		Configura	ition Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Capture <sup>c</sup>	H2S En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	1	-		-		BASELINE ACT	UAL EMISSION	S (March 202	1 - February	2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.13E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS															3.61
		_	-	_			PROJECTED AG	TUAL EMISSI	ONS			-			
New Stripper Online         90.0%         7,884.0         SRL Online         95.0%         7,489.8         SRL Methanol to RF2/3 <sup>G.H</sup> 100.0%         7,489.8         2,700         ADTP/day         0.24         Vendor / Preliminary Design Information         99.5											99.9%	0.03	0.10		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.24
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
ASB - Backup Stripper Online	8.0%	700.8	H2S Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	9.81E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.39
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	9.54E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.09
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															5.69
						NE	T EMISSIONS	CHANGE (PAE	- BAE)						
PAE - BAE															2.09

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

#### PM EMISSIONS REFERENCES

	Stripper	Scenario		Oper	rating		Con	trols				PM	PM		
	Operati	ng Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Control	PM Em	issions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIC	DNS (March 20	21 - February	2023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.3
PM BASELINE ACTUAL EMISSIONS											1.1				1.1
						PROJECTED	ACTUAL EMIS	SIONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>i</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	mBtu/hr 1.61E-01 AP-42 Tables 1.3-1 (filterable) and 1.3-2 NA 3.9 0.3 (condensable).				
PM PROJECTED ACTUAL EMISSIONS	INS 13.4														
						NET EMISSION	S CHANGE (PA	E - BAE)							
PAE - BAE															12.3

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### PM10 EMISSIONS REFERENCES

(	Stripper	Scenario		Ope	rating		Con	trols				PM10	PM10		
	Operat	ing Time		Configura	ation Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	PM10 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	Ib/UOM Reference		%	lb/hr	tpy
	÷		•			BASELINE ACTUAL EMISSION	S (March 202:	L - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
PM10 BASELINE ACTUAL EMISSIONS											1.				1.0
						PROJECTED AC	TUAL EMISSIO	ONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	8.9         24.1         mmBtu/hr         1.17E-01         AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).         NA         2.8         0.2						0.2
PM10 PROJECTED ACTUAL EMISSIONS	•							•							10.4
						NET EMISSIONS C	HANGE (PAE	- BAE)							
PAE - BAE															9.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### PM2.5 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				PM2.5			
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	PM2.5 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS	March 2021 -	February 202	!3)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															1.0
						PROJECTED ACTU	AL EMISSION	S							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.4
						NET EMISSIONS CH	ANGE (PAE - E	BAE)							
PAE - BAE															7.5

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### LEAD EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				Lead	Lead		
	Operat	ing Time		Configura	ation Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	Lead En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	IS (March 202	1 - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	5.10E-05
												U.S. EPA document "Estimating Air Toxic Emissions			
Packup Strippor Stoom <sup>A</sup>	91.4%	8 004 0	No. 6 Oil <sup>B</sup>	2 1%	168.3		100.0%	168 3	24.8	mmBtu/hr	2 80F-05	from Coal and Oil Combustion Sources" [EPA-450/2-	NΔ	6 95E-04	5 85F-05
backup stripper steam	51.470	0,004.0	140. 0 61	2.170	100.5		100.076	100.5	24.0	minbta/m	2.000 05	89-001] for Uncontrolled Residual Oil-fired Utility	110	0.552.04	5.052.05
												Boilers (Table 4-1)			
LEAD BASELINE ACTUAL EMISSIONS										1				1.10E-04	
						PROJECTED AG	CTUAL EMISSI	ONS			-				
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.27E-05	3.62E-06
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	hr 2.80E-05 U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)				4.35E-05
LEAD PROJECTED ACTUAL EMISSIONS 2.0										2.08E-03					
						NET EMISSIONS	CHANGE (PAE	- BAE)							
PAE - BAE 1											1.97E-03				

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### CO2 EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				CO2	CO2		
	Operat	ng Time		Configura	ation Time		Operati	ng Time	Product	ion Rate		Emissions Factor	Control	CO2 En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
				BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)											
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,044.8	11,929
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	346
CO2 BASELINE ACTUAL EMISSIONS															12,275
		PROJECTED ACTUAL EMISSIONS													
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas <sup>D</sup>	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	2,958.3	846
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil <sup>D</sup>	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	3,993.0	257
CO2 PROJECTED ACTUAL EMISSIONS															48,629
	NET EMISSIONS CHANGE (PAE - BAE)														
PAE - BAE															36,354

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## SUMMARY OF ASB EMISSIONS FACTORS

		ASB Emissions Factors (Ib/ODTP)										
Scenario	H <sub>2</sub> S	DMDS	DMS	ММС	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>					
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	0.89	0.95	0.0453					
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	0.30	0.32	0.0269					
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	1.53	1.59	0.0302					
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	2.31	2.44	0.0809					

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

		Concentration (ppm)										
		Hydrogen	Methyl	Dimethyl	Dimethyl							
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	<b>Total TRS</b>						
6/24/2021	15:10	130	14	16	13	173						
6/24/2021	15:10	140	14	16	17	187						
6/24/2021	17:00	140	17	18	14	189						
6/24/2021	18:45	150	19	18	16	203						
6/25/2021	10:35	130	12	12	11	165						
6/25/2021	12:05	120	10	12	9.6	151.6						
6/25/2021	13:45	190	22	22	23	257						
Average of all	l data	142.9	15.4	16.3	14.8	189.4						
Max of 6/24 of	or 6/25	146.7	16.0	17.0	15.0	194.7						

		MW
H2S	Hydrogen Sulfide	34.08 g/mol
Ch4S	Methyl Mercaptan	48.11 g/mol
C2H6S	Dimethyl Sulfide	62.13 g/mol
C2H6S2	Dimethyl Disulfide	94.20 g/mol
S	Sulfur	32.07 g/mol

# Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl
Sulfide	Mercaptan	Sulfide	Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AHL)
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.7001

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

## Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

### CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination			
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total	Total	
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil				
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu	
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309	1,3
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0	1,4
May-21	46,962	38,834	63,467	102,301	0	0	0	0	1,5
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180	1,4
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15	1,5
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0	1,4
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13	1,3
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0	1,5
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0	1,3
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0	1,2
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388	1,4
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112	1,3
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50	1,4
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0	1,3
May-22	38,896	39,982	73,918	113,900	0	0	0	0	1,2
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336	77
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0	1,2
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0	1,7
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4	1,5
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0	1,5
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0	1,3
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511	1,0
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384	1,1
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252	1,4
Total	996,766			3,237,544				69,553	
Annual Average	498,383								
				97.9%				2.1%	

996,766 498,383

New Indy Catawba ASB BAE Methanol Emissions Factor R	REVISED June 7	Response
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Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference
	ADTP	ODTP	lb/ODTP	
Mar-21	42,474	38,226	1.50	
Apr-21	43,075	38,767	1.50	
May-21	46,962	42,266	1.50	
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart
Jul-21	49,371	44,434	1.50	S Performance Tests.
Aug-21	44,614	40,152	1.50	Representative of ASB
Sep-21	40,177	36,159	1.50	operation from March
Oct-21	47,234	42,510	1.50	2021 to February 2022.
Nov-21	39,185	35,266	1.50	
Dec-21	38,734	34,860	1.50	1
Jan-22	43,690	39,321	1.50	1
Feb-22	37,736	33,962	0.33	1
Mar-22	43,944	39,549	0.33	1
Apr-22	40,046	36,041	0.33	1
May-22	38,896	35,006	0.33	1
Jun-22	23,184	20,866	0.33	Average of 2022 Subpart
Jul-22	39,890	35,901	0.33	S Performance Tests.
Aug-22	53,396	48,057	0.33	Representative of ASB
Sep-22	45,044	40,539	0.33	operation from February
Oct-22	47,517	42,765	0.33	2022 to February 2023.
Nov-22	40,133	36,120	0.33	1
Dec-22	33,859	30,474	0.33	1
Jan-23	35,464	31,918	0.33	1
Feb-23	39,276	35,348	0.33	1
Baseline Methanol E	missions Factor (Pul	p Weighted Average)	0.89	lb/ODTP
			<u> </u>	•

Additional information added to spreadsheet on 6/16/2023.

# **BAE Other VOC Emissions Factors**

Date of Subpart S	Acetadehyde,	MEK nom	Pron nnm	
Performance Testing	ppm	MEK, ppm	μορ., μριτι	
7/9/2021	24.3	7.7	1.1	
7/10/2021	25.3	5.7	4.0	
7/11/2021	25.0	6.5	7.0	
10/26/2021	25.0	12.3	0.8	
10/27/2021	27.5	13.3	1.0	
10/28/2021	10.6	6.6	1.2	
10/29/2021	15.0	8.6	0.9	
2/14/2022	16.7	7.5	0.7	
2/15/2022	17.0	9.5	0.6	
2/16/2022	15.7	8.6	1.0	
5/4/2022	20.7	7.1	1.0	
5/5/2022	16.3	7.3	1.0	
5/6/2022	15.0	6.8	1.0	
8/9/2022	15.3	5.9	0.7	
8/10/2022	25.0	7.2	1.1	
8/11/2022	20.3	6.0	1.0	
9/27/2022	14.3	5.3	0.7	
9/28/2022	15.0	5.2	0.7	
9/29/2022	18.0	5.6	0.9	
10/18/2022	25.0	5.6	1.0	
10/19/2022	23.7	5.5	1.1	
10/20/2022	23.0	6.6	0.9	
AVG ppm:	19.72	7.28	1.34	
Lbs into ASB	55.48	20.49	3.78	
Fair estimated from WATER9				
properties	0.55	0.38	0.43	
Lbs emitted	30.73	7.73	1.61	
Average Pulp Production				
during Subpart S testing		1716		
lb/ODTP	0.018	0.005	0.001	

# PAE Other VOC Emissions Factors

			PAE	
			lb/ODTP	
	BAE		Backup	
	lb/ODTP	New Stripper	Stripper	No Stripper
Methanol	0.89	0.30	1.53	2.31
Acetadehyde	0.018	0.006	0.031	0.046
MEK	0.005	0.002	0.008	0.012
Propionaldehyde	0.001	0.000	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504
DMS	0.0185	0.0136	0.0147	0.0192
MMC	3.28E-04	1.88E-04	1.30E-03	7.42E-04
VOC:	0.95	0.32	1.59	2.44

## October 2021 SO2 Testing - Weston

	Combina	tion Boiler No.	1 Stack	Combination Boiler No. 2 Stack				
	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG		
ODTP/hr	77.3	79.0		91.1	92.9			
ADTP/hr	85.9	87.8		101.2	103.2			
lb SO2/hr	342.8	230.7		380.9	309.9			
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00	0.76		

	Controlled	l Emissions	Sulfu	r Capture	Uncontrolled Emissions		
	Average Maximum		Bark Ash <sup>C</sup> LVHC Scrubber		Average	Maximum	
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP	lb SO2/ADTP	
SOG	1.06	1.36	20%	NA	1.33	1.70	
NCG	2.82	3.00					
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92	5.25	
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06	1.13	

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (0.473 lb SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C). C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

# WESTER

RESULTS AND DISCUSSION

Combination Boiler #1

Average:

- 2

# TABLE 2-2 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	0844	1029	1206	
Time Ended	0944	1129	1306	
Stack Gas Data				
Temperature, °F	430	435	438	434
Velocity, ft/sec	64	63	63	63
Moisture, %	17	17	17	17
CO <sub>2</sub> Concentration, %	8.8	9.0	8.6	8.8
O2 Concentration, %	10.5	10.5	10.8	10.6
VFR, x 10 <sup>5</sup> dscfin	1.46	1.45	1.44	1.45
Sulfur Dioxide				
Concentration, ppm	280	227	204	237
Emission Rate, lb/hr	407.4	328.3	292.6	342.8

Conditio	n 1 21	With NCGs	with SOGs												
Run N		Start Time	Steam Rate	Bark Rate	Gas Flow (10 <sup>4</sup> SCF/H/)	TOF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condénsate Flow (GPM)	LVHC Flow to Boilers (SCFM)	SOG Flow ta Boilers (SCFM)	HVLC Flow to Bailers (SCFM)	Puip Production (ODT/Hr)	Рир ХАРРА
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	1407	1103	10851	77.3	82,7
	2	1029	265.3	33.0	109.1	1.23	40	10.9	505	213	1409	1200	10885	77.3	85.7
	3	1206	257.7	32.6	100.4	1.23	40	10.9	504	2	1443	1205	10963	77.3	84.8
Average:	:		261.9	31.8	112.1	1.23	40	10.9	507	148	1420	1170	10900	77.3	84.4

#### Condition 2: With NCGs, without SOGs 13-Oct-21

							NCG			Hard Pipe						
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Productio	n	
Run #	3	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPP/	A,
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	1416		11071		/9.0	83.9
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	1414	教授的問題意思	10976	i T	79.0	81.6
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	1430		11061	. 7	79.0	80.3
Average			265.8	33.0	106.4	1.23	40	10.9	505	146	1420		11036	F 7	79.0	81.9
													-			

# TABLE 2-3 No. 1 Combination Boiler Condition 2: NCG Gases Only Summary of SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	1407	1544	1714	
Time Ended	1507	1644	1814	
Stack Gas Data				
Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, %	17	18	16	17
CO2 Concentration, %	9.6	9.9	8.9	9.5
O2 Concentration, %	10.1	9.8	10.7	10.2
VFR, x 105 dscfm	1.37	1.39	1.43	1.40
Sulfur Dioxide				
Concentration, ppm	140	176	180	165
Emission Rate, lb/hr	191.3	243.6	257.0	230.7

K 115730 NEW IND YOOT CATAWIA SCOOPJEE/ORTNEW-IND/Y CATAWIA OCT 2021 1-2 CB 502 EMISSION TEST REPORT.DOCM 28 Onsider 2021 1-50 p.m. Vension

15730.001.009 #1-2 CBs SO, Emission Report

# WESTON

RESULTS AND DISCUSSION

#### Combination Boiler #2

14-Oct-21

Condition 1: With NCGs, with SOGs

#### TABLE 2-4 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	
Time Began	0830	1026	1222	
Time Ended	0930	1126	1322	
Stack Gas Data				
Temperature, °F	463	477	465	469
Velocity, fl/sec	63	68	61	64
Moisture, %	17	19	16	17
CO <sub>2</sub> Concentration, %	8.2	9.5	7.5	8.4
O2 Concentration, %	10.8	10.1	11.5	10.8
VFR, x 10 <sup>5</sup> dscfm	1.40	1.43	1.35	1.39
Sulfur Dioxide				
Concentration, ppm	275	262	286	274
Emission Rate, lb/hr	383.7	373.7	385.4	380.9

14-Oct	-21														
							NCG			Hard Pipe					
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Run		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209	1409	1203	11071	91.1	94.5
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200	1420	1179	11160	91.1	88.2
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199	1429	1157	11090	91.1	80.7
Average			234	33.8	158.6	1.23	40	10.9	505	203	1419	1180	11107	91.1	87.8

Condition 2:	With NCGs	, without SOGs
14-Oct-21		

						NCG			Hard Pipe						
						Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
		Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
	Start Time	(103 lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
1	1410	198	21.7	174.8	1.23	40	10.9	505	209	1438		11109	92.9	78.8	
2	1547	218	35.4	206.4	1.23	40	10.9	505	224	1435		11060	92.9	78.7	
3	1725	214	49.6	220.6	0.65	40	10.9	505	262	1453		10977	92.9	79.3	
		210	35.6	200.6	1.04	40	10.9	505	232	1442		11049	92.9		
	1 2 3	Start Time 1 1410 2 1547 3 1725	Steam Rate           Start Time         (10 <sup>3</sup> lbs/hr)           1         1410         198           2         1547         218           3         1725         214           :         210         210	Steam Rate         Bark Rate           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)           1         1410         198         21.7           2         1547         218         35.4           3         1725         214         49.6           ::         20         35.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> )           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)           1         1410         198         21.7         174.8           2         1547         218         35.4         206.4           3         1725         214         49.6         220.6           ::         210         35.6         200.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TDF (TPH)           1         1410         198         21.7         174.8         1.23           2         1547         218         35.4         206.4         1.23           3         1725         214         49.6         220.6         0.65           ::         20         35.6         200.6         1.04	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strubber           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)           1         1410         198         21.7         174.8         1.23         40           2         1547         218         35.4         206.4         1.23         40           3         1725         214         49.6         220.6         0.65         40	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strart Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)         (GPM)         (SU)           1         1410         198         21.7         174.8         1.23         40         10.9           2         1547         21.8         35.4         206.4         1.23         40         10.9           3         1725         21.4         49.6         220.6         0.65         40         10.9	NCG         Stream Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG         Stripper Fault           Start Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Ster Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STER Time (10 <sup>3</sup> Ibs/hr)         STER Time (10 <sup>3</sup> Ibs/Hr)	Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         NCG         Stripper Foul         Foul           Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         Flow         Scrubber / Scrubber         Condensate         Condensate           1         1410         198         21.7         174.8         1.23         40         10.9         505         209           2         1547         218         35.4         206.4         1.23         40         10.9         505         224           3         1725         214         49.6         220.6         0.65         40         10.9         505         262	Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow Scrubber         NCG         Stripper Foul         Foul         LVHC Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         209         1438           3         1725         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Stripper Foul         Four         Hard Pipe           Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow         Scrubber pH         Condensate         Condensate         Sond Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         224         1435           3         172.5         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Hard Pipe           NCG         Stripper Fault         Four         NCG         Stripper Fault         Stripper Fault         Stripper Fault         Stripper Fault         Kore Stripper Fault         Stripper Fault <th colspa="6" fault<="" stripper="" td=""><td>NCG         NCG         Net definition of the set of th</td></th>	<td>NCG         NCG         Net definition of the set of th</td>	NCG         NCG         Net definition of the set of th

#### TABLE 2-5 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	·
Time Began	1410	1547	1725	
Time Ended	1510	1647	1825	
Stack Gas Data				
Temperature, °F	457	461	460	459
Velocity, ft/sec	59	59	58	59
Moisture, %	15	15	15	15
CO <sub>2</sub> Concentration, %	7.2	7.6	7.0	7.3
O2 Concentration, %	11.9	11.2	11.7	11.6
VFR, x 10 <sup>5</sup> dscfm	1.33	1.33	1.33	1.33
Sulfur Dioxide				
Concentration, ppm	235	234	232	234
Emission Rate, lb/hr	311.3	311.0	307.4	309.9

K 11579 NEW PROVINE CATAWIDA, SCOOPALIPORTINEW (BODY CATAWIDA OCT 2021 1-3 CIS SO2 3PARISSION TEST REPORT DOCM 8 28 Okuber 2021 1:00 p.m. Vennim

> 15730,001,009 #1-2 CBs SO, Emission Report

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#### June 2021 TRS\_H2S Testing - Weston

	Comb	ination Boiler No	. 1 Stack	Combin	ation Boiler No.	2 Stack		Combin	nation Boiler No.	1 Stack	Combin	ation Boiler No.	2 Stack
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG	H2S	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG
ODTP/hr	55.9	76.0		88.3	85.2		ODTP/hr	55.9	76.0		88.3	85.2	
ADTP/hr	62.1	84.4		98.1	94.7		ADTP/hr	62.1	84.4		98.1	94.7	
lb TRS (as H2S)/hr	0.75	0.68		0.85	0.92		lb H2S/hr	0.07	0.05		0.07	0.04	
lb TRS (as TRS)/hr	1.07	0.97		1.22	1.32								
Ib TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02	1.39E-02	-1.51E-03	Ib H2S/ADTP	1.13E-03	5.92E-04	5.35E-04	7.13E-04	4.23E-04	2.91E-04
	Controller	Emissions	Sulfur Co	nversion	Uncontrolle	d Emissions		Controlled	Emissions	Sulfur C	onversion	Uncontrolle	d Emissions
	Average	Maximum	Combustion	I VHC Scrubber	Average	Maximum			Maximum	Combustion	IVHC Scrubber		Maximum
TRS as TRS	Ib TRS/ADTP	Ib TRS/ADTP	%	%	Ib TRS/ADTP	Ib TRS/ADTP	H2S	Ib H2S/ADTP	Ib H2S/ADTP	%	%	Ib H2S/ADTP	Ib H2S/ADTP
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA	0.29	0.58	SOG	4.13E-04	5.35E-04	99%	NA	4.13E-02	5.35E-02
NCG	1.27E-02	1.39E-02					NCG	5.07E-04	5.92E-04				
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%	1.60	1.75	LVHC <sup>A,C</sup>	5.03E-04	5.87E-04	99%	50%	1.01E-01	1.17E-01
LIN / CA-B							A.C.						

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HVLC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C). C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and HVLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1			CB1			CB2			CB2						
TRS as S		MW	NCG+SOG			NCG			NCG+SOG			NCG						
sulfur	S	32.065	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	AVG		PLC Cross C	heck back to TRS as H2S
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08	0.07	0.1	0.07	0.07	0.07	0.08	0.08	0.08	0.05	0.05	0.05	0.07	8.0%		0.085742 0.085742
methyl mercaptan	CH <sub>4</sub> S	48.107	0.55	0.53	0.49	0.52	0.52	0.53	0.77	0.63	0.64	0.94	0.91	0.69	0.64	72.6%		0.778738 0.55169
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62.134	0.16	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.08	0.07	0.07	0.12	13.5%		0.144248 0.079121
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.04	0.04	0.03	0.03	0.03	0.05	5.9%		0.06355 0.045984
															0.89	Total TRS		1.072278 0.762538
															84.8%			

10^6 ACFM Flowrate Basis to Ib/min												
H <sub>2</sub> S	0.007081766	0.006196545	0.008852208	0.006196545	0.006196545	0.006196545	0.007081766	0.007081766	0.007081766	0.004426104	0.004426104	0.004426104
CH <sub>4</sub> S	0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S	0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182

CH <sub>4</sub> S		0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S		0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>		0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182
	TRS as H2S	0.082325532	0.07966987	0.078784649	0.078784649	0.078784649	0.080555091	0.089407299	0.077014208	0.077899429	0.100029948	0.096489065	0.077014208
	TRS as TRS	0.118755065	0.115370779	0.113028312	0.114121247	0.114121247	0.116984649	0.125993636	0.108500182	0.109749714	0.142133299	0.136770831	0.109281117

Ratio TRS as H2s/TRS a 0.693238074 0.690555015 0.697034647 0.690359171 0.690359171 0.68859596 0.709617575 0.709807177 0.70979163 0.703775603 0.705479846 0.704734816 0.69944568 1.43



RESULTS AND DISCUSSION

### Combination Boiler #1

Condition 1: With NCGs, with SOGs 23-Jun-21

#### TABLE 2-11 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1158	1400	1541	
Time Ended	1258	1500	1641	
Stack Gas Data				
Temperature, *F	415	418	415	416
Velocity, fl/sec	59	57	57	57
Moisture, %	17	18	16	17
CO <sub>2</sub> Concentration, %	7.8	8.4	7.7	8.0
O2 Concentration, %	12.1	11.4	12.0	11.8
VFR, x 105 dscfm	1.35	1.31	1.33	1.33
Hydrogen Sulfide				
Concentration, ppm	0.09	0.08	0.12	0.10
Emission Rate, Ib/hr	0.07	0.06	0.08	0.07
Total Reduced Sulfur				
Concentration, ppm	1.09	1.07	1.03	1.06
Emission Rate, Ib/hr	0.78	0.74	0.73	0.75
Sulfur Dioxide				
Concentration, ppm	195	278	344	272
Emission Rate, Ib/hr	262.7	362.5	457.4	360.9

							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	<b>Pulp Production</b>	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	S	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(lbs/ODT Pulp)	(lbs/hr)
	1	1158	208	25.1	80.8	1.37	40	10.9	458	146	1585	621	11575	49.7	262.7	5.29	0.56
	2	1400	225	29.3	68.8	1.37	40	10.9	491	152	1595	1219	11048	54.0	362.5	6.71	0.49
	3	1541	207	24.8	81.2	1.37	40	10.9	491	45	1578	1136	11009	64.0	457.4	7.15	0.50
Average:			213	26.4	76.9	1.37	40	10.9	480	114	1586	992	11211	55.9	360.9	6.46	0.52

# Condition 2: With NCGs, without SOGs 23-Jun-21

								NCG			Hard Pipe							
								Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Ra	te	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	5	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/H	ir)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/OOT Pulp)	(lbs/hr)
	1	1824	23	30	26.3	94.9	1.37	40	10.9	489	123	1587		10515	74.1	404.4	5.46	0.43
	2	2019	21	16	23.7	97.5	1.37	40	10.9	491	184	1593		10377	74.7	7 452.9	6.06	0.42
	з	2202	22	20	25.2	92.4	1.37	40	10.9	490	152	1570		10573	79.3	450.8	5.69	0.46
Average	21		22	22	25.1	94.9	1.37	40	10.9	490	153	1583		10488	76.0	436.1	5.74	0.44

TABLE 2-12
NO. 1 COMBINATION BOILER
CONDITION 2: NCG GASES ONLY
SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, "F	416	411	415	414
Velocity, fl/sec	56	56	56	56
Moisture, %	16	16	17	17
CO <sub>2</sub> Concentration, %	8.3	7.8	8.1	8.1
O <sub>2</sub> Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>8</sup> dscfin	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, Ib/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, Ib/hr	0.67	0.68	0.68	0.68
Sulfer Diaxide				
Concentration, nem	313	348	349	337
Emission Rate, Ib/hr	404.4	452.9	450.8	436.1

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> 15730.001.0 Pulp Dryer, 43 Paper Machia #2-3 SDTV1, & #1-2 C Emission Repo



RESULTS AND DISCUSSION

#### Combination Boiler #2

Average:

16

235

32.4

140.7

1.37

40

10.9

481

Condition 1: With NCGs, with SOGs 24-Jun-21

# TABLE 2-13 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/24/21	6/24/21	6/24/21	
Time Began	1445	1630	1806	
Time Ended	1545	1730	1906	
Stack Gas Data				
Temperature, *F	475	474	479	476
Velocity, ft/sec	69	69	69	69
Modelham, %6	14	14	15	14
CO <sub>2</sub> Concentration, %	6.6	6.9	7.3	6.9
O2 Concentration, %	13.1	12.7	12.3	12.7
VFR, x 10 <sup>5</sup> dscfm	1.57	1.56	1.54	1.56
Hydrogen Sulfide				
Concentration, ppm	0.09	0.09	0.09	0.09
Emission Rate, Ib/hr	0.07	0.07	0.07	0.07
Total Reduced Sulfur				
Concentration, ppm	1.13	0.97	0.97	1.02
Emission Rate, Ib/hr	0.94	0.80	0.80	0.85
Sulfur Dioxide				
Concentration, ppm	324	327	322	324
Emission Rate Ibbr	508.7	507.2	496.1	504.0

# TABLE 2-14 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF H<sub>2</sub>S, TOTAL TRS, AND SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, "F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> discfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide				
Concentration, pom	0.05	0.05	0.05	0.05
Emission Rate, Ib/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				
Concentration, perm	1.22	1.18	0.94	1.11
Emission Rate, Ib/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, Ib/hr	383.2	380.0	366.2	376.4

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24-3011																	
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>#</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run	N	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1445	219	39.0	125.3	1.37	40	10.9	491	190	1572	1231	10253	87.8	508.7	5.79	0.77
	2	1630	224	31.1	146.4	1.37	40	10.9	490	186	1576	1231	10277	88.6	507.2	5.72	0.63
	3	1806	241	33.6	146.4	1.37	40	10.9	490	190	1580	1231	10300	88.6	496.1	5.60	0.63
Average	e:		228	34.6	139.4	1.37	40	10.9	490	189	1576	1231	10277	88.3	504.0	5.71	0.68
Conditio	on 2	: With NCG	s, without SOG:														
25-Jun	-21																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boiters	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #		Start Time	(10 <sup>*</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1000	234	35.7	132.7	1.37	40	10.9	482	155	1579		10475	87.2	383.2	4.39	0.86
	2	1135	225	30.8	147.8	1.37	40	10.9	479	252	1573		10425	84 3	380.0	4.51	0.82
	3	1315	245	30.6	141.7	1.37	40	10.9	482	97	1571		10500	84.2	366.2	4.35	0.63

168

1574

10467

85.2

376.4

4.42

0.77

# SCDHEC BAQ comments/questions for New-Indy (2440-0005) on the new Stripper construction application, sent Jun 12, 2023, responses due June 16, 2023

- Please provide the data, calculations, and any assumptions used to develop the emission factor for the baseline VOC for "Backup Stripper SOG". The VOC emissions factor of 4.35 lb/ADTP for the "Backup Stripper SOG" is based on the average daily methanol (MeOH) stripped from daily Subpart S compliance through 2/28/2023, 4.35 lb/ODTP, and this value was conservatively assumed to be 4.35 lb VOC/ADTP to account for small amounts of the other VOC's in the foul condensate [4.35 lb MeOH/ODTP x (0.9 ODTP/ADTP) x (1.0 lb VOC/ 0.9 lb MeOH)]. Attachment A provides the data, calculations, and assumptions for development of the 4.35 lb methanol/ODTP factor and we have also included the accompanying emissions spreadsheet.
- 2. On the third set of comments, sent May 8, 2023, information on MEK, acetaldehyde, and propionaldehyde was submitted as part of item 15. Can you provide the spreadsheet for the calculations? Can you explain the calculations at the end and any assumptions? It appears that the "Ibs into ASB" should be multiplied by the "Fair estimate..." factor to get the "Ibs emitted". Maybe there is some rounding but I don't arrive at the same "Ibs emitted" values. I get: MEK 7.786, Acetaldehyde 30.514, and Propionaldehyde 1.625. A revised PSD spreadsheet is included with this submittal that provides the data, calculations, and assumptions for development of the baseline emissions factors for MEK, acetaldehyde, and propionaldehyde. See the new ACE, MEK, PROP tab.
- What is the basis for MEK, acetaldehyde, and propionaldehyde used in the projected actual emissions for each scenario – New stripper, backup stripper, no stripper? Please provide the calculations, assumptions, etc. so these rates can be verified. A revised PSD spreadsheet is included with this submittal that provides the data, calculations, and assumptions for development of the projected emissions factors for MEK, acetaldehyde, and propionaldehyde. See the new ACE,MEK,PROP tab.
- 4. In the Foul Cond Sulfur tab, there is a calculation that is missing a value, cell G29. It says "<Ref>", so a link to a factor is missing. What is this number? What does it represent? The calculation in cell G29 was extraneous information that was not meant to be carried through to the final submittal. This cell is not linked to any emissions calculations or underlying data used in the emissions calculations and we will remove it from the spreadsheet.
- 5. Please provide the data, calculations, and assumptions used to derive the VOC emission factors for the new stripper.

The VOC emissions factor used to estimate the new stripper emissions is based on industry values supplied by the vendor designing the new stripper. The vendor supplied emissions of MeOH are 16 lb MeOH/ODTP [16 lb MeOH/ODTP  $\times$  (0.9 ODTP/ADTP) = 14.4 lb MeOH/ADTP]. This was conservatively assumed to be 16 lb VOC/ADTP to account for small amounts of the other VOC's in the foul condensate.

The methanol condenser was conservatively estimated to condense 90% of the methanol from the stripper-off-gases for burning the liquid methanol (aka stripper rectified liquid or SRL) in the

recovery furnaces [16.0 lb VOC/ADTP  $\times$  (90  $\div$  100) = 14.4 lb VOC/ADTP]. The remaining methanol (10% or 16.0 lb VOC/ADTP  $\times$  (10  $\div$  100) = 1.60 lb VOC/ADTP]) is incinerated in the No. 3 recovery furnace when the condenser is operating, or in the combination boilers when the condenser is down.

6. Why do the design parameters/emission factors for the backup stripper match those for when the new stripper is operating with the SRL offline? If the backup stripper is operating to remove TRS and the new stripper is operating to remove MeOH, how can the design values/emission factors be the same? This is for SO2, TRS, H2S, and VOC.

The new stripper and the backup stripper will both remove the same amounts of TRS and H2S from the foul condensate, generating the same amounts of SO2 when controlled. The backup stripper will remove 45% of the methanol from the foul condensate when operated as a TRS stripper. The VOC emissions factor for the backup stripper has been adjusted with this response to reflect 45% of the methanol being stripped from the condensate [16.0 lb VOC/ADTP × (45  $\div$  100) = 7.20 lb VOC/ADTP]. A revised PSD spreadsheet is included with this submittal.

Please note that the stripped condensate from the backup stripper will be sent to the ASB through the hardpipe to biologically treat the remaining 55% of the methanol. Although New-Indy Catawba plans to utilize the hardpipe to route the stripped condensates to the ASB; the Mill currently has no plans to utilize the Hardpipe and ASB for compliance with treatment of the pulping condensates under 40 CFR Part 63, Subpart S.

# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Thursday, July 6, 2023 6:23 PM
То:	Buckner, Katharine; Tourville, Bob
Cc:	McAvoy, Bryan P.; Steven Moore; Ryan Cleary
Subject:	RE: SC DHEC Modeling Section comments on New Indy's stripper project application
Attachments:	Response to Comments - Modeling Tables - July 6 2023.xlsx; July 6 Response to BAQ
	Modeling Section's Comments.docx

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Hi Katharine,

Please see attached documents with responses to your questions below. Please reach out if anything is unclear.

Thanks, Caleb

> Caleb Fetner / Consulting Engineer 678.293.9431 / Profile / LinkedIn

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**<u>L4</u>** <u>ALL4</u> // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>

Sent: Friday, June 30, 2023 3:56 PM

To: Caleb Fetner <cfetner@all4inc.com>; Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM> Cc: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>; Steven Moore <smoore@all4inc.com>; Ryan Cleary <rcleary@all4inc.com>

Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

Hey Caleb,

Thank you for the information on the splits. I will review and let you know if I have any questions.

I have been reviewing and verifying rates used in the modeling and have a couple questions/comments for you.

- 1. For all 3 Ditches, please provide the information used and the calculations for the rates used in the model.
- 2. On the Clarifier, an incorrect diameter may have been used. In Response to Comments Modeling Tables sheet, the Vol Area tab, the diameter is listed as 42 m. Previously a diameter of 84 m has been used. Please review and either provide a revised table or explain why 42 m is correct.

Please submit this information by Thursday, July 6, 2023.

# Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Caleb Fetner <cfetner@all4inc.com>

Sent: Friday, June 30, 2023 12:48 PM

To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>> Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Ryan Cleary <<u>rcleary@all4inc.com</u>>

Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

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Hi Katharine,

Apportioning the total ASB emissions between the three zones for the purposes of modeling was estimated based on the WATER9 results for the TRS compounds in the worst-case scenario (No Stripper Scenario) for TRS compounds. Based on the WATER9 results for each zone, ~98% of the total ASB emissions were apportioned to zone 1.

H2SSIM/WATER9 Results	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.57	0.22	8.40E-03
ASB Zone 2	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	1.85E-04	1.70E-04	5.26E-06
Total ASB	0.58	0.22	8.56E-03

This is a similar calculation to what you outlined in your question for H2S, but with the sum of the TRS compounds from the No Stripper Scenario (worst-case for TRS). The % splits were first developed for TRS as H2S, but was conservatively also applied to the H2S emissions rates as well due to the expected maximum receptor being closer to zone 1.

Please let me know if you have any further questions.

Caleb



From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Friday, June 30, 2023 8:23 AM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>; Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>

**Cc:** McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>> **Subject:** RE: SC DHEC Modeling Section comments on New Indy's stripper project application

Thank you. I was just making sure you saw the request.

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Friday, June 30, 2023 8:22 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

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Hi all – pulled together the information to answer Katherine's question and will be sending later today.

**Caleb Fetner** / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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.4 <u>ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.</u>

From: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>

Sent: Friday, June 30, 2023 8:17 AM

To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>

Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>

Subject: Re: SC DHEC Modeling Section comments on New Indy's stripper project application

I did.

Caleb Please let me know where we stand with information to Katharine?

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Friday, June 30, 2023 8:12 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>

Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>

Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

# Hey Bob,

Resending this to make sure you saw this earlier this week.

# Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

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From: Buckner, Katharine
Sent: Wednesday, June 28, 2023 3:50 PM
To: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: McAvoy, Bryan P. <<u>MCAVOYBP@dhec.sc.gov</u>>
Subject: FW: SC DHEC Modeling Section comments on New Indy's stripper project application

Hey Bob,

Thak you for all this information and responses. I have been working on verifying rates and stuff. I have one question. In the "Revised Emission Calculations (6-26-23)...", in the "WWTP Factors" tab, how were the Zone splits calculated? What data was used to determine this? Please explain the rationale on these. I tried to come up with these but did not follow how they were done, etc.

For instance, Backup Stripper is the worst for H2S. Using page B-76 from the app, if you total the H2S for all 3 zones, then divide zone 1 by the total, I get 62%.

# Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> Facebook Twitter



From: Steven Moore <<u>smoore@all4inc.com</u>>
Sent: Tuesday, June 27, 2023 1:23 PM
To: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Bob Tourville
<<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Ryan Cleary <<u>rcleary@all4inc.com</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>;
Subject: FW: SC DHEC Modeling Section comments on New Indy's stripper project application

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On behalf of and at the request of New-Indy Catawba, please find the attached responses to the comments received on June 20, 2023.

If you have any additional questions please contact Bob Tourville at New-Indy Catawba.

Steven Moore / Senior Managing Consultant D: <u>919.234.5981</u> / C: <u>864.616.4711</u> / Profile www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Sent: Tuesday, June 20, 2023 11:09 AM
To: Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Subject: FW: SC DHEC Modeling Section comments on New Indy's stripper project application

Just in. Can you follow up and respond by next Tuesday, June 27.

From: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Sent: Tuesday, June 20, 2023 11:04 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Subject: SC DHEC Modeling Section comments on New Indy's stripper project application

External Email

Hello,

I'm in the modeling section of the SCDHEC's Bureau of Air Quality. We've reviewed the facility's application for the installation of a new condensate stripper. Attached are some comments related to that review.

The first two questions are simply a request for a more complete of the Standard 2 and Standard 8 emission rates data related to the project.

The third question points out an emission factor error. Correcting the error would result in lower methyl mercaptan emission rates from one source.

The final two questions relate to the Std. 8 air toxics emissions calculations from the ASB's and ditches. Katharine will be able to help with questions related to emission factors, and I can help with questions about the air compliance averaging period referenced in question 5.

I work from home a few days a week, so please try my cell if you cannot reach me in the office.

We request a reply to these questions by Tuesday, June 27th.

Bryan McAvoy

Meteorologist

S.C. Dept. of Health & Environmental Control

Office: (803) 898-1275

Cell: (864) 350-0930

Email: mcavoybp@dhec.sc.gov

# Connect:

https://url.avanan.click/v2/ www.scdhec.gov .YXAzOm5ld2luZHk6YTpvOjNiZjJjN2M2MmU4MmFhZWV mNWFjNDM2NzM2NTE2OTImOjY6YjUyYjo1YjE3ZGZiODk2ODZINmNhMWEwZmVhNTcxMjYxNDc3MjIIMzIIYzdh MjIIN2E3ODZkODA1N2RkNDA2ZTY0YmI3OnQ6VA

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# New-Indy Catawba 2023 New Stripper Permitting Response to Comment 2 - Point Sources

Modeled	UTM Easting	UTM Northing	Stack	Temperature	Exit	Stack		Stack	H <sub>a</sub> S Emissions	MMC Emissions	TRS Emissions
Source ID		g	Height		Velocity	Diameter	Stack Orientation	Connod?			
Source ID	(m)	(m)	(m)	(K)	(m/s)	(m)		Cappeur	(g/s)	(g/s)	(g/s)
FUTRF2	510,095.85	3,855,743.58	59.44	457.98	30.21	2.13	VERTICAL	No	2.02E-02	8.89E-03	2.96E-02
FUTRF3	510,032.37	3,855,802.28	68.58	445.43	18.81	3.20	VERTICAL	No	3.64E-02	1.61E-02	5.35E-02
FUTST2	510,030.37	3,855,771.28	66.45	350.04	10.49	1.83	VERTICAL	No	4.72E-02	1.16E-02	5.73E-02
FUTST3	510,030.37	3,855,771.28	66.45	350.04	10.49	1.83	VERTICAL	No	8.53E-02	2.09E-02	1.04E-01
FUTLK2	510,206.31	3,855,812.91	56.08	470.37	9.78	1.83	VERTICAL	No	1.22E-01	5.86E-05	1.22E-01
FUTNCG1	510,039.32	3,855,689.18	69.49	457.48	14.39	3.05	VERTICAL	No	1.60E-02	1.58E-01	1.71E-01
FUTPD	509,894.71	3,855,778.28	23.74	343.15	13.11	1.52	VERTICAL	No	4.34E-03	5.49E-02	4.99E-02
FUTPM2_1	509,915.49	3,855,960.57	26.37	350.93	19.20	1.42	VERTICAL	No	5.38E-03	6.97E-03	1.67E-02
FUTPM2_2	509,894.11	3,855,948.21	26.37	358.15	17.07	1.42	VERTICAL	No	8.89E-03	9.42E-03	2.66E-02
FUTPM2_3	509,874.69	3,855,936.64	26.37	357.59	21.95	1.42	VERTICAL	No	3.84E-03	6.76E-03	1.87E-02
FUTPM3_1	509,799.90	3,855,820.64	25.73	350.93	19.20	1.27	VERTICAL	No	7.40E-03	8.66E-03	2.22E-02
FUTPM3_2	509,791.38	3,855,814.96	25.45	354.82	23.77	1.42	VERTICAL	No	1.51E-02	2.05E-02	4.75E-02
FUTPM3_3	509,782.85	3,855,810.05	25.45	358.15	24.99	1.42	VERTICAL	No	2.02E-02	2.14E-02	5.85E-02
FUTPM3_4	509,778.46	3,855,806.69	25.45	363.15	17.07	1.42	VERTICAL	No	7.44E-03	8.23E-03	2.23E-02
FUTPM3_6	509,768.38	3,855,802.04	25.73	361.48	23.77	1.32	VERTICAL	No	9.55E-03	9.75E-03	3.06E-02
FUTPM3_7	509,762.18	3,855,798.17	26.87	360.37	22.86	1.68	VERTICAL	No	8.18E-03	1.33E-02	3.68E-02
FUTPM3_8	509,752.11	3,855,792.74	26.87	357.59	21.95	1.68	VERTICAL	No	7.88E-03	1.50E-02	4.14E-02
POSTAERB	510,295.58	3,854,460.36	3.05	0.00	8.52	0.46	HORIZONTAL	No	1.40E-04	5.12E-04	2.45E-03

## New-Indy Catawba 2023 New Stripper Permitting Response to Comment 2 - Volume and Area Sources

					Volume So	ources			
Modeled Source ID	UTM Easting	UTM Northing	Release Height	Length of Side	Initial Horizontal Dimension	Initial Vertical Dimension	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions
	(m)	(m)	(m)	(m)	(m)	(m)	(g/s)	(g/s)	(g/s)
CAUST	510,240.52	3,855,749.76	13.70	18.00	4.19	6.40	0.00E+00	1.23E-02	3.45E-02
NEWSPLTK <sup>(a)</sup>	510,015.82	3,855,803.47	18.29	18.29	4.25	8.51	1.20E-03	5.67E-04	1.11E-02

(a) The NEWSPLTK source was added as part of the new stripper project modeling demonstration.

					Area Sour	ces			
Modeled	LITM Easting	UTM Northing	Release	Length of	Length of Side	Rotation	H-S Emissions	ММС	TRS
Seuree ID	o mi Lasting		Height	Side (x)	(у)	Angle		Emissions	Emissions
Source ID	(m)	(m)	(m)	(m)	(m)	(°)	(g/s/m <sup>2</sup> )	(g/s/m²)	(g/s/m <sup>2</sup> )
PULPSTOR	509,928.73	3,855,822.71	15.24	93.28	98.17	-27.40	0.00E+00	6.34E-06	1.01E-04
BLAKSTOR	510,021.22	3,855,756.55	12.19	85.00	85.00	-27.40	4.22E-06	4.19E-06	2.02E-05
MIXTANK	510,044.49	3,855,765.65	6.10	23.35	19.88	0.00	0.00E+00	2.58E-06	3.81E-06
WLIQSTOR	510,153.86	3,855,704.12	16.80	20.00	20.00	-30.00	5.67E-06	3.65E-04	3.75E-04

#### **AREAPOLY** Sources

Modeled Source ID	UTM Easting	UTM Northing	Release Height	Modeled Area	Initial Vertical Dimension	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions
	(m)	(m)	(m)	(m²)	(m)	(g/s/m²)	(g/s/m²)	(g/s/m²)
EQLBASIN	510,439.13	3,855,563.34	0.00	7,610.8	0.00	9.37E-07	0.00E+00	9.37E-07
DITCH1	510,812.79	3,856,255.42	0.00	2,219.3	0.00	1.50E-07	3.21E-07	2.58E-05
ASB1 <sup>(b)</sup>	510,803.40	3,856,319.69	6.10	50,889.4	0.00	2.69E-06	3.20E-07	1.43E-05
ASB2 <sup>(b)</sup>	510,964.42	3,856,054.20	6.10	68,158.5	0.00	4.81E-08	5.74E-09	2.55E-07
ASB3 <sup>(b)</sup>	511,052.13	3,855,887.21	6.10	72,789.5	0.00	1.21E-09	1.45E-10	6.47E-09
DITCH2 <sup>(c)</sup>	510,992.97	3,855,727.21	0.00	1,844.2	0.00	1.34E-06	3.17E-07	2.63E-06
SLDGLAGN	510,924.33	3,855,544.61	0.00	45,225.3	0.00	9.37E-07	0.00E+00	9.37E-07
HOLDPOND	510,391.65	3,855,142.65	0.00	390,739.1	0.00	1.61E-07	6.20E-11	1.61E-07
DITCH0	510,377.59	3,855,634.91	0.00	240.9	0.00	1.11E-07	5.05E-07	3.75E-05

(b)Worst-case emissions rates for ASB1, ASB2, and ASB3 calculated for the new stripper project.

(c) DHEC modified the DITCH2 UTM coordinates order to correct an elevation issue - only for the 1-hr H2S demonstration. For 1-hour H<sub>2</sub>S - DITCH2 starting coordinates were (510,904.77, 3,855,661.77).

_								
Modeled Source ID	UTM Easting	UTM Northing	Release Height	Radius	Initial Vertical Dimension	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions
	(m)	(m)	(m)	(m)	(m)	(g/s/m <sup>2</sup> )	(g/s/m <sup>2</sup> )	(g/s/m <sup>2</sup> )
CLARIFY	510,342.42	3,855,604.87	0.00	42.00	0.00	3.70352E-06	3.96E-08	6.94E-06

#### **AREACIRC Sources**

SCDHEC's Modeling Section Email Questions, dated June 30, 2023, to New Indy Concerning the March 23, 2023 Construction Permit Application for the Installation of a New Condensate Stripper.

1) For all 3 Ditches, please provide the information used and the calculations for the rates used in the model.

**New-Indy Catawba Response:** Please refer to the information and calculations submitted by New-Indy Catawba on October 27, 2021, and December 2, 2021, regarding the maximum emissions rates used in the air dispersion modeling analyses for Ditch 0, Ditch 1 and Ditch 2.

2) On the Clarifier, an incorrect diameter may have been used. In Response to Comments – Modeling Tables sheet, the Vol Area tab, the diameter is listed as 42 m. Previously a diameter of 84 m has been used. Please review and either provide a revised table or explain why 42 m is correct.

**New-Indy Catawba Response:** The units for the modeled emissions rates for the Clarifier provided in the workbook, "Response to Comments – Modeling Tables – June 27 2023.xlsx" were incorrectly labeled as diameter. Both the historical modeling and the submitted modeling for the New Condensate Stripper uses a modeled radius of 42.0 m (diameter of 84.0 m). The corrected units have been incorporated in the "Response to Comments – Modeling Tables – July 6 2023.xlsx" workbook.

# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Wednesday, June 21, 2023 8:59 AM
То:	Buckner, Katharine
Cc:	Bob Tourville; Sheryl Watkins; Steven Moore
Subject:	RE: follow up on responses from 6-16-2023

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hey Katherine – I'm following up on your question to Bob on Monday that he forwarded to me.

August 9-11, 2022 was quarterly Subpart S performance test where the methanol treated in the steam stripper is calculated on a daily basis for each day of the performance test rather than the 15-day average of methanol sent to the steam stripper. The amount treated in the stripper for those days in Attachment A were the results if the ongoing compliance method was used which is why there is a difference with the performance test results.

That said, the results of the performance test (seen below) are the correct values to use for those three days, but as you pointed out, it does not have a tangible impact on the baseline SOG VOC emissions factor if those three days are corrected.

	ΗΔΡ
	Treated
	in
	Stripper
Day	(lb/ODTP)
9-Aug	3.2
10-Aug	3.2
11-Aug	3.9

Hope that helps.

Caleb Fetner / Consulting Engineer 678.293.9431 / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Monday, June 19, 2023 4:18 PM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Subject: follow up on responses from 6-16-2023

**External Email** 

Hey Bob,

I have been reviewing the responses sent on 6-16-2023 to my questions/comments earlier that week. I have a follow up question for you.

In the Attachment A – Existing Stripper Methanol in SOG, when comparing the methanol treated in the stripper column data to that submitted in reports to the BAQ, I have found a discrepancy in a values. The values reported for Aug 9-11, 2022 are different between those reported to BAQ and those in the attachment. There were two submittals to the BAQ that included the Aug 9-11, 2022, dated September 21, 2022 and October 17, 2022. Why are the values reported to BAQ in the two reports referenced different than that in the Attachment A document? I plugged in the numbers from the BAQ reports and it did not affect the overall emission factor for VOC for the baseline actual emissions from the existing stripper. Please provide an explanation for the differences.

Thank you for this last round of responses. These have been very helpful.

### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

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# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Tuesday, July 11, 2023 4:44 PM
То:	Buckner, Katharine
Cc:	Tourville, Bob; Steven Moore; Sheryl Watkins
Subject:	RE: 40 CFR 64, CAM for stripper project
Attachments:	July 11 CAM response.docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email.

Hi Katharine – see attached in response to your questions on CAM. Appreciate your patience with the holiday week last week.

Thanks,

Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>
Sent: Friday, June 30, 2023 8:22 AM
To: Sheryl Watkins <swatkins@all4inc.com>; Steven Moore <smoore@all4inc.com>; Caleb Fetner
<cfetner@all4inc.com>
Subject: Fw: 40 CFR 64, CAM for stripper project

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Thursday, June 29, 2023 4:52 PM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Subject: RE: 40 CFR 64, CAM for stripper project

### External Email

Hey I sent that too quickly.

Please also address CAM for the Boilers, the Recovery Furnaces, and the caustic scrubber.

I don't think anything else part of this project would need to be looked at for CAM.

Thank you,

Katharine K. Buckner Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter

From: Buckner, Katharine
Sent: Thursday, June 29, 2023 4:33 PM
To: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Subject: 40 CFR 64, CAM for stripper project

Hey Bob,

According to the Title V renewal SOB, the existing stripper is subject to CAM. CAM was not addressed in the construction application for the new stripper. Can you please address CAM for the new stripper. Please try to provide this as soon as you can.

#### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

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As requested by electronic mail on June 29, 2023, New-Indy Catawba LLC (New-Indy Catawba) has addressed the Compliance Assurance Monitoring (CAM) Rule at 40 CFR Part 64 for the new and modified emissions units included in the construction air permit application for the new condensate steam stripper submitted on March 23, 2023. Although CAM is an operating permit requirement and New-Indy Catawba has not yet been issued a construction permit or applied for a revised operating permit, New-Indy Catawba is responding to your request with a table that outlines the CAM requirements that apply to the combination boilers, recovery furnaces, and the caustic scrubber on the LVHC system and that will apply for the backup and new steam strippers. New-Indy Catawba is not proposing any changes to the previously approved CAM approaches for these units.

	Table 1. CAM Approaches for Stripper Project New and Modified Emissions Units						
Unit ID	Equip. No.	Control Device No.	Pollutant	Applicable Requirement	Ranges		Range Basis
07	2505	2505C	РМ	SC Reg. 61-62.5, Std. 4	<ul> <li>CAM Indicator Range: No. 2 Recovery Furnace ESP {MACT MM Presumptive for CAM}</li> <li>Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:</li> <li>Opacity [average of ten (10) consecutive six-minute (6-min.) averages]</li> </ul>	<b>≤ 20</b>	Based on MACT MM requirements
07	5105	5105C	РМ	SC Reg. 61-62.5, Std. 4 40 CFR 60, Subpart BB SC Reg. 61-62.5, Std. 7	<ul> <li>CAM Indicator Range: No. 3 Recovery Furnace ESP {MACT MM Presumptive for CAM}</li> <li>Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:</li> <li>Opacity [average of ten (10) consecutive six-minute (6-min.) averages]</li> </ul>	<u>≤ 20</u>	• Based on MACT MM requirements
08	2605	2610C1	РМ	SC Reg. 61-62.5, Std. 4	<ul> <li>CAM Indicator Ranges: No. 1 Combination Boiler ESP {MACT DDDDD Presumptive for CAM}</li> <li>Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:</li> <li>Opacity, daily block average</li> <li>Steam load, 30-day average</li> <li>Boiler O<sub>2</sub> concentration, 30-day average</li> </ul>	Test value	• Based on MACT DDDDD compliance demonstration
08	2605	2605	TRS	SC Reg. 61-62.5, Std. 4 40 CFR 60, Subpart BB	<ul> <li>CAM Indicator Range: No. 1 Combination Boiler</li> <li>Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:</li> <li>Venting:</li> </ul>	≥ 5 minutes	• Flame Failure System and Bypass Vents

	Table 1. CAM Approaches for Stripper Project New and Modified Emissions Units						
Unit ID	Equip. No.	Control Device No.	Pollutant	Applicable Requirement	Ranges		Range Basis
08	3705	3705C	РМ	SC Reg. 61-62.5, Std. 4	CAM Indicator Ranges: No. 2 Combination Boiler ESP {MACT DDDDD Presumptive for CAM} Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:	Tested	Based on MACT DDDDD compliance demonstration
					<ul> <li>Steam load, 30-day average</li> <li>Boiler O<sub>2</sub> concentration, 30-day average</li> </ul>	value	
08	3705	3705	TRS	SC Reg. 61-62.5, Std. 4 40 CFR 60, Subpart BB	<ul> <li>CAM Indicator Range: No. 2 Combination Boiler)</li> <li>Excursion range corrective action required if outside following range(s) under conditions defined by CAM condition:</li> <li>Venting:</li> </ul>	≥ 5 minutes	• Flame Failure System and Bypass Vents
08	9801	9820	TRS	40 CFR 60, Subpart BB	CAM Indicator Range: Backup Steam Stripper Excursion range (corrective action required if outside following range(s) under conditions defined by CAM condition): Steam feed rate (kpph), condensate flow (gpm), and condensate feed temperature (°F) are continuously monitored in order to calculate an effective steam to feed ratio (ESFR). The CAM indicator is minimum 15- day average ESFR.	≥Tested value	• Test Data for TRS removal
08	9803	9820, 2605, 3705	TRS	40 CFR 60, Subpart BB	CAM Indicator Range: New Steam Stripper Excursion range (corrective action required if outside following range(s) under conditions defined by CAM condition): Steam feed rate (kpph), condensate flow (gpm), and condensate feed temperature (°F) will be continuously monitored in order to calculate an effective steam to feed ratio (ESFR). The CAM indicator is minimum 15- day average ESFR.	≥Tested value	• Test Data for TRS removal
02	5260	5260C	TRS	40 CFR 60, Subpart BB	<ul> <li>CAM Indicator Ranges: LVHC Scrubber</li> <li>Excursion range (corrective action required if outside following range(s) under conditions defined by CAM condition):</li> <li>Scrubber liquid flow (at least once daily)</li> <li>Scrubbing liquid pH (at least once daily)</li> </ul>	≥30 gpm ≥10	• Test data

# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Friday, July 14, 2023 8:02 AM
То:	McAvoy, Bryan P.; Buckner, Katharine
Cc:	Tourville, Bob; Steven Moore; Sheryl Watkins; Ryan Cleary
Subject:	RE: TRS rates in model

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Good morning Bryan, happy Friday.

We are trying to look into Katharine's question below on the emissions rates from the ditches, but I believe Katharine is out yesterday/today. Can you please send the "outputs from H2SSIM model and Water 9 that were dated June 27, 2022" that she is referencing below, so we can verify the rates she is requesting?

Thanks in advance, Caleb

Caleb Fetner / Consulting Engineer 678.293.9431 / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM> Sent: Wednesday, July 12, 2023 3:43 PM To: Caleb Fetner <cfetner@all4inc.com>; Sheryl Watkins <swatkins@all4inc.com> Subject: Fw: TRS rates in model

Sheryl can you address?

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>> Sent: Wednesday, July 12, 2023 3:39 PM To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>> Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>> Subject: TRS rates in model

#### **External Email**

Hey Bob,

I left a voice mail earlier. I am following up with this email.

We are trying to verify the rates for H2S, TRS as H2S, and methyl mercaptan (MM) used in the modeling. Specifically, we are interested in the rates for the three ditches – Ditch 0 + splitter, Ditch 1, and Ditch 2. The last time modeling was done, rates from July 2022 were used. These rates are different from those used in Oct and Dec 2021 and they are different than those submitted as part of the new stripper project.

As I mentioned in the voice mail, I had outputs from H2SSIM model and Water 9 that were dated June 27, 2022. These rates were used in the last modeling.

Can you verify if the rates from June 27, 2022 are accurate and should be used in the model? Or are these not accurate and why?

### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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# **Buckner**, Katharine

From:	Tourville, Bob <bob.tourville@new-indycb.com></bob.tourville@new-indycb.com>
Sent:	Wednesday, August 16, 2023 11:12 AM
То:	Buckner, Katharine; Sheryl Watkins; Caleb Fetner
Cc:	McAvoy, Bryan P.
Subject:	RE: Modeling for new stripper project

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I think a call is best. I am available most of day on Thursday and all day Friday. Please send me your availabilities and I will schedule a call.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Tuesday, August 15, 2023 10:22 AM
To: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>; Sheryl Watkins <swatkins@all4inc.com>; Caleb Fetner
<cfetner@all4inc.com>
Cc: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>
Subject: Modeling for new stripper project

### **External Email**

Hey All,

Bryan and I have been trying to understand the differences mainly in the rates used for the ditches this time in the modeling for the new stripper and the July 2022 modeling that was done for compliance demonstration. It appears the rates for the ditches in the new stripper app are those from using the RSK analysis method for the July 2021 IPT testing. The 2022 modeling demonstration used the average rates from the ALS analysis method. An email from Dan Mallett on June 17, 2022, relays the request by DHEC (Michael Shroup) to do the modeling demonstration using the average ALS results.

So should this modeling for the new stripper also use rates from the ALS method too? Who makes the call on what rates should be used in the modeling now and going forward?

Sheryl explained about initially the RSK-175 method was used because EPA required it. The July 2021 IPT results were reported in a summary letter in May 2022. Then in June 2022, the summary was updated and reported results in from the ALS method.

We can have a call to discuss if necessary. Let us discuss with our management too.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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# **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Monday, October 2, 2023 4:49 PM
То:	Buckner, Katharine
Cc:	McAvoy, Bryan P.; Ryan Cleary; Rachel Davis; Robert Tourville; Sheryl Watkins; Steven
	Moore
Subject:	RE: ALS vs RSK method of analysis for liquid samples
Attachments:	Revised Modeling WWTP Rates for ALS (9-28-23).xlsx; New Stripper Modeling Results -
	05 - 20230915.xlsx; New Stripper - ALS Modeling Transmittal Document (10-2-23).docx;
	Referenced Files.zip

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine,

At the request of the mill, I am providing the updated air dispersion modeling emissions rates for the WWTP sources using the ALS GC method. The following files are attached.

- 1. Revised Modeling WWTP Rates for ALS (9-28-23)
  - a. Provides the updated ALS-based emissions rates in both g/s and g/s/m2, as well as a comparison to both the previous DHEC modeling demonstration and the original new stripper application modeling rates.
  - b. References are given for each emissions rate pointing to a specific document in the attached Referenced Files zipped folder.
- 2. New Stripper Modeling Results 05 20230915
- 3. New Stripper ALS Modeling Transmittal Document (10-2-23)
  - a. Provides background information and explanation of this update.

We will send the updated modeling files to you and Bryan in a separate email, but wanted to get you the emissions rates and results for your review.

Please let me know if you have any questions or have any difficulties opening any files.

Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u> www.all4inc.com / <u>Locations</u> / <u>Articles</u> / <u>Podcast</u> / <u>Training</u>

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>

**Sent:** Friday, August 25, 2023 7:30 AM

**To:** Robert Tourville <BOB.TOURVILLE@NEW-INDYCB.COM>; Sheryl Watkins <swatkins@all4inc.com>; Caleb Fetner <cfetner@all4inc.com>

Cc: Hardee, Christopher <hardeecd@dhec.sc.gov>; Shroup, Michael <shroupmd@dhec.sc.gov>; McCaslin, Steven <mccaslsd@dhec.sc.gov>; McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>; Verzwyvelt, Michael <verzwymg@dhec.sc.gov> Subject: ALS vs RSK method of analysis for liquid samples

Hello All,

We have discussed it internally and the method to use to analyze liquid samples is the ALS GC method. Michael Shroup also discussed it with EPA and they too said the method to use is the ALS GC.

Let me know if you would like to discuss further.

### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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### October 2, 2023

New-Indy Catawba - Update to Air Dispersion Modeling Analysis for New Stripper Permitting

### **Background:**

New-Indy Catawba submitted an updated ambient air dispersion modeling analysis in support of the New Condensate Stripper Construction Permit Application (application). Facility-wide modeling of hydrogen sulfide (H<sub>2</sub>S), methyl mercaptan (MMC), and total reduced sulfur (TRS) compounds was conducted using the source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK) that were included in the March 8, 2023 modeling submitted to SCDHEC.

For WWTP sources, New-Indy Catawba used the maximum actual emissions rates as submitted in the October 2021 analysis (for H2S, and TRS) and corresponding MMC emissions rates, with the exception of the ASB. Based on EPA's direction, the October 2021 modeling analysis was performed using WWTP emissions rates derived from the RSK-175 method results, rather than the ALS GC method results.

Refined emissions rates reflecting the new steam stripper operation and foul condensate flow for the ASB were developed in support of the application based on ALS GC method results. Due to the ASB being the only WWTP source impacted by the new condensate steam stripper, New-Indy Catawba submitted the ambient air dispersion modeling analysis in Appendix C of the application with the updated ASB emissions rates (ALS GC method), but did not change the emissions rates of the other WWTP sources from the October 2021 modeling analysis (RSK-175 method).

The emissions rates used in the application modeling analysis were most recently provided to SCDHEC in New-Indy Catawba's July 6, 2023 response.

In discussions and communications after submittal of the application, SCDHEC has directed New-Indy Catawba to update the air dispersion modeling analysis with emissions rates for all of the WWTP sources based on the ALS GC method results, specifically in the August 25, 2023 email from Katharine Buckner (SCDHEC).

### Discussion of Updated WWTP Emissions Rates:

The ALS-based emissions rates are being provided to SCDHEC in the "Revised Modeling WWTP Rates for ALS (9-28-23) spreadsheet. The references of the emissions rates are included in the spreadsheet. Other referenced spreadsheets and PDFs with any supporting calculations are also provided with this transmittal.

In general, the average ALS GC results from the July 2021 sampling were used to estimate actual emissions rates, which was then scaled up to a maximum emissions rate using the ratio of the July 2021 actual pulp production to a max of 2700 ADTP/day. The modeling analysis is based on these maximum emissions rates. There are no changes to the Post Aeration Basin, Holding Pond (H<sub>2</sub>S only), and Sludge Pond emissions rates, as they were not dependent upon July 2021 liquid sulfur sampling results.

### Air Dispersion Modeling Results:

The air dispersion modeling analysis was conducted using the updated ALS emissions rates for WWTP sources as discussed above, with the same source parameters and emissions rates for non-WWTP sources and the Post-Aeration Basin as the original modeling analysis for the application. Results of the air dispersion modeling analysis demonstrate that ambient concentrations are below the relevant standards for H<sub>2</sub>S, MM, and TRS for each averaging period.

Medeled Source	UTM Easting	UTM Northing	Release	Modeled	Initial Vertical		MMC Emissions	TPS Emissions		ММС	TRS
	OTW Easting	o na Northing	Height	Area	Dimension	H23 Emissions				Emissions	Emissions
	(m)	(m)	(m)	(m <sup>2</sup> )	(m)	(g/s)	(g/s)	(g/s)	(g/s/m²)	(g/s/m²)	(g/s/m <sup>2</sup> )
EQLBASIN	510,439.13	3,855,563.34	0.00	7,610.8	0.00	7.14E-03		7.14E-03	9.38E-07		9.38E-07
DITCH1	510,812.79	3,856,255.42	0.00	2,219.3	0.00	4.10E-03	2.33E-03	1.28E-01	1.85E-06	1.05E-06	5.78E-05
ASB1 <sup>(b)</sup>	510,803.40	3,856,319.69	6.10	50,889.4	0.00	1.37E-01	1.63E-02	7.28E-01	2.68E-06	3.20E-07	1.43E-05
ASB2 <sup>(b)</sup>	510,964.42	3,856,054.20	6.10	68,158.5	0.00	2.45E-03	2.92E-04	1.30E-02	3.59E-08	4.28E-09	1.91E-07
ASB3 <sup>(b)</sup>	511,052.13	3,855,887.21	6.10	72,789.5	0.00	6.17E-05	7.35E-06	3.29E-04	8.47E-10	1.01E-10	4.52E-09
DITCH2 <sup>(c)</sup>	510,992.97	3,855,727.21	0.00	1,844.2	0.00	9.28E-02	4.20E-03	1.01E-01	5.03E-05	2.28E-06	5.49E-05
SLDGLAGN	510,924.33	3,855,544.61	0.00	45,225.3	0.00	4.14E-02		4.14E-02	9.16E-07		9.16E-07
HOLDPOND	510,391.65	3,855,142.65	0.00	390,739.1	0.00	6.26E-02	1.75E-04	6.28E-02	1.60E-07	4.48E-10	1.61E-07
DITCH0	510,377.59	3,855,634.91	0.00	240.9	0.00	3.03E-04	3.72E-04	1.86E-02	1.26E-06	1.54E-06	7.72E-05

Comparison to July 6 2023 Response to DHEC Provided R	
Original application emissions rates	

	ММС	TRS	
n <sub>2</sub> 5 Emissions	Emissions	ons Emissions	
(g/s/m <sup>2</sup> )	(g/s/m²)	(g/s/m <sup>2</sup> )	
9.37E-07		9.37E-07	
1.50E-07	3.21E-07	2.58E-05	
2.69E-06	3.20E-07	1.43E-05	
4.81E-08	5.74E-09	2.55E-07	
1.21E-09	1.45E-10	6.47E-09	
1.34E-06	3.17E-07	2.63E-06	
9.37E-07		9.37E-07	
1.61E-07	6.20E-11	1.61E-07	
1.11E-07	5.05E-07	3.75E-05	

MMC

Emissions

(g/s/m<sup>2</sup>)

3.96E-08

H<sub>2</sub>S Emissions

(g/s/m<sup>2</sup>)

3.70352E-06

TRS

Emissions

(g/s/m²)

6.94E-06

Modeled Source	UTM Easting	UTM Northing	Release Height	Radius	Modeled Area	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions
טו	(m)	(m)	(m)	(m)	(m <sup>2</sup> )	(g/s)	(g/s)	(g/s)	(g/s/m²)	(g/s/m²)	(g/s/m²)
CLARIFY	510,342.42	3,855,604.87	0.00	42.00	5541.77	2.59E-04	7.26E-04	3.98E-02	4.67E-08	1.31E-07	7.18E-06

#### Emissions Rate Basis

Source	Pollutant	Actual	Reference File Provided	Maximum
		g/s		g/s
Equalization Basin	H2S	4.56E-03	EQ Basin and Sludge Lagoon Calcs.xlsx	7.14E-03
	TRS	4.56E-03	TRS = H2S	7.14E-03
Ditch 0	H2S	1.94E-04	ALS AVG Ditch #0 Calcs.xlsx	3.03E-04
			PC and Ditch 0-1_ALS AVG_WATER9.pdf	
	MMC	2.38E-04	Sum of Unit 3 Open Trench, Open Sum, and Closed Trench WATER9	3.72E-04
	TRS	1.19E-02	Sum of reduced sulfur compounds, as H2S	1.86E-02
Ditch 1	H2S	2.62E-03	ALS AVG Ditch #1 Calcs.xlsx	4.10E-03
	MMC	1.49E-03	PC and Ditch 0-1_ALS AVG_WATER9.pdf	2.33E-03
	TRS	8.19E-02	Sum of reduced sulfur compounds, as H2S	1.28E-01
Ditch 2	H2S	5.93E-02	ALS AVG Ditch #2 Calcs.xlsx	9.28E-02
	MMC	2.68E-03	Holding Pond_Ditch 2_ ALS AVG_WATER9	4.20E-03
	TRS	6.47E-02	Sum of reduced sulfur compounds, as H2S	1.01E-01
Sludge Lagoon	H2S	2.65E-02	EQ Basin and Sludge Lagoon Calcs.xlsx	4.14E-02
	TRS	2.65E-02	TRS = H2S	4.14E-02
Holding Pond	H2S	4.00E-02	No change.	6.26E-02
	MMC	1.12E-04	Holding Pond Ditch 2 ALS AVG WATER9	1.75E-04
	TRS	4.01E-02	Sum of reduced sulfur compounds, as H2S	6.28E-02
Primary Clarifier	H2S	1.65E-04	PC ALS AVG H2SSIM.pdf	2.59E-04
	MMC	4.64E-04	PC and Ditch 0-1_ALS AVG_WATER9	7.26E-04
	TRS	2.54E-02	Sum of reduced sulfur compounds, as H2S	3.98E-02

#### 2700 ADTP, max 1726 ADTP, actual July 2021 pulp production.

156%

ASB

Worst-case Emissions for Modeling					
	H <sub>2</sub> S	MMC	TRS as H <sub>2</sub> S		
Total ASB lb/ODTP	0.0109	1.30E-03	5.81E-02		
Total ASB lb/hr	1.10	0.13	5.88		
Total ASB g/s	0.139	0.017	0.741		
Zone 1 g/s	1.37E-01	1.63E-02	7.28E-01		
Zone 2 g/s	2.45E-03	2.92E-04	1.30E-02		
Zone 3 g/s	6.17E-05	7.35E-06	3.29E-04		

REVISED Emissions Calculations (6-26-23)\_Modeling Emissions Rates

June 27, 2023 Response to DHEC on New Stripper Application

H <sub>2</sub> S	ммс
Percent Cl	nange vs. Ju
0.1%	

Percent Cl	hange vs. July 6	6 Response	
0.1%		0.1%	EQLBASIN
1134%	226%	124%	DITCH1
-0.3%	-0.1%	0.0%	ASB1 <sup>(b)</sup>
-25%	-25%	-25%	ASB2 <sup>(b)</sup>
-30%	-30%	-30%	ASB3 <sup>(b)</sup>
3653%	619%	1989%	DITCH2 <sup>(c)</sup>
-2%		-2%	SLDGLAGN
-1%	622%	0%	HOLDPOND
1037%	206%	106%	DITCH0

TRS

Comparison to DHEC Rates:	
Emissions rates used by DHEC in modeling demonstration	

H2S	ммс	TRS
(g/s/m²)	(g/s/m <sup>2</sup> )	(g/s/m²)
5.99E-07		5.99E-07
1.18E-06	6.70E-07	3.69E-05
1.05E-06	1.53E-06	4.69E-06
5.92E-07	3.26E-08	6.73E-07
3.29E-07	8.40E-10	3.32E-07
3.22E-05	1.46E-06	3.51E-05
5.85E-07		5.85E-07
1.02E-07	2.86E-10	1.03E-07
8.05E-07	9.87E-07	4.93E-05

	TRS	ммс	H₂S	
	IEC	Change vs. Di	Percen	
EQLBASIN	56.5%		56.5%	F
DITCH1	56.5%	56.5%	56.5%	
ASB1 <sup>(b)</sup>				Г
ASB2 <sup>(b)</sup>				Г
ASB3 <sup>(b)</sup>				Г
DITCH2(c)	56.4%	56.5%	56.4%	Г
SLDGLAGN	56.5%		56.5%	
HOLDPONI	56.5%	56.5%	56.7%	Г
DITCH0	56.4%	56.5%	56.1%	Г

H <sub>2</sub> S	ммс	TRS	
Perce			
-98.7%	231%	3.5%	CLARIFY

H2S	ммс	TRS
(g/s/m²)	(g/s/m²)	(g/s/m²)
3.00E-08	8.38E-08	4.59E-06

H₂S	ммс	TRS	
Percent	Change due to	ALS	
55.6%	56.5%	56.5%	CLARIFY

### New-Indy Catawba, LLC 2023 New Steam Stripper Application

Pollutant	Standard <sup>(a)</sup>		Modeled Concentration	UTM Easting	UTM Northing	Rank <sup>(a)</sup>	Standard <sup>(a)(c)(d)</sup>
		Period	(µg/m <sup>3</sup> )	(m)	(m)		(µg/m <sup>3</sup> )
H.S	MAAC	24-hour	20.20	511,397.27	3,856,649.76	1st High	140
1125	EPA Action Level	30-minute	100.80	511,249.70	3,856,644.83	1-hour 1st High	837
MMC	MAAC	24-hour	9.46	510,115.55	3,856,041.31	1st High	10
IVIIVIC	EPA Action Level	30-minute	48.00	510,209.41	3,856,039.95	1-hour 1st High	57,000
TDC	MAAC	24-hour	77.25	511,249.70	3,856,644.83	1st High	140
IKS	EPA Action Level	30-minute	385.32	510,143.86	3,855,999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ\_SC%20Modeling%20Guidelines\_10.15.18\_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to  $H_2S$ .

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.



Free Sulfide Fraction Calculation Tool		Convert Total Sulfide to H2S(dissolved)	
рН	9.08	Hydrogen Concentration	8.31764E-10
К1	1.036E-07	Hydrogen Concenration	8.31764E-13
К2	6.43E-16		

Free Fraction	0.796%	Convert Total Sulfide Measurement to H2	2S(dissolved)	
		5.5	96.8%	
		5.75	94.5%	
		6	90.6%	
		6.25	84.4%	
		6.5	75.3%	
		6.75	63.2%	
		7	49.1%	
		7.25	35.2%	
		7.5	23.4%	
		7.75	14.7%	
		8	8.8%	
		8.25	5.1%	
		8.5	3.0%	
		8.75	1.7%	
		9	1.0%	

#### **Ditch #0 H2S Emissions Calculation**

3.65 mWidth of Ditch #061 mLength of Ditch #00.25 mg/LConcentration of Hydrogen Sulfide Entering Ditch #00.0080Free Sulfide pH Adjustment1,000 L/m³Conversion Factor1,000 mg/gConversion Factor			
61 mLength of Ditch #00.25 mg/LConcentration of Hydrogen Sulfide Entering Ditch #00.0080Free Sulfide pH Adjustment1,000 L/m³Conversion Factor1,000 mg/gConversion Factor			
0.25 mg/LConcentration of Hydrogen Sulfide Entering Ditch #00.0080Free Sulfide pH Adjustment1,000 L/m³Conversion Factor1,000 mg/gConversion Factor			
0.0080Free Sulfide pH Adjustment1,000 L/m³Conversion Factor1,000 mg/gConversion Factor			
1,000 L/m³Conversion Factor1,000 mg/gConversion Factor			
1,000 mg/g Conversion Factor			
	4		_
0.0004428 x $3.65$ x $61$ x $0.25$ x $0.0080$ x $1000$ x		{	3
m m mg/L L/m 1	1000		ng

H2S emissions rate 0.0001936 g/s



Free Sulfide Fraction Calculation Tool		Convert Total Sulfide to H2S(dissolved)	
рН	8.94	Hydrogen Concentration	1.14815E-09
К1	1.036E-07	Hydrogen Concenration	1.14815E-12
К2	6.43E-16		

Free Fraction	1.096%	Convert Total Sulfide Measurement to H2	2S(dissolved)	
		5.5	96.8%	
		5.75	94.5%	
		6	90.6%	
		6.25	84.4%	
		6.5	75.3%	
		6.75	63.2%	
		7	49.1%	
		7.25	35.2%	
		7.5	23.4%	
		7.75	14.7%	
		8	8.8%	
		8.25	5.1%	
		8.5	3.0%	
		8.75	1.7%	
		9	1.0%	

#### Ditch #1 H2S Emissions Calculation

0.0004428 m/s	KL	<u>_</u>										
3.65 m	W	/idth of D	itch #1									
600 m	Le	ength of D	itch #1									
0.25 mg/L	Co	oncentrat	ion of Hydrog	gen Sulfide	e Entering Dite	ch #1						
0.011	Fr	ee Sulfide	e pH Adjustm	ent								
1,000 L/m <sup>3</sup>	Co	onversion	Factor									
1,000 mg/g	Co	onversion	Factor									
0.0004428 x	3.65	x	600	x	0.25	x	0.011	x	1000	x	1	g
m/s i	m		m		mg/L				L/m³		1000	mg

H2S emissions rate 0.00262 g/s



Free Sulfide Fraction Calculation Tool		Convert Total Sulfide to H2S(dissolved)	
рН	7.47	Hydrogen Concentration	3.38844E-08
К1	1.036E-07	Hydrogen Concenration	3.38844E-11
К2	6.43E-16		

Free Fraction	24.646%	Convert Total Sulfide Measurement to Ha	2S(dissolved)	
		5.5	96.8%	
		5.75	94.5%	
		6	90.6%	
		6.25	84.4%	
		6.5	75.3%	
		6.75	63.2%	
		7	49.1%	
		7.25	35.2%	
		7.5	23.4%	
		7.75	14.7%	
		8	8.8%	
		8.25	5.1%	
		8.5	3.0%	
		8.75	1.7%	
		9	1.0%	

#### Ditch #2 H2S Emissions Calculation

0.0004276 m/s	KL								
3.65 m	Width of Ditch #2	Width of Ditch #2							
500 m	Length of Ditch #2	Length of Ditch #2							
0.308 mg/L	Concentration of Hydrogen	Sulfide Entering Ditc	h #2						
0.246	Free Sulfide pH Adjustment								
1,000 L/m <sup>3</sup>									
1,000 mg/g	<b>Conversion Factor</b>								
0.0004276 x m/s m	3.65 x 500	x 0.31	x 0.246	х	1000 L/m <sup>3</sup>	x	1	_g mg	
111/3 111	111	ing/ L			L/ 111		1000	ing	

H2S emissions rate 0.05930 g/s

#### Equalization Basin H2S Emissions Calculation

4.2 49.12%	lb/day-acre	N Pe	NCASI SARA HB Emissions Factor for Sludge Pond Percent H2S emitted at average pH of ponds tested for NCASI emissions factor (average pH 7).						
1.881955 5.4%	acre	Free water surface Area of EQ Basin Percent H2S emitted at site-specific pH of 8.22							
4.2 lb/day-acre	× _	5.40% 49.12%	x	1 day 24 hrs	x	1.881955 acre	x	0.125998 g/s 1 lb/hr	

H2S emissions rate 0.00456 g/s

#### #4 Sludge Lagoon H2S Emissions Calculation

4.2 49.12% 10.92	lb/day-acre acre	N P F	NCASI SARA HB Emissions Factor for Sludge Pond Percent H2S emitted at average pH of ponds tested for NCASI emissions factor (average pH 7). Free water surface Area of #4 Sludge Lagoon					
5.4%		Percent H2S emitted at site-specific pH of 8.22						
4.2 Ib/day-acre	x	5.40% 49.12%	x	1 day 24 hrs	x	10.92 acre	x	0.125998 g/s 1 lb/hr
H2S emission 0.02647	s rate g/s							

Free Sulfide Fraction Calculation Tool		Convert Total Sulfide to H2S(dissolved)					
рН	8.23	Hydrogen Concentration	5.91562E-09				
К1	1.036E-07	Hydrogen Concenration	5.91562E-12				
К2	6.43E-16						
Free Fraction	5.402%	Convert Total Sulfide Measurement to	H2S(dissolved)				
		5.5	96.8%				
		5.75	94.5%				
		6	90.6%				
		6.25	84.4%				
		6.5	75.3%				
		6.75	63.2%				
		7	49.1%				
		7.25	35.2%				
		7.5	23.4%				
		7.75	14.7%				
		8	8.8%				
		8.25	5.1%				
		8.5	3.0%				

1.7%

1.0%

8.75 9



# HOLDING POND WATER9 ALS AVERAGE CONCENTRATIONS

1 2 3 Type of unit is 1 Total water added at the unit (l/s) 4 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 34 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 10 def.open trench 39 Type: open trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:55 COMPOUND: DIMETHYL DISULFIDE 41 42 43 Type of unit is open trench 44 1 Description of unit 10 def.open trench 45 2 Underflow T (C) 31.6 46 3 Total water added at the unit (1/s)0 47 8 Subsurface entrance=1 0 9 subsurface exit =1 48 0 49 10 width of trench (m) 3.65 50 11 distance to next unit (cm) 50000 12 slope of underflow conduit 51 0.015 52 13 depth of trench (m) 3 53 19 pH (enter 0 for no pH adjustment) 7.47 54 55 Trench model for mass transfer from a surface. 56 The effective depth of water flow (h) is 0.44324 ft. The water flow rate is 9.505e+05 cm3/s. 57 58 The velocity of the flow (v) is 6.32388 ft/s. The width of the unit is 365. cm. 59 60 The oxygen diffusion coefficient (ratio) adjustment factor is 0.55467. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 61 62 The liquid phase mass transfer coefficient from surface is 2.904e-04 m/s. The Schmidt number is 1.72847. 63 64 The friction velocity is 13.347 m/s

```
kg is estimated as 0.005209 m/s. Model: 3
 65
 66
            The slope of the U drain is 0.015
 67
            The water velocity is 192.752 cm/s. (6.32388 ft/s.)
 68
            The depth of the water is 13.51 cm (5.51429 in.)
 69
            Kl= 2.904e-04 m/s; Kg= 5.208595E-03 m/s
 70
            the ratio of the mass transfer to depth is 1.14422640253297E-03
 71
            The residence time in the trench is 259.4007 sec.
 72
            fraction emitted 0.25682
 73
               fraction loss in wastel drop to hub
                                                         0.
 74
               fraction loss in waste2 drop to hub
                                                        0
 75
               fraction loss in waste3 drop to hub
                                                        Ο.
 76
               fraction loss in collection hub drop
                                                        Ο.
 77
               fraction loss in unit
                                                        0.
 78
               fraction loss in line run
                                                        0.25682
 79
               component upstream of unit, g/s
                                                        0.009317
 80
               mol fract. headspace upstream (y)
                                                        1.585e-07
 81
               headspace at conduit discharge, y
                                                        Ο.
               headspace end of conduit (y)
 82
                                                        Ο.
               mol fract. headspace vent base
                                                        Ο.
 83
               headspace flow out vent (cc/s)
 84
                                                        Ο.
               headspace flow down line (cc/s)
 85
                                                        0.
                                                        0.005209
               KG surface (m/s)
 86
               KL surface (m/s)
 87
                                                        2.904e-04
               flow of waste down hub (1/s)
 88
                                                        0.
 89
               component flow in waste into unit (g/s) 0.
 90
               total component into unit, g/s
                                                        0.009317
               TOTAL AIR EMISSIONS (g/s)
 91
                                                        0.002393
 92
                                (Mg/year)
                                                        0.075461
 93
               EMISSION FACTOR (g/cm2-s)
                                                        1.311e-10
 94
               UNIT EXIT CONCENTRATION (ppmw)
                                                        0.007285
 95
            DETAILED CALCULATIONS at Unit 11 def.aerated biotre
 96
            Type: aerated biotreatment
 97
              Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
              Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG
              RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:55
 98
            COMPOUND: DIMETHYL DISULFIDE
 99
100
            Type of unit is aerated biotreatment
101
            1 Description of unit
                                                       11
                                                              def.aerated biotre
102
            2 Wastewater temperature
                                                              30.4
                                       (C)
103
            3 length of aeration unit (m)
                                                              818
104
           4 width of aeration unit (m)
                                                              475
                                                              8.5
105
            5 depth of aeration unit (m)
            6 Area of agitation (each aerator, m2)
                                                              47
106
107
            7 Total number of agitators in the unit
                                                              2
108
            8 Power of agitation (each aerator, HP)
                                                              75
109
            9 Impeller diameter (cm)
                                                              49.53
110
            10 Impeller rotation (RPM)
                                                              1200
111
            11 Agitator mechanical efficiency
                                                              0.83
112
            12 aerator effectiveness, alpha
                                                              0.83
113
            13 if there is plug flow, enter 1
                                                              Ο
114
            14 Overall biorate (mg/g bio-hr)
                                                              19
            15 Aeration air flow (m3/s)
115
                                                              0
            16 active biomass, aeration (g/l)
                                                              0.3
116
            17 If covered, then enter 1
117
                                                              0
            18 special input
118
                                                              0
119
            19 pH (enter 0 for no pH adjustment)
                                                              7.56
120
            Properties of DIMETHYL DISULFIDE at 30.4 deq.C (86.7 deq.F)
121
122
               hl= 0.001437 atm-m3/mol vp= 38.537 mmHg (0.74539 psia)
123
                   79.85 y/x
124
                   0.057737 g/L gas per g/L liquid
125
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
126
               k1=0. L/g-hr
                                      dl= 1.028e-05 cm2/s dv= 0.086185 cm2/s
127
            Compound flow rate from inlet water is 0.006924 g/s.
128
            Compound flow rate from inlet vent is 0. g/s.
```

Compound flow rate from inlet duct is 0. g/s. 129 130 Submerged aeration rate from inlet vent is 0. m3/s.131 Total submerged aeration is 0. m3/s. The residence time in the unit is 965.198 hr. 132 Biomass production 133 134 The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . 135 136 The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer 137 The fetch to depth ratio is 82.748. 138 139 kl is estimated as 5.923e-06 m/s. 140 kg is estimated as 0.005084 m/s. Model: 2 141 kg is estimated as 0.005084 m/s. Model: 2 The Schmidt number is 1.74044. 142 143 The friction velocity is 31.28 m/s 144 kg is estimated as 0.010834 m/s. Model: 3 \_\_Agitated surface\_ 145 The rotation speed is 125.654 radians per second. 146 The rotation factor NRW is 2.052e+06. 147 The power number NPR is 7.881e-04. 148 The rotation factor NFR is 797.027. 149 kg (agitated) is estimated as 0.11443 m/s. 150 151 kl (agitated) is estimated as 0.045752 m/s. 152 The specified and growth biomass is 0.3 g/L. 153 The effective KL (surface + diffused air) is 7.251e-06 m/s. 154 The effective stripping time (surface + diffused air) is 1.954e+04 minutes. (325.645 hrs.) 155 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 156 The ratio of the mixing to the striping (surface + diffused air) is 0. 157 The mean residence time is 5.791e+04 min. (965.198 hr.) 158 The ratio of the pump mixing to the residence time is 0. 159 KG aerated (m/s) 0.11657 160 KL aerated (m/s) 0.045752 161 KL OVERALL AERATED (m/s) 0.00596 162 KG quiescent (m/s) 0.005179 KL quiescent (m/s) 163 5.923e-06 5.81e-06 164 KL OVERALL QUIESCENT (m/s) 165 KL OVERALL (m/s) 7.251e-06 1.954e+04 166 air stripping time constant (min) 167 0.002996 FRACTION SURFACE VOLATILIZED 168 FRACTION SUBMERGED VOLATILIZED 0. 169 TOTAL FRACTION VOLATILIZED 0.002996 170 FRACTION BIOLOGICALLY REMOVED 0.99599 FRACTION ABSORBED 171 0. TOTAL AIR EMISSIONS (g/s) 172 2.075e-05 173 (Mg/year) 6.542e-04 EMISSION FACTOR (g/cm2-s) 174 5.339e-15 175 UNIT EXIT CONCENTRATION (ppmw) 7.364e-06 176 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream 177 178 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:55 COMPOUND: DIMETHYL DISULFIDE 179 180 181 Type of unit is system exit stream 182 1 Description of unit 12 def.system exit st 183 TOTAL AIR EMISSIONS (q/s) 184 0. 185 (Mg/year) Ο. 186 EMISSION FACTOR (g/cm2-s) 5.339e-15 187 UNIT EXIT CONCENTRATION (ppmw) 7.364e-06 188 DETAILED CALCULATIONS at Unit 13 default open hub d 189 Type: open hub drain 190 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG
RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:55 COMPOUND: DIMETHYL DISULFIDE 191 192 193 Type of unit is open hub drain 194 1 Description of unit 13 default open hub d 195 2 Underflow T (C) 31.6 3 Total water added at the unit (1/s)0 196 4 Area of openings at unit (cm2) 50 197 5 Radius of drop pipe (cm) 5 198 199 6 Drop length to conduit (cm) 61 200 7 Open surface=1 0 201 8 Subsurface entrance=1 0 202 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 12 203 204 11 distance to next unit (cm) 500 205 12 slope of underflow conduit 0.015 206 16 velocity air at drain opening (ft/min) 84 207 17 municipal waste in conduit =1 0 208 18 Assume equilibrium in unit, =1 Ο 19 pH (enter 0 for no pH adjustment) 209 7.47 210 211 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 950.489 l/s. 212 Weight fraction down is 1.04E-08 213 Gas concentration in 0 mol fraction. 214 Gas flow 950.489 L/s 215 Weight fraction out at base of drop is 9.80262324051644E-09 216 fraction transferred in the drain drop from hub is .05744 217 218 fraction loss in wastel drop to hub 0. 219 fraction loss in waste2 drop to hub Ο. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.05744 220 fraction loss in waste3 drop to hub 221 fraction loss in unit 222 0. 223 fraction loss in line run -9.996e-08 224 component upstream of unit, g/s Ο. mol fract. headspace upstream (y) 225 0. headspace at conduit discharge, y 1.585e-07 226 headspace end of conduit (y) 227 1.585e-07 mol fract. headspace vent base 1.585e-07 228 headspace flow out vent (cc/s) 229 -9.505e+05 230 headspace flow down line (cc/s) 9.505e+05 KG surface (m/s) 231 1621.827 KL surface (m/s) 232 5.743e-09 flow of waste down hub (l/s) 233 Ο. 234 component flow in waste into unit (g/s) 0.009885 235 total component into unit, g/s 0.009317 236 TOTAL AIR EMISSIONS (g/s) Ο. (Mg/year) EMISSION FACTOR (g/cm2-s) 237 0. 238 5.339e-15 239 UNIT EXIT CONCENTRATION (ppmw) 0.009803 240 DETAILED CALCULATIONS at Unit 14 default open hub d 241 Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 242 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:55 243 COMPOUND: DIMETHYL DISULFIDE 244 245 Type of unit is open hub drain 1 Description of unit 14 default open hub d 246 247 2 Underflow T (C) 25 248 3 Total water added at the unit (1/s)0 50 249 4 Area of openings at unit (cm2) 250 5 Radius of drop pipe (cm) 5 251 6 Drop length to conduit (cm) 61 7 Open surface=1 252 0 253 8 Subsurface entrance=1 0

254	9 subsurface exit =1	0
255	10 radius of underflow conduit (cm)	12
256	11 distance to next unit (cm)	500
257	12 slope of underflow conduit	0.015
258	16 velocity air at drain opening (ft/min)	84
259	17 municipal waste in conduit =1	0
260	18 Assume equilibrium in unit, =1	0
261	19 pH (enter 0 for no pH adjustment)	0
262		
263	fraction loss in wastel drop to hub	0.
264	fraction loss in waste2 drop to hub	0.
265	fraction loss in waste3 drop to hub	0.
266	fraction loss in collection hub drop	0.
267	fraction loss in unit	0.
268	fraction loss in line run	0.
269	component upstream of unit, g/s	0.
270	mol fract. headspace upstream (y)	0.
271	headspace at conduit discharge, y	0.
272	headspace end of conduit (y)	0.
273	mol fract. headspace vent base	0.
274	headspace flow out vent (cc/s)	0.43059
275	headspace flow down line (cc/s)	-0.01876
276	KG surface (m/s)	0.00101
277	KL surface (m/s)	1.8e-21
278	flow of waste down hub (l/s)	0.
279	component flow in waste into unit (g/s)	0.
280	total component into unit, g/s	0.
281	TOTAL AIR EMISSIONS (g/s)	0.
282	(Mg/year)	0.
283	EMISSION FACTOR (g/cm2-s)	5.339e-15
284	UNIT EXIT CONCENTRATION (ppmw)	0.
285		

1 2 3 Type of unit is 1 Total water added at the unit (l/s) 4 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 34 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 10 def.open trench 39 Type: open trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:28 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is open trench 44 1 Description of unit 10 def.open trench 45 2 Underflow T (C) 31.6 46 3 Total water added at the unit (1/s)0 47 8 Subsurface entrance=1 0 9 subsurface exit =1 48 0 49 10 width of trench (m) 3.65 50 11 distance to next unit (cm) 50000 12 slope of underflow conduit 51 0.015 52 13 depth of trench (m) 3 53 19 pH (enter 0 for no pH adjustment) 7.47 54 55 Trench model for mass transfer from a surface. 56 The effective depth of water flow (h) is 0.44324 ft. The water flow rate is 9.505e+05 cm3/s. 57 58 The velocity of the flow (v) is 6.32388 ft/s. The width of the unit is 365. cm. 59 60 The oxygen diffusion coefficient (ratio) adjustment factor is 0.75312. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 61 62 The liquid phase mass transfer coefficient from surface is 3.943e-04 m/s. The Schmidt number is 1.03042. 63 64 The friction velocity is 13.347 m/s

kg is estimated as 0.006957 m/s. Model: 3 65 66 The slope of the U drain is 0.015 67 The water velocity is 192.752 cm/s. (6.32388 ft/s.) 68 The depth of the water is 13.51 cm (5.51429 in.) 69 Kl= 3.943e-04 m/s; Kg= 6.956951E-03 m/s 70 the ratio of the mass transfer to depth is 1.9339408383684E-03 71 The residence time in the trench is 259.4007 sec. 72 fraction emitted 0.39448 73 fraction loss in wastel drop to hub 0. 74 fraction loss in waste2 drop to hub 0 75 fraction loss in waste3 drop to hub Ο. 76 fraction loss in collection hub drop Ο. 77 fraction loss in unit 0. 78 fraction loss in line run 0.39448 79 component upstream of unit, g/s 0.007986 80 mol fract. headspace upstream (y) 3.614e-07 81 headspace at conduit discharge, y Ο. headspace end of conduit (y) 82 Ο. mol fract. headspace vent base Ο. 83 headspace flow out vent (cc/s) 84 Ο. headspace flow down line (cc/s) 85 0. 0.006957 KG surface (m/s) 86 KL surface (m/s) 87 3.943e-04 flow of waste down hub (1/s) 88 0. 89 component flow in waste into unit (g/s) 0. 90 total component into unit, g/s 0.007986 TOTAL AIR EMISSIONS (g/s) 91 0.00315 92 (Mg/year) 0.099346 93 EMISSION FACTOR (g/cm2-s) 1.726e-10 94 UNIT EXIT CONCENTRATION (ppmw) 0.005087 95 DETAILED CALCULATIONS at Unit 11 def.aerated biotre 96 Type: aerated biotreatment 97 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:28 98 COMPOUND: DIMETHYL SULFIDE (DMS) 99 100 Type of unit is aerated biotreatment 101 1 Description of unit 11 def.aerated biotre 102 2 Wastewater temperature 30.4 (C) 103 3 length of aeration unit (m) 818 104 4 width of aeration unit (m) 475 8.5 105 5 depth of aeration unit (m) 6 Area of agitation (each aerator, m2) 47 106 107 7 Total number of agitators in the unit 2 108 8 Power of agitation (each aerator, HP) 75 109 9 Impeller diameter (cm) 49.53 110 10 Impeller rotation (RPM) 1200 111 11 Agitator mechanical efficiency 0.83 112 12 aerator effectiveness, alpha 0.83 113 13 if there is plug flow, enter 1 Ο 114 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 115 0 16 active biomass, aeration (g/l) 0.3 116 17 If covered, then enter 1 117 0 18 special input 118 0 119 19 pH (enter 0 for no pH adjustment) 7.56 120 Properties of DIMETHYL SULFIDE (DMS) at 30.4 deq.C (86.7 deq.F) 121 122 hl= 0.002556 atm-m3/mol vp= 615.845 mmHg (11.912 psia) 123 141.988 y/x 124 0.10267 g/L gas per g/L liquid 125 Temperature adjustment factor = 1.046 ^(T-25), deg. C 126 k1=0. L/g-hrdl= 1.486e-05 cm2/s dv= 0.14457 cm2/s Compound flow rate from inlet water is 0.004836 g/s. 127 128 Compound flow rate from inlet vent is 0. g/s.

Compound flow rate from inlet duct is 0. g/s. 129 130 Submerged aeration rate from inlet vent is 0. m3/s.131 Total submerged aeration is 0. m3/s. The residence time in the unit is 965.198 hr. 132 Biomass production 133 The biomass production rate is 0.mg/hr. (0. mg/L) 134 The fraction dissolved solids converted is 0. . 135 136 The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer 137 The fetch to depth ratio is 82.748. 138 139 kl is estimated as 7.572e-06 m/s. 140 kg is estimated as 0.007189 m/s. Model: 2 141 kg is estimated as 0.007189 m/s. Model: 2 The Schmidt number is 1.03756. 142 143 The friction velocity is 31.28 m/s 144 kg is estimated as 0.014912 m/s. Model: 3 \_\_Agitated surface\_ 145 The rotation speed is 125.654 radians per second. 146 The rotation factor NRW is 2.052e+06. 147 The power number NPR is 7.881e-04. 148 The rotation factor NFR is 797.027. 149 kg (agitated) is estimated as 0.1482 m/s. 150 151 kl (agitated) is estimated as 0.055007 m/s. 152 The specified and growth biomass is 0.3 g/L. 153 The effective KL (surface + diffused air) is 1.046e-05 m/s. 154 The effective stripping time (surface + diffused air) is 1.354e+04 minutes. (225.655 hrs.) 155 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 156 The ratio of the mixing to the striping (surface + diffused air) is 0. 157 The mean residence time is 5.791e+04 min. (965.198 hr.) 158 The ratio of the pump mixing to the residence time is 0. 159 KG aerated (m/s) 0.15098 160 KL aerated (m/s) 0.055007 161 KL OVERALL AERATED (m/s) 0.012264 162 KG quiescent (m/s) 0.007324 KL quiescent (m/s) 163 7.572e-06 164 KL OVERALL QUIESCENT (m/s) 7.498e-06 165 KL OVERALL (m/s) 1.046e-05 166 air stripping time constant (min) 1.354e+04 167 0.018853 FRACTION SURFACE VOLATILIZED FRACTION SUBMERGED VOLATILIZED 168 0. 169 TOTAL FRACTION VOLATILIZED 0.018853 170 FRACTION BIOLOGICALLY REMOVED 0.97674 FRACTION ABSORBED 171 Ο. 172 TOTAL AIR EMISSIONS (g/s) 9.116e-05 173 (Mg/year) 0.002875 EMISSION FACTOR (g/cm2-s) 174 2.346e-14 175 UNIT EXIT CONCENTRATION (ppmw) 2.242e-05 176 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream 177 178 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:28 179 COMPOUND: DIMETHYL SULFIDE (DMS) 180 181 Type of unit is system exit stream 182 1 Description of unit 12 def.system exit st 183 TOTAL AIR EMISSIONS (q/s) 184 0. 185 (Mg/year) Ο. 186 EMISSION FACTOR (g/cm2-s) 2.346e-14 187 UNIT EXIT CONCENTRATION (ppmw) 2.242e-05 188 DETAILED CALCULATIONS at Unit 13 default open hub d 189 Type: open hub drain 190 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG

RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:28 191 COMPOUND: DIMETHYL SULFIDE (DMS) 192 193 Type of unit is open hub drain 194 1 Description of unit 13 default open hub d 195 2 Underflow T (C) 31.6 3 Total water added at the unit (1/s)0 196 50 197 4 Area of openings at unit (cm2) 5 Radius of drop pipe (cm) 5 198 199 6 Drop length to conduit (cm) 61 200 7 Open surface=1 0 201 8 Subsurface entrance=1 0 202 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 203 12 204 11 distance to next unit (cm) 500 205 12 slope of underflow conduit 0.015 206 16 velocity air at drain opening (ft/min) 84 207 17 municipal waste in conduit =1 0 208 18 Assume equilibrium in unit, =1 Ω 19 pH (enter 0 for no pH adjustment) 209 7.47 210 211 Equilibrium partitioning in drain drop hub is assumed. 212 Total drain flow is 950.489 1/s. Weight fraction down is 9.300001E-09 213 Gas concentration in 0 mol fraction. 214 215 Gas flow 950.489 L/s Weight fraction out at base of drop is 8.40183103595816E-09 216 fraction transferred in the drain drop from hub is .096577 217 218 fraction loss in wastel drop to hub Ο. 219 fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub0.fraction loss in collection hub drop0.096577 220 fraction loss in waste3 drop to hub 221 222 fraction loss in unit Ο. 223 fraction loss in line run 0. component upstream of unit, g/s 224 0. 225 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 226 3.614e-07 headspace end of conduit (y) 227 3.614e-07 mol fract. headspace vent base 3.613e-07 228 headspace flow out vent (cc/s) 229 -9.505e+05 230 headspace flow down line (cc/s) 9.505e+05 KG surface (m/s) 231 2290.047 KL surface (m/s) 232 7.434e-09 flow of waste down hub (l/s) 233 Ο. 234 component flow in waste into unit (g/s) 0.00884 235 total component into unit, g/s 0.007986 236 TOTAL AIR EMISSIONS (g/s) Ο. 237 0. (Mg/year) EMISSION FACTOR (g/cm2-s) 238 2.346e-14 239 UNIT EXIT CONCENTRATION (ppmw) 0.008402 240 DETAILED CALCULATIONS at Unit 14 default open hub d 241 Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 242 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:25:28 243 COMPOUND: DIMETHYL SULFIDE (DMS) 244 245 Type of unit is open hub drain 1 Description of unit 14 default open hub d 246 247 2 Underflow T (C) 25 248 3 Total water added at the unit (1/s)0 249 4 Area of openings at unit (cm2) 50 250 5 Radius of drop pipe (cm) 5 251 6 Drop length to conduit (cm) 61 7 Open surface=1 252 0 253 8 Subsurface entrance=1 0

254	9 subsurface exit =1	0
255	10 radius of underflow conduit (cm)	12
256	11 distance to next unit (cm)	500
257	12 slope of underflow conduit	0.015
258	16 velocity air at drain opening (ft/min)	84
259	17 municipal waste in conduit =1	0
260	18 Assume equilibrium in unit, =1	0
261	19 pH (enter 0 for no pH adjustment)	0
262		
263	fraction loss in wastel drop to hub	0.
264	fraction loss in waste2 drop to hub	0.
265	fraction loss in waste3 drop to hub	0.
266	fraction loss in collection hub drop	0.
267	fraction loss in unit	0.
268	fraction loss in line run	0.
269	component upstream of unit, g/s	0.
270	mol fract. headspace upstream (y)	0.
271	headspace at conduit discharge, y	0.
272	headspace end of conduit (y)	0.
273	mol fract. headspace vent base	0.
274	headspace flow out vent (cc/s)	-0.2153
275	headspace flow down line (cc/s)	-0.01876
276	KG surface (m/s)	0.001426
277	KL surface (m/s)	1.8e-21
278	flow of waste down hub (l/s)	0.
279	component flow in waste into unit (g/s)	0.
280	total component into unit, g/s	0.
281	TOTAL AIR EMISSIONS (g/s)	0.
282	(Mg/year)	0.
283	EMISSION FACTOR (g/cm2-s)	2.346e-14
284	UNIT EXIT CONCENTRATION (ppmw)	0.
285		

1 2 3 Type of unit is 1 Total water added at the unit (1/s) 4 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 34 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 10 def.open trench 39 Type: open trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:23:40 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is open trench 44 1 Description of unit 10 def.open trench 45 2 Underflow T (C) 31.6 46 3 Total water added at the unit (1/s)0 47 8 Subsurface entrance=1 0 9 subsurface exit =1 48 0 49 10 width of trench (m) 3.65 50 11 distance to next unit (cm) 50000 12 slope of underflow conduit 51 0.015 52 13 depth of trench (m) 3 53 19 pH (enter 0 for no pH adjustment) 7.47 54 55 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.44324 ft. 56 The water flow rate is 9.505e+05 cm3/s. 57 58 The velocity of the flow (v) is 6.32388 ft/s. The width of the unit is 365. cm. 59 60 The oxygen diffusion coefficient (ratio) adjustment factor is 0.76167. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 61 62 The liquid phase mass transfer coefficient from surface is 3.988e-04 m/s. The Schmidt number is 0.64189. 63 64 The friction velocity is 13.347 m/s

kg is estimated as 0.009184 m/s. Model: 3 65 66 The slope of the U drain is 0.015 67 The water velocity is 192.752 cm/s. (6.32388 ft/s.) 68 The depth of the water is 13.51 cm (5.51429 in.) 69 Kl= 3.988e-04 m/s; Kg= 9.18442E-03 m/s 70 the ratio of the mass transfer to depth is 2.32502892978858E-03 71 The residence time in the trench is 259.4007 sec. 72 fraction emitted 0.45289 73 fraction loss in wastel drop to hub 0. 74 fraction loss in waste2 drop to hub 0 75 fraction loss in waste3 drop to hub Ο. 76 fraction loss in collection hub drop Ο. 77 fraction loss in unit 0. 78 fraction loss in line run 0.45289 79 component upstream of unit, g/s 0.005927 80 mol fract. headspace upstream (y) 5.012e-07 81 headspace at conduit discharge, y Ο. headspace end of conduit (y) 82 Ο. mol fract. headspace vent base Ο. 83 headspace flow out vent (cc/s) 84 Ο. headspace flow down line (cc/s) 85 0. 0.009184 KG surface (m/s) 86 KL surface (m/s) 3.988e-04 87 flow of waste down hub (1/s) 88 0. 89 component flow in waste into unit (g/s) 0. 90 total component into unit, g/s 0.005927 91 TOTAL AIR EMISSIONS (g/s) 0.002684 92 (Mg/year) 0.084649 93 EMISSION FACTOR (g/cm2-s) 1.471e-10 94 UNIT EXIT CONCENTRATION (ppmw) 0.003411 DETAILED CALCULATIONS at Unit 11 def.aerated biotre 95 96 Type: aerated biotreatment 97 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:23:40 98 COMPOUND: METHANETHIOL(methyl mercaptan) 99 100 Type of unit is aerated biotreatment 101 1 Description of unit 11 def.aerated biotre 102 2 Wastewater temperature 30.4 (C) 103 3 length of aeration unit (m) 818 104 4 width of aeration unit (m) 475 8.5 105 5 depth of aeration unit (m) 6 Area of agitation (each aerator, m2) 47 106 107 7 Total number of agitators in the unit 2 108 8 Power of agitation (each aerator, HP) 75 109 9 Impeller diameter (cm) 49.53 110 10 Impeller rotation (RPM) 1200 111 11 Agitator mechanical efficiency 0.83 112 12 aerator effectiveness, alpha 0.83 113 13 if there is plug flow, enter 1 Ο 114 14 Overall biorate (mg/g bio-hr) 19 15 Aeration air flow (m3/s) 115 0 16 active biomass, aeration (g/l) 0.3 116 17 If covered, then enter 1 117 0 18 special input 118 0 19 pH (enter 0 for no pH adjustment) 119 7.56 120 Properties of METHANETHIOL(methyl mercaptan) at 30.4 deq.C (86.7 deq.F) 121 122 hl= 0.00373 atm-m3/mol vp= 2038.439 mmHg (39.428 psia) 123 207.231 y/x 124 0.14984 g/L gas per g/L liquid 125 Temperature adjustment factor = 1.046 ^(T-25), deg. C 126 k1=0. L/g-hrdl= 1.507e-05 cm2/s dv= 0.23208 cm2/s 127 Compound flow rate from inlet water is 0.003243 g/s. 128 Compound flow rate from inlet vent is 0. g/s.

Compound flow rate from inlet duct is 0. g/s. 129 130 Submerged aeration rate from inlet vent is 0. m3/s.131 Total submerged aeration is 0. m3/s. The residence time in the unit is 965.198 hr. 132 Biomass production 133 134 The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . 135 136 The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer 137 The fetch to depth ratio is 82.748. 138 139 kl is estimated as 7.641e-06 m/s. 140 kg is estimated as 0.009872 m/s. Model: 2 141 kg is estimated as 0.009872 m/s. Model: 2 The Schmidt number is 0.64634. 142 143 The friction velocity is 31.28 m/s 144 kg is estimated as 0.020108 m/s. Model: 3 \_\_Agitated surface\_ 145 The rotation speed is 125.654 radians per second. 146 The rotation factor NRW is 2.052e+06. 147 The power number NPR is 7.881e-04. 148 The rotation factor NFR is 797.027. 149 kg (agitated) is estimated as 0.18777 m/s. 150 151 kl (agitated) is estimated as 0.055383 m/s. 152 The specified and growth biomass is 0.3 g/L. 153 The effective KL (surface + diffused air) is 1.223e-05 m/s. 154 The effective stripping time (surface + diffused air) is 1.159e+04 minutes. (193.128 hrs.) 155 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 156 The ratio of the mixing to the striping (surface + diffused air) is 0. 157 The mean residence time is 5.791e+04 min. (965.198 hr.) 158 The ratio of the pump mixing to the residence time is 0. 159 KG aerated (m/s) 0.19129 160 KL aerated (m/s) 0.055383 161 KL OVERALL AERATED (m/s) 0.019113 162 KG quiescent (m/s) 0.010057 KL quiescent (m/s) 163 7.641e-06 164 KL OVERALL QUIESCENT (m/s) 7.604e-06 165 KL OVERALL (m/s) 1.223e-05 166 air stripping time constant (min) 1.159e+04 167 0.034475 FRACTION SURFACE VOLATILIZED 168 FRACTION SUBMERGED VOLATILIZED 0. 169 TOTAL FRACTION VOLATILIZED 0.034475 170 FRACTION BIOLOGICALLY REMOVED 0.95863 FRACTION ABSORBED 171 Ο. TOTAL AIR EMISSIONS (g/s) 172 1.118e-04 173 (Mg/year) 0.003525 EMISSION FACTOR (g/cm2-s) 174 2.877e-14 175 UNIT EXIT CONCENTRATION (ppmw) 2.353e-05 176 DETAILED CALCULATIONS at Unit 12 def.system exit st Type: system exit stream 177 178 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:23:40 179 COMPOUND: METHANETHIOL(methyl mercaptan) 180 181 Type of unit is system exit stream 182 1 Description of unit 12 def.system exit st 183 TOTAL AIR EMISSIONS (q/s) 184 0. 185 (Mg/year) Ο. 186 EMISSION FACTOR (g/cm2-s) 2.877e-14 187 UNIT EXIT CONCENTRATION (ppmw) 2.353e-05 188 DETAILED CALCULATIONS at Unit 13 default open hub d 189 Type: open hub drain 190 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG

RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:23:40 191 COMPOUND: METHANETHIOL(methyl mercaptan) 192 193 Type of unit is open hub drain 194 1 Description of unit 13 default open hub d 195 2 Underflow T (C) 31.6 3 Total water added at the unit (1/s)0 196 50 197 4 Area of openings at unit (cm2) 5 Radius of drop pipe (cm) 5 198 199 6 Drop length to conduit (cm) 61 200 7 Open surface=1 0 201 8 Subsurface entrance=1 0 202 9 subsurface exit =1 0 10 radius of underflow conduit (cm) 12 203 204 11 distance to next unit (cm) 500 205 12 slope of underflow conduit 0.015 206 16 velocity air at drain opening (ft/min) 84 207 17 municipal waste in conduit =1 0 208 18 Assume equilibrium in unit, =1 Ο 209 19 pH (enter 0 for no pH adjustment) 7.47 210 211 Equilibrium partitioning in drain drop hub is assumed. 212 Total drain flow is 950.489 1/s. Weight fraction down is 7.2E-09 213 Gas concentration in 0 mol fraction. 214 215 Gas flow 950.489 L/s Weight fraction out at base of drop is 6.23546093564362E-09 216 fraction transferred in the drain drop from hub is .133964 217 218 fraction loss in wastel drop to hub 0. 219 fraction loss in waste2 drop to hub 0. 220 fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 0.13396 221 222 fraction loss in unit Ο. 223 fraction loss in line run Ο. component upstream of unit, g/s 224 0. 225 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 5.012e-07 226 headspace end of conduit (y) 5.012e-07 227 mol fract. headspace vent base 5.011e-07 228 headspace flow out vent (cc/s) 229 -9.505e+05 230 headspace flow down line (cc/s) 9.505e+05 KG surface (m/s) 231 3140.126 KL surface (m/s) 232 7.505e-09 flow of waste down hub (l/s) 233 Ο. 234 component flow in waste into unit (g/s) 0.006844 235 total component into unit, g/s 0.005927 236 TOTAL AIR EMISSIONS (g/s) Ο. 237 0. (Mg/year) EMISSION FACTOR (g/cm2-s) 238 2.877e-14 239 UNIT EXIT CONCENTRATION (ppmw) 0.006235 240 DETAILED CALCULATIONS at Unit 14 default open hub d 241 Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 242 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\IPT Holding Pond ALS AVG 6/28/2022 5:25:58 PM 10:23:40 243 COMPOUND: METHANETHIOL(methyl mercaptan) 244 245 Type of unit is open hub drain 1 Description of unit default open hub d 246 14 247 2 Underflow T (C) 25 248 3 Total water added at the unit (1/s)0 50 249 4 Area of openings at unit (cm2) 250 5 Radius of drop pipe (cm) 5 251 6 Drop length to conduit (cm) 61 7 Open surface=1 252 0 253 8 Subsurface entrance=1 0

254	9 subsurface exit =1	0
255	10 radius of underflow conduit (cm)	12
256	Il distance to next unit (cm)	500
257	12 slope of underflow conduit	0.015
258	16 velocity air at drain opening (ft/min)	84
259	17 municipal waste in conduit =1	0
260	18 Assume equilibrium in unit, =1	0
261	19 pH (enter 0 for no pH adjustment)	0
262		
263	fraction loss in wastel drop to hub	0.
264	fraction loss in waste2 drop to hub	0.
265	fraction loss in waste3 drop to hub	0.
266	fraction loss in collection hub drop	0.
267	fraction loss in unit	0.
268	fraction loss in line run	0.
269	component upstream of unit, g/s	0.
270	mol fract. headspace upstream (y)	0.
271	headspace at conduit discharge, y	0.
272	headspace end of conduit (y)	0.
273	mol fract. headspace vent base	0.
274	headspace flow out vent (cc/s)	0.2153
275	headspace flow down line (cc/s)	-0.01876
276	KG surface (m/s)	0.001955
277	KL surface (m/s)	1.8e-21
278	flow of waste down hub (l/s)	0.
279	component flow in waste into unit (g/s)	0.
280	total component into unit, g/s	0.
281	TOTAL AIR EMISSIONS (g/s)	0.
282	(Mg/year)	0.
283	EMISSION FACTOR (g/cm2-s)	2.877e-14
284	UNIT EXIT CONCENTRATION (ppmw)	0.
285		

## NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

0

1.625

1200

0

0.38

ΗP

RPM

meters -

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feet

cms

Data Type 1. Site Ide	ntification			_	Data Type 5. Zone Physic	cal and Chemical	Conditions				7/9/2021 - 7/11/202	21 Average
Company Na	ame	New	-Indy		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	Model Cont	rols
Facility Nar	me	Cataw	vba SC		Dissolved Oxygen	0				mg/L		
Basin Nam	ne	Primary	Clarifier		Temperature	111.9				F	Run H2SS	M
Data Type 2. Model Z	Zone Informa	tion			рН	9.08				s.u.		
Number of Zones	1 –				Redox Condition	Anoxic 🔽	Aerobic 🔽	Aerobic 🔻	Aerobic 🔫		View	
Zone Location of Hardpipe	None				Length	243.7				feet 🚽	Paramete	rs
Type of Basin	PC -				Width	243.7				feet 🚽	Clear Inp	ut
Data Type 3. Load Ch	aracteristics			_	Depth	5.41				meters 🔫	Sheet	
Loading	Main				Mixing	Moderat -	Moderat -	Moderat -				
Characteristics	Influent	Hardpipe	Units		8							
Flow	21.35	0	MGD -		Number of Aerators	0						

Total Horsepower

Impellor Size

Impellor RPM

Diffused Air Flow

Weir Height

Data Type 4. Atmospheric Conditions

Total Sulfide

Sulfate

Windspeed	3.79	mph 🚽
Ambient	79	F 🚽
remperature		

0.24657041

390

mg/L 🔫

mg/L 🔫

0

0

## **H2SSIM Results**

<b>Basin Emissions</b>		Units			
Total Emissions (H <sub>2</sub> S)	0.000	gms/s			
Total Emissions (H <sub>2</sub> S)	11.6	lbs/yr			
Total Emissions (H <sub>2</sub> S)	0.0	tons/yr			
Total Emissions (H <sub>2</sub> S)	0.0	tonnes/yr			
Emission Flux (H <sub>2</sub> S)	1.0	gms/m² yr			
Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions $(H_2S)$	0.00				gms/s
Zone Emissions (H <sub>2</sub> S)	11.6				lbs/yr
Emission Flux (H <sub>2</sub> S)	1.0				gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.472				mg/L
Liquid Sulfide Load (lbs/yr)	4839.400				lbs/yr

Current Parameters				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	2500			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

**Percent Inlet Sulfide Removed** 

69.7%

## 7/9/2021 - 7/11/2021 Average

## PRIMARY CLARIFIER WATER9 ALS AVERAGE CONCENTRATIONS

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 14 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 19 25 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 8 HL partition flag=1, adjust for sorption 0 26 9 unit recycle convergence number 200 27 10 oil molecular weight Ο 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 14 parts biomass per 1000 parts COD 31 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 1 def.Closed trench 39 Type: Closed trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 COMPOUND: DIMETHYL DISULFIDE 41 42 43 Type of unit is Closed trench 44 1 Description of unit 1 def.Closed trench 45 2 Underflow T (C) 44.4 46 3 Total water added at the unit (1/s) 0 47 4 Area of openings at unit (cm2) 50 5 Radius of drop pipe (cm) 5 48 49 6 Drop length to conduit (cm) 61 50 7 Open surface=1 0 8 Subsurface entrance=1 1 51 9 subsurface exit =1 52 1 53 10 width of trench (m) 1.2 54 11 distance to next unit (cm) 500 55 12 slope of underflow conduit 0.015 56 13 depth of trench (m) 1.2 16 velocity air at opening (ft/min) 57 84 58 17 municipal waste in conduit =1 0 59 18 Assume equilibrium in unit, =1 0 60 19 pH (enter 0 for no pH adjustment) 9.08 61 62 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 63 The water flow rate is 9.356e+05 cm3/s. 64

The velocity of the flow (v) is 8.35415 ft/s. 65 The width of the unit is 120. cm. 66 67 The oxygen diffusion coefficient (ratio) adjustment factor is 0.57394. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 68 69 The liquid phase mass transfer coefficient from surface is 1.806e-04 m/s. 70 71 Covered Ground Level Trench (U drain); UNIT: 1 72 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 73 74 Length 0.5382 ft; Friction Factor0. Manning coef 0. 75 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 76 Velocity 254.6344 cm/s; Flow 0. gal/min 77 \_\_\_\_drag\_ 78 average water velocity 254.634 cm/s. Fraction full: 0.25515 79 average water surface velocity 288.957cm/sec 80 velocity of air from internal recirculation 144.479 cm/sec 81 Reynolds number for internal air flow 9.705e+04 82 83 Properties of DIMETHYL DISULFIDE at 44.4 deg.C (111.9 deg.F) 84 hl= 0.002733 atm-m3/mol vp= 73.279 mmHg (1.41737 psia) 85 151.837 y/x 86 0.10494 g/L gas per g/L liquid 87 Temperature adjustment factor = 1.046 (T-25), deq. C dl= 1.076e-05 cm2/s dv= 0.093261 cm2/s 88 kl = 0. L/g-hr89 \_loss due to mass transfer in conduit run\_ 90 The length of the run of conduit line is 5. m (16.404 ft.) 91 Flow of headspace gas in the conduit run\_\_\_\_0. L/s 92 the pressure gradient for the headspace flow is 0. gf/cm2 93 the headspace area of the sewer 1.073e+04 cm2 94 the headspace average velocity is 0. cm/s. 95 the headspace recirculation velocity is 144.479 cm/s. 96 Flow of water in the conduit run\_\_\_\_935.575 L/s 97 the width of the surface is 120. cm. 98 the depth of the liquid is 30.618 cm. (12.054 in.) the average depth of the liquid is 30.618 cm. (12.054 in.) 99 100 fraction full of liquid is 0.25515 101 the residence time of the liquid is 1.9636 s. 102 The oil corrected aqueous HL is 1.518e+02 (y/x) 103 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) 104 Velocity of headspace in sewer 0. cm/sec (0. M.P.H.) (0.ft/min) 105 fraction loss in wastel drop to hub Ο. 106 fraction loss in waste2 drop to hub Ο. 107 fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 108 0. 109 fraction loss in unit Ο. 110 fraction loss in line run Ο. 111 component upstream of unit, g/s 0. 112 mol fract. headspace upstream (y) 0. 113 headspace at conduit discharge, y 0. 114 headspace end of conduit (y) 0. 115 mol fract. headspace vent base 0. headspace flow out vent (cc/s) 116 0. headspace flow down line (cc/s) 117 Ο. KG surface (m/s) 118 Ο. KL surface (m/s) 119 1.806e-04 flow of waste down hub (1/s) 120 Ο. 121 component flow in waste into unit (g/s) 0.092435 122 total component into unit, g/s 0.092435 123 TOTAL AIR EMISSIONS (g/s) 0. 124 (Mg/year) 0. 4.716e-09 125 EMISSION FACTOR (g/cm2-s) 126 UNIT EXIT CONCENTRATION (ppmw) 0.0988 127 DETAILED CALCULATIONS at Unit 2 def.primary munici 128 Type: primary municipal clarifier 129 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG

RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 130 COMPOUND: DIMETHYL DISULFIDE 131 Type of unit is primary municipal clarifier 132 133 1 Description of unit 2 def.primary munici 134 2 Wastewater temperature (C) 44.4 3 primary clarifier diameter (m) 84 135 4 primary clarifier depth (m) 5.41 136 5 clarifier solids removal efficiency 0.7 137 138 6 waterfall drop height (cm) 38 139 7 clarifier weir/circumference 1 140 8 Center well present, =1 1 10 number of identical units in parallel 141 1 15 vent air emission control factor 142 0 143 16 cover vent rate (m3/s per m2 surface) 0.0005 144 17 If covered, then enter 1 Ο 145 19 pH (enter 0 for no pH adjustment) 9.08 146 147 Properties of DIMETHYL DISULFIDE at 44.4 deg.C (111.9 deg.F) hl= 0.002733 atm-m3/mol vp= 73.279 mmHg (1.41737 psia) 148 149 151.837 y/x 150 0.10494 g/L gas per g/L liquid 151 Temperature adjustment factor = 1.046 (T-25), deq. C dl= 1.076e-05 cm2/s dv= 0.093261 cm2/s 152 k1=0. L/q-hrClarifier surface\_ 153 The residence time in the clarifier is 8.902 hrs. 154 155 The Henry's law constant of 0.002733 atm-m3/mol is multiplied by 156 a adsorption factor of 1.. 157 The adsorption corrected aqueous HL is 1.518e+02 (y/x) 158 The gas phase mass transfer is estimated using correlation 3, MacKay (1983). The Schmidt number is 1.60839. 159 160 The friction velocity is 13.347 m/s 161 kg is estimated as 0.005417 m/s. Model: 3 162 Gas phase mass transfer 2.257e-05 g mol/ cm2-s. 163 The flow of water is 935.575 cm3/s. 164 The effective flow depth in the clarifier is 54.1 cm. Clarifier model liquid phase mass transfer 8.494e-05 g mol/ cm2-s. 165 166 Overall mass transfer 8.288e-05 g mol/cm2-s. 167 Clarifier weir emissions 168 The Schmidt number is 1.60839. 169 The friction velocity is 13.347 m/s 170 kg is estimated as 0.005417 m/s. Model: 3 171 Weir mass transfer is estimated from the Pincince 11/7/89 primary model 172 The water drop was 0.38 m. 173 The water flow rate was 0.93558 m3/s. (12.763 m3/hr-m) 174  $R = Exp(0.* drop ^ 0.* (q * 3600 / cir) ^ 0.* 0. ^ 0.31$ 175 R = 1.03824176 The diffusion constant correction is (1.076e-05/.000024)^.677 177 The unadjusted fraction O2 lost from the model is 0.036834. The overall O2 mass transfer coefficient from the model is 3.436e-O4 m/s. 178 179 The overall compound mass transfer coefficient from the model is 2.007e-04 m/s. residence time (hours) 180 8.90152 KG surface (m/s) 181 0.005519 KL surface (m/s) 182 1.529e-05 KL OVERALL SURFACE (m/s) 183 1.492e-05 Fraction lost from clarifier surface 184 0.08458 KG waterfall (m/s) 185 0.005519 KL waterfall (m/s) 186 2.007e-04 KL OVERALL WATERFALL (m/s) 187 1.514e-04 188 Fraction lost from weir waterfall 0.01474 189 fraction of equilibrium in the unit Ο. Fraction absorbed in underflow 190 0. TOTAL FRACTION LOST TO THE AIR 191 0.09932 192 TOTAL AIR EMISSIONS (g/s) 0.009181 193 (Mg/year) 0.28952 194 EMISSION FACTOR (g/cm2-s) 1.657e-10

195 UNIT EXIT CONCENTRATION (ppmw) 0.088987 196 DETAILED CALCULATIONS at Unit 3 def.open trench 197 Type: open trench 198 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 199 COMPOUND: DIMETHYL DISULFIDE 200 Type of unit is open trench 201 3 202 1 Description of unit def.open trench 203 2 Underflow T (C) 44.4 204 3 Total water added at the unit (1/s)0 205 8 Subsurface entrance=1 0 206 9 subsurface exit =1 0 207 10 width of trench (m) 3.65 208 11 distance to next unit (cm) 6100 209 12 slope of underflow conduit 0.015 210 13 depth of trench (m) 3 211 19 pH (enter 0 for no pH adjustment) 9.08 212 213 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.43996 ft. 214 The water flow rate is 9.356e+05 cm3/s. 215 The velocity of the flow (v) is 6.27108 ft/s. 216 The width of the unit is 365. cm. 217 218 The oxygen diffusion coefficient (ratio) adjustment factor is 0.57394. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 219 220 The liquid phase mass transfer coefficient from surface is 3.007e-04 m/s. 221 The Schmidt number is 1.60839. The friction velocity is 13.347 m/s 222 223 kg is estimated as 0.005417 m/s. Model: 3 224 The slope of the U drain is 0.015 225 The water velocity is 191.142 cm/s. (6.27108 ft/s.) The depth of the water is 13.41 cm (5.47347 in.) 226 227 Kl= 3.007e-04 m/s; Kq= 5.417201E-03 m/s 228 the ratio of the mass transfer to depth is 1.50754208738415E-03 The residence time in the trench is 31.91338 sec. 229 230 fraction emitted 0.046972 fraction loss in wastel drop to hub 231 0 232 fraction loss in waste2 drop to hub 0. 233 fraction loss in waste3 drop to hub 0. 234 fraction loss in collection hub drop 0. fraction loss in unit 235 Ο. fraction loss in line run 0.046972 236 component upstream of unit, g/s 0.083254 237 238 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 239 Ο. 240 headspace end of conduit (y) 0. mol fract. headspace vent base 0. 241 headspace flow out vent (cc/s) 242 0 243 headspace flow down line (cc/s) 0. KG surface (m/s) 0.005417 244 KL surface (m/s) 245 3.007e-04 246 flow of waste down hub (1/s) Ο. 247 component flow in waste into unit (g/s) 0. total component into unit, g/s 248 0.083254 249 TOTAL AIR EMISSIONS (g/s) 0.003911 250 (Mg/year) 0.12332 251 EMISSION FACTOR (q/cm2-s) 1.756e-09 252 UNIT EXIT CONCENTRATION (ppmw) 0.084807 253 DETAILED CALCULATIONS at Unit 4 def.open sump 254 Type: open sump 255 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 256 COMPOUND: DIMETHYL DISULFIDE

257 258 Type of unit is open sump 259 1 Description of unit 4 def.open sump 260 2 Underflow T (C) 44.4 261 3 Total water added at the unit (l/s) Ο 4 Area of openings at unit (cm2) 50 262 5 Radius of drop pipe (cm) 5 263 264 6 Drop length to conduit (cm) 61 7 Open surface=1 1 265 8 Subsurface entrance=1 0 266 267 9 subsurface exit =1 0 268 10 radius of underflow conduit (cm) 12 269 11 distance to next unit (cm) 500 12 slope of underflow conduit 270 0.015 271 13 Open surface of liquid at the unit (cm2) 1000 272 14 flow entrance depth under surface (cm) 10 273 15 depth of liquid in sump (cm) 50 274 16 velocity air at opening (ft/min) 88 275 17 municipal waste in conduit =1 0 276 18 Assume equilibrium in unit, =1 0 277 19 pH (enter 0 for no pH adjustment) 9.08 278 279 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.32808 ft. 280 The water flow rate is 9.356e+05 cm3/s. 281 282 The velocity of the flow (v) is 97.065 ft/s. The width of the unit is 31.623 cm. 283 The oxygen diffusion coefficient (ratio) adjustment factor is 0.57394. 284 285 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 286 The liquid phase mass transfer coefficient from surface is 0.002419 m/s. The Schmidt number is 1.60839. 287 288 The friction velocity is 13.347 m/s 289 kg is estimated as 0.005417 m/s. Model: 3 fraction loss in wastel drop to hub 290 0. 291 fraction loss in waste2 drop to hub Ο. 292 fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 293 0. 5.253e-05 294 fraction loss in unit 295 fraction loss in line run 0 296 component upstream of unit, g/s 0.079344 297 mol fract. headspace upstream (y) Ο. 298 headspace at conduit discharge, y Ο. 299 headspace end of conduit (y) 2.458e-06 300 mol fract. headspace vent base Ο. 301 headspace flow out vent (cc/s) 0. 302 headspace flow down line (cc/s) -0.0306 303 KG surface (m/s) 0.005417 304 KL surface (m/s) 0.002419 flow of waste down hub (1/s) 305 0. component flow in waste into unit (g/s) = 0. 306 307 total component into unit, g/s 0.079344 TOTAL AIR EMISSIONS (g/s) 308 4.168e-06 309 (Mg/year) 1.315e-04 310 EMISSION FACTOR (g/cm2-s) 1.756e-09 311 UNIT EXIT CONCENTRATION (ppmw) 0.084803 DETAILED CALCULATIONS at Unit 5 def.Closed trench 312 313 Type: Closed trench Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 314 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 315 COMPOUND: DIMETHYL DISULFIDE 316 317 Type of unit is Closed trench 5 318 1 Description of unit def.Closed trench 319 2 Underflow T (C) 44.4 0 320 3 Total water added at the unit (1/s)

50 321 4 Area of openings at unit (cm2) 322 5 Radius of drop pipe (cm) 5 323 6 Drop length to conduit (cm) 61 324 7 Open surface=1 0 325 8 Subsurface entrance=1 0 326 9 subsurface exit =1 0 327 10 width of trench (m) 1.2 328 11 distance to next unit (cm) 42614 329 12 slope of underflow conduit 0.015 330 13 depth of trench (m) 3 331 16 velocity air at opening (ft/min) 84 332 17 municipal waste in conduit =1 0 333 18 Assume equilibrium in unit, =1 0 334 19 pH (enter 0 for no pH adjustment) 0 335 336 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 337 The water flow rate is 9.356e+05 cm3/s. 338 The velocity of the flow (v) is 8.35415 ft/s. 339 The width of the unit is 120. cm. 340 The oxygen diffusion coefficient (ratio) adjustment factor is 0.57394. 341 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 342 343 The liquid phase mass transfer coefficient from surface is 1.806e-04 m/s. 344 345 Covered Ground Level Trench (U drain); UNIT: 5 346 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp 347 Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 348 Length 45.869 ft; Friction Factor0. Manning coef 0. 349 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 350 Velocity 254.6344 cm/s; Flow 0. gal/min 351 \_drag\_ 352 average water velocity 254.634 cm/s. Fraction full: 0.10206 353 average water surface velocity 288.957cm/sec 354 velocity of air from internal recirculation 144.479 cm/sec 355 Reynolds number for internal air flow 1.535e+05 356 357 Properties of DIMETHYL DISULFIDE at 44.4 deq.C (111.9 deq.F) 358 hl= 0.002733 atm-m3/mol vp= 73.279 mmHg (1.41737 psia) 359 151.837 y/x 360 0.10494 g/L gas per g/L liquid 361 Temperature adjustment factor = 1.046 ^(T-25), deg. C 362 kl= 0. L/g-hrdl= 1.076e-05 cm2/s dv= 0.093261 cm2/s 363 \_loss due to mass transfer in conduit run\_ 364 The length of the run of conduit line is 426.14 m (1398.097 ft.) 365 Flow of headspace gas in the conduit run\_\_\_\_10.523 L/s 366 the pressure gradient for the headspace flow is -0.1206 gf/cm2 367 the headspace area of the sewer 3.233e+04 cm2 368 the headspace average velocity is 0.32553 cm/s. 369 the headspace recirculation velocity is 144.479 cm/s. 370 Flow of water in the conduit run\_\_\_\_\_935.575 L/s 371 the width of the surface is 120. cm. the depth of the liquid is 30.618 cm. (12.054 in.) 372 the average depth of the liquid is 30.618 cm. (12.054 in.) 373 374 fraction full of liquid is 0.10206 the residence time of the liquid is 167.354 s. 375 The oil corrected aqueous HL is 1.518e+02 (y/x) 376 377 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) Velocity of headspace in sewer 0.32553 cm/sec (0.007282 M.P.H.) (0.6408ft/min) 378 kg is estimated as 7.653e-04 m/s. Model: 5 379 380 Modified J factor model is used for mass transfer. 381 the effective gas speed for the correlation is 144.479 cm/s. 382 the effective width for the correlation is 4.261e+04cm. the gas phase mass transfer coefficient is 3.1887e-06 gmol/cm2-s. 383 384 (kg) 7.6528e-04 m/s. 385 Trench model (Owens) for mass transfer in liquid phase. 386 the average liquid velocity is 254.634 cm/s.

387 the liquid depth in the underflow 30.618 cm. 388 the liquid phase mass transfer coefficient is 9.6889e-04 gmol/cm2-s. 389 (kl) 1.744e-04 m/s. 390 Overall mass transfer coefficient. 391 KL = 1 / (1 / kg / koc + 1 / kl) \* 0.18392 the corrected partition coefficient is 151.837 y/x at one atm. (KL) the overall liquid based mass transfer coefficient is 5.811e-05 m/s. 393 Countercurrent flow model model is used for mass transfer. 394 the overall mass transfer coefficient is 5.811e-05 m/s. 395 the average depth of the liquid is 30.618 cm. 396 397 the ratio of the transfer coefficient to average depth is 1.898e-04 398 the residence time of the liquid is 167.354 s. 399 the maximum fraction from open air mass transfer is 0.031263 400 the molar liquid flow is 5.198e+04 gmol/s. 401 the molar gas flow is 0.40406 gmol/s. 402 (fe) the fraction lost from the liquid is 1.1803e-03 403 the g/s from the gas to the liquid is 0.e+00 g/s. fraction loss in wastel drop to hub 404 Ο. fraction loss in waste2 drop to hub 405 Ο. fraction loss in waste3 drop to hub 406 Ο. fraction loss in collection hub drop 407 Ο. fraction loss in unit 408 0 fraction loss in line run 409 0.001179 component upstream of unit, g/s 410 0.079339 411 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 412 2.458e-06 413 headspace end of conduit (y) 0. mol fract. headspace vent base 414 2.458e-06 415 headspace flow out vent (cc/s) 1.052e+04 416 headspace flow down line (cc/s) -1.052e+04 KG surface (m/s) 417 7.653e-04 418 KL surface (m/s) 1.744e-04 419 flow of waste down hub (1/s) Ο. 420 component flow in waste into unit (g/s) -9.354e-05 total component into unit, g/s 421 0.079339 TOTAL AIR EMISSIONS (g/s) 422 9.354e-05 423 0.00295 (Mg/year) EMISSION FACTOR (g/cm2-s) 424 1.756e-09 425 UNIT EXIT CONCENTRATION (ppmw) 0.084703 426 DETAILED CALCULATIONS at Unit 6 def.open trench 427 Type: open trench 428 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 429 COMPOUND: DIMETHYL DISULFIDE 430 431 Type of unit is open trench 432 1 Description of unit 6 def.open trench 433 2 Underflow T (C) 44.4 434 3 Total water added at the unit (1/s)0 435 8 Subsurface entrance=1 0 436 9 subsurface exit =1 Ο 10 width of trench (m) 437 3.65 11 distance to next unit (cm) 60000 438 12 slope of underflow conduit 439 0.015 440 13 depth of trench (m) 3 441 19 pH (enter 0 for no pH adjustment) 8.94 442 Trench model for mass transfer from a surface. 443 The effective depth of water flow (h) is 0.43996 ft. 444 445 The water flow rate is 9.356e+05 cm3/s. The velocity of the flow (v) is 6.27108 ft/s. 446 The width of the unit is 365. cm. 447 448 The oxygen diffusion coefficient (ratio) adjustment factor is 0.57394. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 449 450 The liquid phase mass transfer coefficient from surface is 3.007e-04 m/s.

The Schmidt number is 1.60839. 451 452 The friction velocity is 13.347 m/s 453 kg is estimated as 0.005417 m/s. Model: 3 454 The slope of the U drain is 0.015 455 The water velocity is 191.142 cm/s. (6.27108 ft/s.) 456 The depth of the water is 13.41 cm (5.47347 in.) 457 Kl= 3.007e-04 m/s; Kg= 5.417201E-03 m/s the ratio of the mass transfer to depth is 1.50754208738415E-03 458 459 The residence time in the trench is 313.9021 sec. 460 fraction emitted 0.37701 461 fraction loss in wastel drop to hub 0. 462 fraction loss in waste2 drop to hub 0. 463 fraction loss in waste3 drop to hub 0. 464 fraction loss in collection hub drop Ο. 465 fraction loss in unit 0 466 fraction loss in line run 0.37701 467 component upstream of unit, g/s 0.079246 468 mol fract. headspace upstream (y) Ο. 469 headspace at conduit discharge, y Ο. 470 headspace end of conduit (y) Ο. 471 mol fract. headspace vent base 0. 472 headspace flow out vent (cc/s) 0. 473 headspace flow down line (cc/s) 0. 474 KG surface (m/s) 0.005417 KL surface (m/s) 475 3.007e-04 476 flow of waste down hub (1/s) 0. 477 component flow in waste into unit (g/s) 0. 478 total component into unit, g/s 0.079246 479 TOTAL AIR EMISSIONS (g/s) 0.029876 480 (Mg/year) 0.94218 EMISSION FACTOR (g/cm2-s) 481 1.364e-09 482 UNIT EXIT CONCENTRATION (ppmw) 0.052769 483 DETAILED CALCULATIONS at Unit 7 def.system exit st 484 Type: system exit stream 485 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:21:01 COMPOUND: DIMETHYL DISULFIDE 486 487 488 Type of unit is system exit stream 489 1 Description of unit 7 def.system exit st 490 491 TOTAL AIR EMISSIONS (g/s) Ο. 492 Ο. (Mg/year) 493 EMISSION FACTOR (g/cm2-s) 1.364e-09 494 UNIT EXIT CONCENTRATION (ppmw) 0.052769 495

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 14 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 19 25 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 8 HL partition flag=1, adjust for sorption 0 26 9 unit recycle convergence number 200 27 10 oil molecular weight Ο 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 14 parts biomass per 1000 parts COD 31 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 1 def.Closed trench 39 Type: Closed trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is Closed trench 44 1 Description of unit 1 def.Closed trench 45 2 Underflow T (C) 44.4 46 3 Total water added at the unit (1/s) 0 4 Area of openings at unit (cm2) 50 47 5 Radius of drop pipe (cm) 5 48 49 6 Drop length to conduit (cm) 61 50 7 Open surface=1 0 8 Subsurface entrance=1 1 51 9 subsurface exit =1 52 1 53 10 width of trench (m) 1.2 54 11 distance to next unit (cm) 500 55 12 slope of underflow conduit 0.015 56 13 depth of trench (m) 1.2 16 velocity air at opening (ft/min) 57 84 58 17 municipal waste in conduit =1 0 59 18 Assume equilibrium in unit, =1 0 60 19 pH (enter 0 for no pH adjustment) 9.08 61 62 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 63 The water flow rate is 9.356e+05 cm3/s. 64

The velocity of the flow (v) is 8.35415 ft/s. 65 The width of the unit is 120. cm. 66 67 The oxygen diffusion coefficient (ratio) adjustment factor is 0.77928. 68 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 69 The liquid phase mass transfer coefficient from surface is 2.453e-04 m/s. 70 71 Covered Ground Level Trench (U drain); UNIT: 1 72 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 73 74 Length 0.5382 ft; Friction Factor0. Manning coef 0. 75 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 76 Velocity 254.6344 cm/s; Flow 0. gal/min 77 \_\_\_\_drag\_ 78 average water velocity 254.634 cm/s. Fraction full: 0.25515 79 average water surface velocity 288.957cm/sec 80 velocity of air from internal recirculation 144.479 cm/sec 81 Reynolds number for internal air flow 9.705e+04 82 83 Properties of DIMETHYL SULFIDE (DMS) at 44.4 deg.C (111.9 deg.F) 84 hl= 0.004189 atm-m3/mol vp= 1009.298 mmHg (19.522 psia) 85 232.701 y/x 86 0.16084 g/L gas per g/L liquid 87 Temperature adjustment factor = 1.046 (T-25), deq. C 88 kl = 0. L/q-hrdl= 1.555e-05 cm2/s dv= 0.15644 cm2/s 89 \_loss due to mass transfer in conduit run\_ 90 The length of the run of conduit line is 5. m (16.404 ft.) 91 Flow of headspace gas in the conduit run\_\_\_\_0. L/s 92 the pressure gradient for the headspace flow is 0. gf/cm2 93 the headspace area of the sewer 1.073e+04 cm2 94 the headspace average velocity is 0. cm/s. 95 the headspace recirculation velocity is 144.479 cm/s. 96 Flow of water in the conduit run\_\_\_\_935.575 L/s 97 the width of the surface is 120. cm. 98 the depth of the liquid is 30.618 cm. (12.054 in.) the average depth of the liquid is 30.618 cm. (12.054 in.) 99 100 fraction full of liquid is 0.25515 101 the residence time of the liquid is 1.9636 s. 102 The oil corrected aqueous HL is 2.327e+02 (y/x) 103 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) 104 Velocity of headspace in sewer 0. cm/sec (0. M.P.H.) (0.ft/min) 105 fraction loss in wastel drop to hub Ο. 106 fraction loss in waste2 drop to hub Ο. 107 fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 108 0. 109 fraction loss in unit Ο. 110 fraction loss in line run Ο. 111 component upstream of unit, g/s Ο. 112 mol fract. headspace upstream (y) 0. 113 headspace at conduit discharge, y 0. 114 headspace end of conduit (y) 0. 115 mol fract. headspace vent base 0. headspace flow out vent (cc/s) 116 0. headspace flow down line (cc/s) 117 Ο. KG surface (m/s) 118 Ο. KL surface (m/s) 119 2.453e-04 flow of waste down hub (1/s) 120 Ο. 121 component flow in waste into unit (g/s) 0.2498 0.2498 122 total component into unit, g/s 123 TOTAL AIR EMISSIONS (g/s) 0. 124 (Mg/year) 0. 125 EMISSION FACTOR (g/cm2-s) 6.785e-11 126 UNIT EXIT CONCENTRATION (ppmw) 0.267 127 DETAILED CALCULATIONS at Unit 2 def.primary munici 128 Type: primary municipal clarifier 129 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG

RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 130 COMPOUND: DIMETHYL SULFIDE (DMS) 131 132 Type of unit is primary municipal clarifier 133 1 Description of unit 2 def.primary munici 134 2 Wastewater temperature (C) 44.4 3 primary clarifier diameter (m) 84 135 4 primary clarifier depth (m) 5.41 136 5 clarifier solids removal efficiency 0.7 137 138 6 waterfall drop height (cm) 38 139 7 clarifier weir/circumference 1 140 8 Center well present, =1 1 10 number of identical units in parallel 141 1 15 vent air emission control factor 142 0 143 16 cover vent rate (m3/s per m2 surface) 0.0005 144 17 If covered, then enter 1 Ο 145 19 pH (enter 0 for no pH adjustment) 9.08 146 147 Properties of DIMETHYL SULFIDE (DMS) at 44.4 deg.C (111.9 deg.F) 148 hl= 0.004189 atm-m3/mol vp= 1009.298 mmHg (19.522 psia) 149 232.701 y/x 150 0.16084 g/L gas per g/L liquid 151 Temperature adjustment factor = 1.046 (T-25), deq. C dl= 1.555e-05 cm2/s dv= 0.15644 cm2/s 152 k1=0. L/q-hrClarifier surface\_ 153 The residence time in the clarifier is 8.902 hrs. 154 155 The Henry's law constant of 0.004189 atm-m3/mol is multiplied by 156 a adsorption factor of 1.. 157 The adsorption corrected aqueous HL is 2.327e+02 (y/x) 158 The gas phase mass transfer is estimated using correlation 3, MacKay (1983). The Schmidt number is 0.95884. 159 160 The friction velocity is 13.347 m/s 161 kg is estimated as 0.007252 m/s. Model: 3 162 Gas phase mass transfer 3.022e-05 g mol/ cm2-s. 163 The flow of water is 935.575 cm3/s. 164 The effective flow depth in the clarifier is 54.1 cm. Clarifier model liquid phase mass transfer 1.099e-04 g mol/ cm2-s. 165 166 Overall mass transfer 1.082e-04 g mol/cm2-s. 167 Clarifier weir emissions 168 The Schmidt number is 0.95884. 169 The friction velocity is 13.347 m/s 170 kg is estimated as 0.007252 m/s. Model: 3 171 Weir mass transfer is estimated from the Pincince 11/7/89 primary model 172 The water drop was 0.38 m. 173 The water flow rate was 0.93558 m3/s. (12.763 m3/hr-m) 174  $R = Exp(0.* drop ^ 0.* (q * 3600 / cir) ^ 0.* 0. ^ 0.31$ 175 R = 1.04921176 The diffusion constant correction is (1.555e-05/.000024)^.677 177 The unadjusted fraction O2 lost from the model is 0.046903. The overall O2 mass transfer coefficient from the model is 4.376e-04 m/s. 178 179 The overall compound mass transfer coefficient from the model is 3.272e-04 m/s. residence time (hours) 180 8.90152 KG surface (m/s) 181 0.007388 KL surface (m/s) 182 1.979e-05 KL OVERALL SURFACE (m/s) 183 1.948e-05 Fraction lost from clarifier surface 184 0.109 KG waterfall (m/s) 185 0.007388 KL waterfall (m/s) 186 3.272e-04 KL OVERALL WATERFALL (m/s) 187 2.6e-04 188 Fraction lost from weir waterfall 0.024485 189 fraction of equilibrium in the unit Ο. Fraction absorbed in underflow 190 0. TOTAL FRACTION LOST TO THE AIR 191 0.13348 192 TOTAL AIR EMISSIONS (g/s) 0.033344 193 (Mg/year) 1.05152 194 EMISSION FACTOR (g/cm2-s) 6.017e-10

195 UNIT EXIT CONCENTRATION (ppmw) 0.23136 196 DETAILED CALCULATIONS at Unit 3 def.open trench 197 Type: open trench Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 198 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 199 COMPOUND: DIMETHYL SULFIDE (DMS) 200 Type of unit is open trench 201 3 202 1 Description of unit def.open trench 203 2 Underflow T (C) 44.4 204 3 Total water added at the unit (1/s)0 205 8 Subsurface entrance=1 0 206 9 subsurface exit =1 0 207 10 width of trench (m) 3.65 208 11 distance to next unit (cm) 6100 209 12 slope of underflow conduit 0.015 210 13 depth of trench (m) 3 211 19 pH (enter 0 for no pH adjustment) 9.08 212 213 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.43996 ft. 214 The water flow rate is 9.356e+05 cm3/s. 215 The velocity of the flow (v) is 6.27108 ft/s. 216 The width of the unit is 365. cm. 217 218 The oxygen diffusion coefficient (ratio) adjustment factor is 0.77928. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 219 The liquid phase mass transfer coefficient from surface is 4.083e-04 m/s. 220 221 The Schmidt number is 0.95884. 222 The friction velocity is 13.347 m/s 223 kg is estimated as 0.007252 m/s. Model: 3 224 The slope of the U drain is 0.015 225 The water velocity is 191.142 cm/s. (6.27108 ft/s.) The depth of the water is 13.41 cm (5.47347 in.) 226 227 Kl= 4.083e-04 m/s; Kq= 7.251963E-03 m/s 228 the ratio of the mass transfer to depth is 2.30203530673789E-03 The residence time in the trench is 31.91338 sec. 229 230 fraction emitted 0.070832 fraction loss in wastel drop to hub 231 0 232 fraction loss in waste2 drop to hub 0. 233 fraction loss in waste3 drop to hub 0. 234 fraction loss in collection hub drop 0. fraction loss in unit 235 0. fraction loss in line run 0.070832 236 component upstream of unit, g/s 0.21646 237 238 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 239 Ο. 240 headspace end of conduit (y) 0. mol fract. headspace vent base 0. 241 headspace flow out vent (cc/s) 242 0 243 headspace flow down line (cc/s) 0. KG surface (m/s) 0.007252 244 KL surface (m/s) 245 4.083e-04 246 flow of waste down hub (1/s) 0. 247 component flow in waste into unit (g/s) 0. total component into unit, g/s 248 0.21646 0.015332 249 TOTAL AIR EMISSIONS (g/s) 250 (Mg/year) 0.48351 251 EMISSION FACTOR (q/cm2-s) 6.886e-09 252 UNIT EXIT CONCENTRATION (ppmw) 0.21497 253 DETAILED CALCULATIONS at Unit 4 def.open sump 254 Type: open sump Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 255 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 256 COMPOUND: DIMETHYL SULFIDE (DMS)

257 258 Type of unit is open sump 1 Description of unit 259 4 def.open sump 260 2 Underflow T (C) 44.4 261 3 Total water added at the unit (l/s) Ο 4 Area of openings at unit (cm2) 50 262 5 Radius of drop pipe (cm) 5 263 264 6 Drop length to conduit (cm) 61 7 Open surface=1 1 265 8 Subsurface entrance=1 0 266 267 9 subsurface exit =1 0 268 10 radius of underflow conduit (cm) 12 269 11 distance to next unit (cm) 500 12 slope of underflow conduit 270 0.015 271 13 Open surface of liquid at the unit (cm2) 1000 272 14 flow entrance depth under surface (cm) 10 15 depth of liquid in sump (cm) 50 273 274 16 velocity air at opening (ft/min) 88 275 17 municipal waste in conduit =1 0 276 18 Assume equilibrium in unit, =1 0 277 19 pH (enter 0 for no pH adjustment) 9.08 278 279 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.32808 ft. 280 The water flow rate is 9.356e+05 cm3/s. 281 282 The velocity of the flow (v) is 97.065 ft/s. The width of the unit is 31.623 cm. 283 The oxygen diffusion coefficient (ratio) adjustment factor is 0.77928. 284 285 reareation constant(ft/day) =  $21.6 \times v \circ 0.67 / h \circ 0.85 \times Ratio$ 286 The liquid phase mass transfer coefficient from surface is 0.003284 m/s. The Schmidt number is 0.95884. 287 288 The friction velocity is 13.347 m/s 289 kg is estimated as 0.007252 m/s. Model: 3 fraction loss in wastel drop to hub 290 0. 291 fraction loss in waste2 drop to hub 0. 292 fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 293 0. 294 fraction loss in unit 9.764e-05 295 fraction loss in line run 0. 296 component upstream of unit, g/s 0.20112 297 mol fract. headspace upstream (y) 0. 298 headspace at conduit discharge, y Ο. 299 headspace end of conduit (y) 1.447e-05 300 mol fract. headspace vent base Ο. 301 headspace flow out vent (cc/s) 0. 302 headspace flow down line (cc/s) -0.0306 303 KG surface (m/s) 0.007252 304 KL surface (m/s) 0.003284 flow of waste down hub (1/s) 305 0. component flow in waste into unit (g/s) = 0. 306 307 total component into unit, g/s 0.20112 TOTAL AIR EMISSIONS (g/s) 308 1.964e-05 309 (Mg/year) 6.193e-04 310 EMISSION FACTOR (g/cm2-s) 6.886e-09 311 UNIT EXIT CONCENTRATION (ppmw) 0.21495 DETAILED CALCULATIONS at Unit 5 def.Closed trench 312 Type: Closed trench 313 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 314 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 315 COMPOUND: DIMETHYL SULFIDE (DMS) 316 317 Type of unit is Closed trench 5 318 1 Description of unit def.Closed trench 319 2 Underflow T (C) 44.4 0 320 3 Total water added at the unit (1/s)

50 321 4 Area of openings at unit (cm2) 322 5 Radius of drop pipe (cm) 5 323 6 Drop length to conduit (cm) 61 324 7 Open surface=1 0 325 8 Subsurface entrance=1 0 326 9 subsurface exit =1 0 327 10 width of trench (m) 1.2 328 11 distance to next unit (cm) 42614 329 12 slope of underflow conduit 0.015 330 13 depth of trench (m) 3 331 16 velocity air at opening (ft/min) 84 332 17 municipal waste in conduit =1 0 333 18 Assume equilibrium in unit, =1 0 334 19 pH (enter 0 for no pH adjustment) 0 335 336 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 337 The water flow rate is 9.356e+05 cm3/s. 338 The velocity of the flow (v) is 8.35415 ft/s. 339 The width of the unit is 120. cm. 340 The oxygen diffusion coefficient (ratio) adjustment factor is 0.77928. 341 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 342 343 The liquid phase mass transfer coefficient from surface is 2.453e-04 m/s. 344 345 Covered Ground Level Trench (U drain); UNIT: 5 346 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp 347 Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 348 Length 45.869 ft; Friction Factor0. Manning coef 0. 349 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 350 Velocity 254.6344 cm/s; Flow 0. gal/min 351 \_drag\_ 352 average water velocity 254.634 cm/s. Fraction full: 0.10206 353 average water surface velocity 288.957cm/sec 354 velocity of air from internal recirculation 144.479 cm/sec 355 Reynolds number for internal air flow 1.535e+05 356 357 Properties of DIMETHYL SULFIDE (DMS) at 44.4 deg.C (111.9 deg.F) 358 hl= 0.004189 atm-m3/mol vp= 1009.298 mmHg (19.522 psia) 359 232.701 y/x 360 0.16084 g/L gas per g/L liquid 361 Temperature adjustment factor = 1.046 ^(T-25), deg. C 362 kl= 0. L/g-hrdl= 1.555e-05 cm2/s dv= 0.15644 cm2/s 363 \_loss due to mass transfer in conduit run\_ 364 The length of the run of conduit line is 426.14 m (1398.097 ft.) 365 Flow of headspace gas in the conduit run\_\_\_\_10.523 L/s 366 the pressure gradient for the headspace flow is -0.1206 gf/cm2 367 the headspace area of the sewer 3.233e+04 cm2 368 the headspace average velocity is 0.32553 cm/s. 369 the headspace recirculation velocity is 144.479 cm/s. 370 Flow of water in the conduit run\_\_\_\_\_935.575 L/s 371 the width of the surface is 120. cm. the depth of the liquid is 30.618 cm. (12.054 in.) 372 the average depth of the liquid is 30.618 cm. (12.054 in.) 373 374 fraction full of liquid is 0.10206 the residence time of the liquid is 167.354 s. 375 The oil corrected aqueous HL is 2.327e+02 (y/x) 376 377 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) Velocity of headspace in sewer 0.32553 cm/sec (0.007282 M.P.H.) (0.6408ft/min) 378 kg is estimated as 0.001081 m/s. Model: 5 379 380 Modified J factor model is used for mass transfer. 381 the effective gas speed for the correlation is 144.479 cm/s. 382 the effective width for the correlation is 4.261e+04cm. 383 the gas phase mass transfer coefficient is 4.5024e-06 gmol/cm2-s. 384 (kg) 1.0806e-03 m/s. 385 Trench model (Owens) for mass transfer in liquid phase. 386 the average liquid velocity is 254.634 cm/s.

387 the liquid depth in the underflow 30.618 cm. 388 the liquid phase mass transfer coefficient is 1.254e-03 gmol/cm2-s. 389 (kl) 2.2572e-04 m/s. 390 Overall mass transfer coefficient. 391 KL = 1 / (1 / kg / koc + 1 / kl) \* 0.18392 the corrected partition coefficient is 232.701 y/x at one atm. (KL) the overall liquid based mass transfer coefficient is 1.0275e-04 m/s. 393 Countercurrent flow model model is used for mass transfer. 394 the overall mass transfer coefficient is 1.027e-04 m/s. 395 the average depth of the liquid is 30.618 cm. 396 397 the ratio of the transfer coefficient to average depth is 3.356e-04 398 the residence time of the liquid is 167.354 s. 399 the maximum fraction from open air mass transfer is 0.054611 400 the molar liquid flow is 5.198e+04 gmol/s. 401 the molar gas flow is 0.40406 gmol/s. 402 (fe) the fraction lost from the liquid is 1.809e-03 403 the g/s from the gas to the liquid is 0.e+00 g/s. fraction loss in wastel drop to hub 404 Ο. fraction loss in waste2 drop to hub 405 Ο. fraction loss in waste3 drop to hub 406 Ο. fraction loss in collection hub drop 407 Ο. fraction loss in unit 408 0 fraction loss in line run 409 0.001806 component upstream of unit, g/s 410 0.2011 411 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 412 1.447e-05 413 headspace end of conduit (y) 0. mol fract. headspace vent base 414 1.447e-05 415 headspace flow out vent (cc/s) 1.052e+04 416 headspace flow down line (cc/s) -1.052e+04 KG surface (m/s) 417 0.001081 418 KL surface (m/s) 2.257e-04 419 flow of waste down hub (1/s) 0. 420 component flow in waste into unit (q/s) - 0.00036total component into unit, g/s 421 0.2011 TOTAL AIR EMISSIONS (g/s) 422 3.631e-04 423 0.011452 (Mg/year) EMISSION FACTOR (g/cm2-s) 424 6.886e-09 425 UNIT EXIT CONCENTRATION (ppmw) 0.21456 426 DETAILED CALCULATIONS at Unit 6 def.open trench 427 Type: open trench 428 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 429 COMPOUND: DIMETHYL SULFIDE (DMS) 430 431 Type of unit is open trench 432 1 Description of unit 6 def.open trench 433 2 Underflow T (C) 44.4 434 3 Total water added at the unit (1/s)0 435 8 Subsurface entrance=1 0 436 9 subsurface exit =1 Ο 10 width of trench (m) 437 3.65 11 distance to next unit (cm) 60000 438 12 slope of underflow conduit 439 0.015 440 13 depth of trench (m) 3 441 19 pH (enter 0 for no pH adjustment) 8.94 442 Trench model for mass transfer from a surface. 443 The effective depth of water flow (h) is 0.43996 ft. 444 445 The water flow rate is 9.356e+05 cm3/s. The velocity of the flow (v) is 6.27108 ft/s. 446 The width of the unit is 365. cm. 447 448 The oxygen diffusion coefficient (ratio) adjustment factor is 0.77928. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 449 450 The liquid phase mass transfer coefficient from surface is 4.083e-04 m/s.

The Schmidt number is 0.95884. 451 452 The friction velocity is 13.347 m/s 453 kg is estimated as 0.007252 m/s. Model: 3 454 The slope of the U drain is 0.015 455 The water velocity is 191.142 cm/s. (6.27108 ft/s.) 456 The depth of the water is 13.41 cm (5.47347 in.) 457 Kl= 4.083e-04 m/s; Kg= 7.251963E-03 m/s 458 the ratio of the mass transfer to depth is 2.30203530673789E-03 459 The residence time in the trench is 313.9021 sec. 460 fraction emitted 0.51452 461 fraction loss in wastel drop to hub 0. 462 fraction loss in waste2 drop to hub 0. 463 fraction loss in waste3 drop to hub 0. 464 fraction loss in collection hub drop Ο. 465 fraction loss in unit 0 466 fraction loss in line run 0.51452 467 component upstream of unit, g/s 0.20074 468 mol fract. headspace upstream (y) Ο. 469 headspace at conduit discharge, y Ο. 470 headspace end of conduit (y) Ο. 471 mol fract. headspace vent base 0. 472 headspace flow out vent (cc/s) 0. 473 headspace flow down line (cc/s) 0. 474 KG surface (m/s) 0.007252 KL surface (m/s) 475 4.083e-04 476 flow of waste down hub (1/s) 0. 477 component flow in waste into unit (g/s) 0. 478 total component into unit, g/s 0.20074 479 TOTAL AIR EMISSIONS (g/s) 0.10328 480 (Mg/year) 3.25718 EMISSION FACTOR (g/cm2-s) 481 4.716e-09 482 UNIT EXIT CONCENTRATION (ppmw) 0.10417 483 DETAILED CALCULATIONS at Unit 7 def.system exit st 484 Type: system exit stream 485 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:20:35 486 COMPOUND: DIMETHYL SULFIDE (DMS) 487 488 Type of unit is system exit stream 489 1 Description of unit 7 def.system exit st 490 491 TOTAL AIR EMISSIONS (g/s) Ο. 492 Ο. (Mg/year) 493 EMISSION FACTOR (g/cm2-s) 4.716e-09 494 UNIT EXIT CONCENTRATION (ppmw) 0.10417 495

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 7 Drain air velocity (ft/min) 84 10 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 11 distance to next unit (cm) 14 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 15 radius of underflow conduit (cm) 18 12 16 Underflow T (C) 19 25 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) .4 22 19 design branch line fraction full 23 Type of unit is 24 25 8 HL partition flag=1, adjust for sorption 0 26 9 unit recycle convergence number 200 27 10 oil molecular weight Ο 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 13 NaUT 1=mass tr. 2=equil 30 Ο 14 parts biomass per 1000 parts COD 31 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 1 def.Closed trench 39 Type: Closed trench 40 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is Closed trench 44 1 Description of unit 1 def.Closed trench 45 2 Underflow T (C) 44.4 46 3 Total water added at the unit (l/s) 0 4 Area of openings at unit (cm2) 50 47 5 Radius of drop pipe (cm) 5 48 49 6 Drop length to conduit (cm) 61 50 7 Open surface=1 0 8 Subsurface entrance=1 1 51 9 subsurface exit =1 52 1 53 10 width of trench (m) 1.2 54 11 distance to next unit (cm) 500 55 12 slope of underflow conduit 0.015 56 13 depth of trench (m) 1.2 16 velocity air at opening (ft/min) 57 84 58 17 municipal waste in conduit =1 0 59 18 Assume equilibrium in unit, =1 0 60 19 pH (enter 0 for no pH adjustment) 9.08 61 62 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 63 The water flow rate is 9.356e+05 cm3/s. 64

The velocity of the flow (v) is 8.35415 ft/s. 65 The width of the unit is 120. cm. 66 67 The oxygen diffusion coefficient (ratio) adjustment factor is 0.78813. 68 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 69 The liquid phase mass transfer coefficient from surface is 2.481e-04 m/s. 70 71 Covered Ground Level Trench (U drain); UNIT: 1 72 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 73 74 Length 0.5382 ft; Friction Factor0. Manning coef 0. 75 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 76 Velocity 254.6344 cm/s; Flow 0. gal/min 77 \_\_\_\_\_drag\_ 78 average water velocity 254.634 cm/s. Fraction full: 0.25515 79 average water surface velocity 288.957cm/sec 80 velocity of air from internal recirculation 144.479 cm/sec 81 Reynolds number for internal air flow 9.705e+04 82 83 Properties of METHANETHIOL(methyl mercaptan) at 44.4 deg.C (111.9 deg.F) 84 hl= 0.005553 atm-m3/mol vp= 3034.572 mmHg (58.695 psia) 85 308.5 y/x86 0.21323 g/L gas per g/L liquid 87 Temperature adjustment factor = 1.046 (T-25), deq. C 88 k1=0. L/g-hrdl= 1.576e-05 cm2/s dv= 0.25113 cm2/s 89 \_loss due to mass transfer in conduit run\_ 90 The length of the run of conduit line is 5. m (16.404 ft.) 91 Flow of headspace gas in the conduit run\_\_\_\_0. L/s 92 the pressure gradient for the headspace flow is 0. gf/cm2 93 the headspace area of the sewer 1.073e+04 cm2 94 the headspace average velocity is 0. cm/s. 95 the headspace recirculation velocity is 144.479 cm/s. 96 Flow of water in the conduit run\_\_\_\_935.575 L/s 97 the width of the surface is 120. cm. 98 the depth of the liquid is 30.618 cm. (12.054 in.) the average depth of the liquid is 30.618 cm. (12.054 in.) 99 100 fraction full of liquid is 0.25515 101 the residence time of the liquid is 1.9636 s. 102 The oil corrected aqueous HL is 3.085e+02 (y/x) 103 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) 104 Velocity of headspace in sewer 0. cm/sec (0. M.P.H.) (0.ft/min) 105 fraction loss in wastel drop to hub Ο. 106 fraction loss in waste2 drop to hub Ο. 107 fraction loss in waste3 drop to hub Ο. fraction loss in collection hub drop 108 0. 109 fraction loss in unit Ο. 110 fraction loss in line run Ο. 111 component upstream of unit, g/s Ο. 112 mol fract. headspace upstream (y) 0. 113 headspace at conduit discharge, y 0. 114 headspace end of conduit (y) 0. 115 mol fract. headspace vent base 0. headspace flow out vent (cc/s) 116 0. headspace flow down line (cc/s) 117 Ο. KG surface (m/s) 118 Ο. KL surface (m/s) 119 2.481e-04 flow of waste down hub (1/s) 120 Ο. 121 component flow in waste into unit (g/s) 0.003368 0.003368 122 total component into unit, g/s 123 TOTAL AIR EMISSIONS (g/s) 0. 124 (Mg/year) 0. 6.785e-11 125 EMISSION FACTOR (g/cm2-s) 126 UNIT EXIT CONCENTRATION (ppmw) 0.0036 127 DETAILED CALCULATIONS at Unit 2 def.primary munici 128 Type: primary municipal clarifier 129 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG

RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 130 COMPOUND: METHANETHIOL(methyl mercaptan) 131 132 Type of unit is primary municipal clarifier 133 1 Description of unit 2 def.primary munici 134 2 Wastewater temperature (C) 44.4 3 primary clarifier diameter (m) 84 135 4 primary clarifier depth (m) 5.41 136 5 clarifier solids removal efficiency 0.7 137 6 waterfall drop height (cm) 138 38 139 7 clarifier weir/circumference 1 140 8 Center well present, =1 1 141 10 number of identical units in parallel 1 15 vent air emission control factor 142 0 143 16 cover vent rate (m3/s per m2 surface) 0.0005 144 17 If covered, then enter 1 Ο 145 19 pH (enter 0 for no pH adjustment) 9.08 146 147 Properties of METHANETHIOL(methyl mercaptan) at 44.4 deg.C (111.9 deg.F) 148 hl= 0.005553 atm-m3/mol vp= 3034.572 mmHg (58.695 psia) 308.5 y/x 149 150 0.21323 g/L gas per g/L liquid 151 Temperature adjustment factor = 1.046 (T-25), deq. C dl= 1.576e-05 cm2/s dv= 0.25113 cm2/s 152 k1= 0. L/q-hr Clarifier surface\_ 153 The residence time in the clarifier is 8.902 hrs. 154 155 The Henry's law constant of 0.005553 atm-m3/mol is multiplied by 156 a adsorption factor of 1.. 157 The adsorption corrected aqueous HL is 3.085e+02 (y/x) 158 The gas phase mass transfer is estimated using correlation 3, MacKay (1983). The Schmidt number is 0.5973. 159 160 The friction velocity is 13.347 m/s 161 kg is estimated as 0.00959 m/s. Model: 3 162 Gas phase mass transfer 3.996e-05 g mol/ cm2-s. 163 The flow of water is 935.575 cm3/s. 164 The effective flow depth in the clarifier is 54.1 cm. Clarifier model liquid phase mass transfer 1.11e-04 g mol/ cm2-s. 165 166 Overall mass transfer 1.1e-04 g mol/cm2-s. 167 Clarifier weir emissions\_ 168 The Schmidt number is 0.5973. 169 The friction velocity is 13.347 m/s 170 kg is estimated as 0.00959 m/s. Model: 3 171 Weir mass transfer is estimated from the Pincince 11/7/89 primary model 172 The water drop was 0.38 m. 173 The water flow rate was 0.93558 m3/s. (12.763 m3/hr-m) 174  $R = Exp(0.* drop ^ 0.* (q * 3600 / cir) ^ 0.* 0. ^ 0.31$ 175 R = 1.04967176 The diffusion constant correction is (1.576e-05/.000024)^.677 177 The unadjusted fraction O2 lost from the model is 0.047322. The overall O2 mass transfer coefficient from the model is 4.415e-04 m/s. 178 179 The overall compound mass transfer coefficient from the model is 3.331e-04 m/s. residence time (hours) 180 8.90152 KG surface (m/s) 181 0.009769 KL surface (m/s) 182 1.998e-05 KL OVERALL SURFACE (m/s) 183 1.98e-05 Fraction lost from clarifier surface 184 0.11066 KG waterfall (m/s) 185 0.009769 KL waterfall (m/s) 186 3.331e-04 KL OVERALL WATERFALL (m/s) 187 2.896e-04 188 Fraction lost from weir waterfall 0.027185 189 fraction of equilibrium in the unit Ο. Fraction absorbed in underflow 190 0. TOTAL FRACTION LOST TO THE AIR 191 0.13785 192 TOTAL AIR EMISSIONS (g/s) 4.643e-04 193 (Mg/year) 0.014641 194 EMISSION FACTOR (g/cm2-s) 8.378e-12

195 UNIT EXIT CONCENTRATION (ppmw) 0.003104 196 DETAILED CALCULATIONS at Unit 3 def.open trench 197 Type: open trench 198 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 199 COMPOUND: METHANETHIOL(methyl mercaptan) 200 Type of unit is open trench 201 3 202 1 Description of unit def.open trench 203 2 Underflow T (C) 44.4 204 3 Total water added at the unit (1/s)0 205 8 Subsurface entrance=1 0 206 9 subsurface exit =1 0 207 10 width of trench (m) 3.65 208 11 distance to next unit (cm) 6100 209 12 slope of underflow conduit 0.015 210 13 depth of trench (m) 3 211 19 pH (enter 0 for no pH adjustment) 9.08 212 Trench model for mass transfer from a surface. 213 The effective depth of water flow (h) is 0.43996 ft. 214 The water flow rate is 9.356e+05 cm3/s. 215 The velocity of the flow (v) is 6.27108 ft/s. 216 The width of the unit is 365. cm. 217 218 The oxygen diffusion coefficient (ratio) adjustment factor is 0.78813. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 219 220 The liquid phase mass transfer coefficient from surface is 4.129e-04 m/s. 221 The Schmidt number is 0.5973. The friction velocity is 13.347 m/s 222 223 kg is estimated as 0.00959 m/s. Model: 3 224 The slope of the U drain is 0.015 225 The water velocity is 191.142 cm/s. (6.27108 ft/s.) The depth of the water is 13.41 cm (5.47347 in.) 226 227 Kl= 4.129e-04 m/s; Kq= 9.589518E-03 m/s 228 the ratio of the mass transfer to depth is 2.59608167167113E-03 The residence time in the trench is 31.91338 sec. 229 230 fraction emitted 0.079511 fraction loss in wastel drop to hub 231 0 232 fraction loss in waste2 drop to hub 0. 233 fraction loss in waste3 drop to hub 0. 234 fraction loss in collection hub drop 0. fraction loss in unit 235 Ο. fraction loss in line run 0.079511 236 component upstream of unit, g/s 0.002904 237 238 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 239 0. 240 headspace end of conduit (y) Ο. mol fract. headspace vent base 0. 241 headspace flow out vent (cc/s) 242 0 243 headspace flow down line (cc/s) 0. KG surface (m/s) 0.00959 244 KL surface (m/s) 4.129e-04 245 246 flow of waste down hub (1/s) Ο. 247 component flow in waste into unit (g/s) 0. total component into unit, g/s 248 0.002904 249 TOTAL AIR EMISSIONS (g/s) 2.309e-04 250 (Mg/year) 0.007281 251 EMISSION FACTOR (q/cm2-s) 1.037e-10 252 UNIT EXIT CONCENTRATION (ppmw) 0.002857 253 DETAILED CALCULATIONS at Unit 4 def.open sump 254 Type: open sump 255 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 256 COMPOUND: METHANETHIOL(methyl mercaptan)

257 258 Type of unit is open sump 1 Description of unit 259 4 def.open sump 260 2 Underflow T (C) 44.4 261 3 Total water added at the unit (l/s) Ο 4 Area of openings at unit (cm2) 50 262 5 Radius of drop pipe (cm) 5 263 264 6 Drop length to conduit (cm) 61 7 Open surface=1 1 265 8 Subsurface entrance=1 0 266 267 9 subsurface exit =1 0 268 10 radius of underflow conduit (cm) 12 269 11 distance to next unit (cm) 500 12 slope of underflow conduit 270 0.015 271 13 Open surface of liquid at the unit (cm2) 1000 272 14 flow entrance depth under surface (cm) 10 15 depth of liquid in sump (cm) 50 273 274 16 velocity air at opening (ft/min) 88 275 17 municipal waste in conduit =1 0 276 18 Assume equilibrium in unit, =1 0 277 19 pH (enter 0 for no pH adjustment) 9.08 278 279 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 0.32808 ft. 280 281 The water flow rate is 9.356e+05 cm3/s. 282 The velocity of the flow (v) is 97.065 ft/s. The width of the unit is 31.623 cm. 283 The oxygen diffusion coefficient (ratio) adjustment factor is 0.78813. 284 285 reareation constant(ft/day) =  $21.6 \times v \circ 0.67 / h \circ 0.85 \times Ratio$ 286 The liquid phase mass transfer coefficient from surface is 0.003321 m/s. The Schmidt number is 0.5973. 287 288 The friction velocity is 13.347 m/s 289 kg is estimated as 0.00959 m/s. Model: 3 fraction loss in wastel drop to hub 290 0. 291 fraction loss in waste2 drop to hub 0. 292 fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 293 0. 294 fraction loss in unit 1.422e-04 295 fraction loss in line run 0 296 component upstream of unit, g/s 0.002673 297 mol fract. headspace upstream (y) Ο. 298 headspace at conduit discharge, y 0. 299 headspace end of conduit (y) 3.29e-07 300 mol fract. headspace vent base Ο. 301 headspace flow out vent (cc/s) 0. 302 headspace flow down line (cc/s) -0.0306 303 KG surface (m/s) 0.00959 304 KL surface (m/s) 0.003321 flow of waste down hub (1/s) 305 0. component flow in waste into unit (g/s) = 0. 306 307 total component into unit, g/s 0.002673 TOTAL AIR EMISSIONS (g/s) 308 3.8e-07 309 (Mg/year) 1.198e-05 310 EMISSION FACTOR (g/cm2-s) 1.037e-10 311 UNIT EXIT CONCENTRATION (ppmw) 0.002857 DETAILED CALCULATIONS at Unit 5 def.Closed trench 312 Type: Closed trench 313 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 314 Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 315 COMPOUND: METHANETHIOL(methyl mercaptan) 316 317 Type of unit is Closed trench 318 1 Description of unit 5 def.Closed trench 319 2 Underflow T (C) 44.4 0 320 3 Total water added at the unit (1/s)
50 321 4 Area of openings at unit (cm2) 322 5 Radius of drop pipe (cm) 5 323 6 Drop length to conduit (cm) 61 324 7 Open surface=1 0 325 8 Subsurface entrance=1 0 326 9 subsurface exit =1 0 327 10 width of trench (m) 1.2 328 11 distance to next unit (cm) 42614 329 12 slope of underflow conduit 0.015 330 13 depth of trench (m) 3 331 16 velocity air at opening (ft/min) 84 332 17 municipal waste in conduit =1 0 333 18 Assume equilibrium in unit, =1 0 334 19 pH (enter 0 for no pH adjustment) 0 335 336 Trench model for mass transfer from a surface. The effective depth of water flow (h) is 1.00454 ft. 337 The water flow rate is 9.356e+05 cm3/s. 338 The velocity of the flow (v) is 8.35415 ft/s. 339 The width of the unit is 120. cm. 340 The oxygen diffusion coefficient (ratio) adjustment factor is 0.78813. 341 reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 342 343 The liquid phase mass transfer coefficient from surface is 2.481e-04 m/s. 344 345 Covered Ground Level Trench (U drain); UNIT: 5 346 width 120. cm; Rho 0.001091 g/cc; Visc 1.8e-04 cp 347 Liquid Depth 30.618cm; Slope 0.015; Roughness 0.21336 cm 348 Length 45.869 ft; Friction Factor0. Manning coef 0. 349 Headspace temp. 44.4 C; Humidity 100. %; Water temp. 44.4 C 350 Velocity 254.6344 cm/s; Flow 0. gal/min 351 \_drag\_ 352 average water velocity 254.634 cm/s. Fraction full: 0.10206 353 average water surface velocity 288.957cm/sec 354 velocity of air from internal recirculation 144.479 cm/sec 355 Reynolds number for internal air flow 1.535e+05 356 357 Properties of METHANETHIOL(methyl mercaptan) at 44.4 deg.C (111.9 deg.F) 358 hl= 0.005553 atm-m3/mol vp= 3034.572 mmHg (58.695 psia) 359 308.5 y/x 360 0.21323 g/L gas per g/L liquid 361 Temperature adjustment factor = 1.046 ^(T-25), deg. C 362 kl= 0. L/g-hrdl= 1.576e-05 cm2/s dv= 0.25113 cm2/s 363 \_loss due to mass transfer in conduit run\_ The length of the run of conduit line is 426.14 m (1398.097 ft.) 364 365 Flow of headspace gas in the conduit run\_\_\_\_10.523 L/s 366 the pressure gradient for the headspace flow is -0.1206 gf/cm2 367 the headspace area of the sewer 3.233e+04 cm2 368 the headspace average velocity is 0.32552 cm/s. the headspace recirculation velocity is 144.479 cm/s. 369 370 Flow of water in the conduit run\_\_\_\_\_935.575 L/s 371 the width of the surface is 120. cm. the depth of the liquid is 30.618 cm. (12.054 in.) 372 the average depth of the liquid is 30.618 cm. (12.054 in.) 373 374 fraction full of liquid is 0.10206 the residence time of the liquid is 167.354 s. 375 The oil corrected aqueous HL is 3.085e+02 (y/x) 376 377 Wind Velocity 447. cm/sec ( 10.M.P.H.) (879.921 ft/min) Velocity of headspace in sewer 0.32552 cm/sec (0.007282 M.P.H.) (0.64078ft/min) 378 kg is estimated as 0.001482 m/s. Model: 5 379 380 Modified J factor model is used for mass transfer. 381 the effective gas speed for the correlation is 144.479 cm/s. 382 the effective width for the correlation is 4.261e+04cm. the gas phase mass transfer coefficient is 6.1738e-06 gmol/cm2-s. 383 384 (kg) 1.4817e-03 m/s. 385 Trench model (Owens) for mass transfer in liquid phase. 386 the average liquid velocity is 254.634 cm/s.

387 the liquid depth in the underflow 30.618 cm. 388 the liquid phase mass transfer coefficient is 1.266e-03 gmol/cm2-s. 389 (kl) 2.2788e-04 m/s. 390 Overall mass transfer coefficient. 391 KL = 1 / (1 / kg / koc + 1 / kl) \* 0.18392 the corrected partition coefficient is 308.5 y/x at one atm. (KL) the overall liquid based mass transfer coefficient is 1.3689e-04 m/s. 393 Countercurrent flow model model is used for mass transfer. 394 the overall mass transfer coefficient is 1.369e-04 m/s. 395 the average depth of the liquid is 30.618 cm. 396 397 the ratio of the transfer coefficient to average depth is 4.471e-04 398 the residence time of the liquid is 167.354 s. 399 the maximum fraction from open air mass transfer is 0.07209 400 the molar liquid flow is 5.198e+04 gmol/s. 401 the molar gas flow is 0.40405 gmol/s. 402 (fe) the fraction lost from the liquid is 2.3981e-03 403 the g/s from the gas to the liquid is 0.e+00 g/s. fraction loss in wastel drop to hub 404 Ο. fraction loss in waste2 drop to hub 405 Ο. fraction loss in waste3 drop to hub 406 Ο. fraction loss in collection hub drop 407 Ο. fraction loss in unit 408 0 409 fraction loss in line run 0.002393 component upstream of unit, g/s 410 0.002673 411 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 412 3.29e-07 413 headspace end of conduit (y) 0. mol fract. headspace vent base 414 3.29e-07 415 headspace flow out vent (cc/s) 1.052e+04 416 headspace flow down line (cc/s) -1.052e+04 417 KG surface (m/s) 0.001482 418 KL surface (m/s) 2.279e-04 419 flow of waste down hub (1/s) 0. 420 component flow in waste into unit (g/s) - 6.394e-06total component into unit, g/s 421 0.002673 TOTAL AIR EMISSIONS (g/s) 422 6.394e-06 423 (Mg/year) 2.016e-04 EMISSION FACTOR (g/cm2-s) 424 1.037e-10 425 UNIT EXIT CONCENTRATION (ppmw) 0.00285 426 DETAILED CALCULATIONS at Unit 6 def.open trench 427 Type: open trench 428 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 429 COMPOUND: METHANETHIOL(methyl mercaptan) 430 431 Type of unit is open trench 432 1 Description of unit 6 def.open trench 433 2 Underflow T (C) 44.4 434 3 Total water added at the unit (1/s)0 435 8 Subsurface entrance=1 0 436 9 subsurface exit =1 Ο 10 width of trench (m) 437 3.65 11 distance to next unit (cm) 60000 438 12 slope of underflow conduit 439 0.015 440 13 depth of trench (m) 3 441 19 pH (enter 0 for no pH adjustment) 8.94 442 Trench model for mass transfer from a surface. 443 The effective depth of water flow (h) is 0.43996 ft. 444 445 The water flow rate is 9.356e+05 cm3/s. The velocity of the flow (v) is 6.27108 ft/s. 446 The width of the unit is 365. cm. 447 448 The oxygen diffusion coefficient (ratio) adjustment factor is 0.78813. reareation constant(ft/day) = 21.6 \* v ^ 0.67 / h ^ 0.85 \* Ratio 449 450 The liquid phase mass transfer coefficient from surface is 4.129e-04 m/s.

451 The Schmidt number is 0.5973. 452 The friction velocity is 13.347 m/s 453 kg is estimated as 0.00959 m/s. Model: 3 454 The slope of the U drain is 0.015 455 The water velocity is 191.142 cm/s. (6.27108 ft/s.) 456 The depth of the water is 13.41 cm (5.47347 in.) 457 Kl= 4.129e-04 m/s; Kg= 9.589518E-03 m/s 458 the ratio of the mass transfer to depth is 2.59608167167113E-03 459 The residence time in the trench is 313.9021 sec. 460 fraction emitted 0.55732 461 fraction loss in wastel drop to hub 0. 462 fraction loss in waste2 drop to hub 0. 463 fraction loss in waste3 drop to hub 0. 464 fraction loss in collection hub drop 0. 465 fraction loss in unit 0 466 fraction loss in line run 0.55732 467 component upstream of unit, g/s 0.002666 468 mol fract. headspace upstream (y) Ο. 469 headspace at conduit discharge, y Ο. 470 headspace end of conduit (y) Ο. 471 mol fract. headspace vent base Ο. 472 headspace flow out vent (cc/s) 0. 473 headspace flow down line (cc/s) 0. 474 KG surface (m/s) 0.00959 KL surface (m/s) 475 4.129e-04 476 flow of waste down hub (1/s) 0. 477 component flow in waste into unit (g/s) 0. 478 total component into unit, g/s 0.002666 479 TOTAL AIR EMISSIONS (g/s) 0.001486 480 (Mg/year) 0.046859 EMISSION FACTOR (g/cm2-s) 481 6.785e-11 482 UNIT EXIT CONCENTRATION (ppmw) 0.001262 483 DETAILED CALCULATIONS at Unit 7 def.system exit st 484 Type: system exit stream 485 Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\June 2022 TRS WATER9 H2SSIM Runs\ALS AVG RUNS\ALS AVG IPT Clarifier 6/29/2022 8:05:17 AM 10:18:17 486 COMPOUND: METHANETHIOL(methyl mercaptan) 487 488 Type of unit is system exit stream 489 1 Description of unit 7 def.system exit st 490 491 TOTAL AIR EMISSIONS (g/s) Ο. 492 Ο. (Mg/year) 493 EMISSION FACTOR (g/cm2-s) 6.785e-11 494 UNIT EXIT CONCENTRATION (ppmw) 0.001262 495

## **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Wednesday, October 25, 2023 10:01 AM
То:	Buckner, Katharine
Cc:	Robert Tourville; Rachel Davis; Sheryl Watkins; McAvoy, Bryan P.; Steven Moore; Ryan
	Cleary
Subject:	RE: status of air modeling review
Attachments:	New Stripper Modeling Results - 05b Updated ASB areas.xlsx; Revised Modeling WWTP
	Rates for ALS (9-28-23)_Updated model area.xlsx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine,

Updating the AERMOD modeled areas to reflect less solids in the ASB ended up lowering the maximum concentrations. This is what we expected, but we needed to confirm through modeling. Attached are two spreadsheets:

- 1. Revised Modeling WWTP Rates for ALS (9-28-23)\_Updated model area
  - a. Shows the updated modeled ASB areas (AERMOD areas), which changed the unit area emission rates (g/s/m2). No change to any of the g/s rates from my 10/2 email. Emissions were based on the larger area to begin with.
- 2. New Stripper Modeling Results 05b Updated ASB areas
  - a. Results of modeling the larger areas, as well as a comparison to the results from my 10/2/2023 email.

Please let me know if you have any questions.

Thanks, Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Caleb Fetner

Sent: Monday, October 16, 2023 3:32 PM
To: Buckner, Katharine <bucknekk@dhec.sc.gov>; Steven Moore <smoore@all4inc.com>
Cc: Robert Tourville <BOB.TOURVILLE@NEW-INDYCB.COM>; Rachel Davis <Rachel.Davis@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>
Subject: RE: status of air modeling review

Hi Katharine,

We were unable to determine the effect changing the modeled area would have on the air dispersion modeling results with confidence; therefore, we are proceeding with updating the modeled areas in AERMOD to see. Note that the emissions rates (in g/s) were based on more water surface area that more closely match recent aerials, so this change is just to the area in the AERMOD model and no updates to H2SSIM or WATER9 runs were necessary.

#### Caleb



From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Monday, October 16, 2023 1:48 PM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>
Cc: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>; Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Sheryl
Watkins <<u>swatkins@all4inc.com</u>>; McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: status of air modeling review

#### Hey Caleb and Steve,

I was checking in on the review of the air dispersion modeling for the new stripper application. We had left it a couple of weeks ago that you would, with respect to the size of the ASB used in the modeling, evaluate if the current air modeling represents the worst case scenario or if using the larger basin size for the ASB would present the worst case scenario for emissions from the ASB. Do you have any determinations yet? Do you know if the air dispersion modeling will need to be redone?

#### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



#### New-Indy Catawba, LLC 2023 New Steam Stripper Application - Updated ASB AERMOD Areas

Pollutant	Standard <sup>(a)</sup>	Averaging Period <sup>(b)</sup>	Previous Modeled Concentration	Modeled Concentration	% Change	UTM Easting	UTM Northing	Rank <sup>(a)</sup>	Standard <sup>(a)(c)(d)</sup>
			(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )		(m)	(m)		(µg/m <sup>3</sup> )
H.S	MAAC	24-hour	20.20	18.15	-10%	511,200.42	3,856,646.62	1st High	140
1125	EPA Action Level	30-minute	100.80	94.59	-6%	511,249.70	3,856,644.83	1-hour 1st High	837
MMC	MAAC	24-hour	9.46	9.46	0%	510,115.55	3,856,041.31	1st High	10
IVIIVIC	EPA Action Level	30-minute	48.00	48.00	0%	510,209.41	3,856,039.95	1-hour 1st High	57,000
TDC	MAAC	24-hour	77.25	76.63	-1%	511,151.13	3,856,648.40	1st High	140
IKS	EPA Action Level	30-minute	385.32	385.32	0%	510,143.86	3,855,999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ\_SC%20Modeling%20Guidelines\_10.15.18\_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to  $H_2S$ .

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.

Medaled Source	UTM Eacting	UTM Northing	Release	Modeled	Initial Vertical		MMC Emissions	TBS Emissions	H & Emissions	ММС	TRS
	OT M Easting	O I M Northing	Height	Area	Dimension	H23 Emissions	WINC Emissions	I KO EIIIISSIOIIS		Emissions	Emissions
U	(m)	(m)	(m)	(m <sup>2</sup> )	(m)	(g/s)	(g/s)	(g/s)	(g/s/m²)	(g/s/m²)	(g/s/m²)
EQLBASIN	510,439.13	3,855,563.34	0.00	7,610.8	0.00	7.14E-03		7.14E-03	9.38E-07		9.38E-07
DITCH1	510,812.79	3,856,255.42	0.00	2,219.3	0.00	4.10E-03	2.33E-03	1.28E-01	1.85E-06	1.05E-06	5.78E-05
ASB1	510,803.40	3,856,319.69	6.10	87,039.3	0.00	1.37E-01	1.63E-02	7.28E-01	1.57E-06	1.87E-07	8.36E-06
ASB2	510,964.42	3,856,054.20	6.10	68,803.6	0.00	2.45E-03	2.92E-04	1.30E-02	3.55E-08	4.24E-09	1.90E-07
ASB3	511,052.13	3,855,887.21	6.10	70,796.1	0.00	6.17E-05	7.35E-06	3.29E-04	8.71E-10	1.04E-10	4.64E-09
DITCH2	510,992.97	3,855,727.21	0.00	1,844.2	0.00	9.28E-02	4.20E-03	1.01E-01	5.03E-05	2.28E-06	5.49E-05
SLDGLAGN	510,924.33	3,855,544.61	0.00	45,225.3	0.00	4.14E-02		4.14E-02	9.16E-07		9.16E-07
HOLDPOND	510,391.65	3,855,142.65	0.00	390,739.1	0.00	6.26E-02	1.75E-04	6.28E-02	1.60E-07	4.48E-10	1.61E-07
DITCH0	510,377.59	3,855,634.91	0.00	240.9	0.00	3.03E-04	3.72E-04	1.86E-02	1.26E-06	1.54E-06	7.72E-05

Modeled Source	UTM Easting	UTM Northing	Release Height	Radius	Modeled Area	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions	H <sub>2</sub> S Emissions	MMC Emissions	TRS Emissions
ID	(m)	(m)	(m)	(m)	(m <sup>2</sup> )	(g/s)	(g/s)	(g/s)	(g/s/m²)	(g/s/m²)	(g/s/m²)
CLARIFY	510,342.42	3,855,604.87	0.00	42.00	5541.77	2.59E-04	7.26E-04	3.98E-02	4.67E-08	1.31E-07	7.18E-06

#### Emissions Rate Basis

Source	Pollutant	Actual	Reference File Provided	Maximum
		g/s		g/s
Equalization Basin	H2S	4.56E-03	EQ Basin and Sludge Lagoon Calcs.xlsx	7.14E-03
	TRS	4.56E-03	TRS = H2S	7.14E-03
Ditch 0	H2S	1.94E-04	ALS AVG Ditch #0 Cales.xlsx	3.03E-04
			PC and Ditch 0-1 ALS AVG WATER9.pdf	
	MMC	2.38E-04	Sum of Unit 3 Open Trench, Open Sum, and Closed Trench WATER9	3.72E-04
	TRS	1.19E-02	Sum of reduced sulfur compounds, as H2S	1.86E-02
Ditch 1	H2S	2.62E-03	ALS AVG Ditch #1 Calcs.xlsx	4.10E-03
	MMC	1.49E-03	PC and Ditch 0-1_ALS AVG_WATER9.pdf	2.33E-03
	TRS	8.19E-02	Sum of reduced sulfur compounds, as H2S	1.28E-01
Ditch 2	H2S	5.93E-02	ALS AVG Ditch #2 Calcs.xlsx	9.28E-02
	MMC	2.68E-03	Holding Pond_Ditch 2_ ALS AVG_WATER9	4.20E-03
	TRS	6.47E-02	Sum of reduced sulfur compounds, as H2S	1.01E-01
Sludge Lagoon	H2S	2.65E-02	EQ Basin and Sludge Lagoon Calcs.xlsx	4.14E-02
	MMC			
	TRS	2.65E-02	TRS = H2S	4.14E-02
Holding Pond	H2S	4.00E-02	No change.	6.26E-02
	MMC	1.12E-04	Holding Pond_Ditch 2_ALS AVG_WATER9	1.75E-04
	TRS	4.01E-02	Sum of reduced sulfur compounds, as H2S	6.28E-02
Primary Clarifier	H2S	1.65E-04	PC ALS AVG H2SSIM.pdf	2.59E-04
	MMC	4.64E-04	PC and Ditch 0-1_ALS AVG_WATER9	7.26E-04
	TRS	2.54E-02	Sum of reduced sulfur compounds, as H2S	3.98E-02

2700 ADTP, max 1726 ADTP, actual July 2021 pulp production.

156%

ASB

Worst-case Emissions for Modeling						
	H <sub>2</sub> S	MMC	TRS as H <sub>2</sub> S			
Total ASB lb/ODTP	0.0109	1.30E-03	5.81E-02			
Total ASB lb/hr	1.10	0.13	5.88			
Total ASB g/s	0.139	0.017	0.741			
Zone 1 g/s	1.37E-01	1.63E-02	7.28E-01			
Zone 2 g/s	2.45E-03	2.92E-04	1.30E-02			
Zone 3 g/s	6.17E-05	7.35E-06	3.29E-04			

REVISED Emissions Calculations (6-26-23)\_Modeling Emissions Rates

June 27, 2023 Response to DHEC on New Stripper Application

#### Comparison to July 6 2023 Response to DHEC Provided Rates:

Original application emissions rates						
	ММС	TRS				
n <sub>2</sub> 3 Emissions	Emissions	Emissions				
(g/s/m²)	(g/s/m²)	(g/s/m <sup>2</sup> )				
9.37E-07		9.37E-07				
1.50E-07	3.21E-07	2.58E-05				
2.69E-06	3.20E-07	1.43E-05				
4.81E-08	5.74E-09	2.55E-07				
1.21E-09	1.45E-10	6.47E-09				
1.34E-06	3.17E-07	2.63E-06				
9.37E-07		9.37E-07				
1.61E-07	6.20E-11	1.61E-07				
1 11E-07	5.05E-07	3 75E-05				

H₂S	ммс	TRS	
Percent C	hange vs. July (	6 Response	
0.1%		0.1%	EQLBASIN
1134%	226%	124%	DITCH1
-41.7%	-41.6%	-41.5%	ASB1 <sup>(b)</sup>
-26%	-26%	-26%	ASB2 <sup>(b)</sup>
-28%	-28%	-28%	ASB3 <sup>(b)</sup>
3653%	619%	1989%	DITCH2 <sup>(c)</sup>
-2%		-2%	SLDGLAGN
-1%	622%	0%	HOLDPOND
1037%	206%	106%	DITCH0

H <sub>2</sub> S	ммс	TRS	
Perce			
-98.7%	231%	3.5%	CLARIFY

**Comparison to DHEC Rates:** Emissions rates used by DHEC in modeling demonstration

H2S	ммс	TRS
(g/s/m²)	(g/s/m <sup>2</sup> )	(g/s/m²)
5.99E-07		5.99E-07
1.18E-06	6.70E-07	3.69E-05
1.05E-06	1.53E-06	4.69E-06
5.92E-07	3.26E-08	6.73E-07
3.29E-07	8.40E-10	3.32E-07
3.22E-05	1.46E-06	3.51E-05
5.85E-07		5.85E-07
1.02E-07	2.86E-10	1.03E-07
8.05E-07	9.87E-07	4.93E-05

H2S	ммс	TRS
(g/s/m <sup>2</sup> )	(g/s/m²)	(g/s/m²)
3.00E-08	8.38E-08	4.59E-06

H <sub>2</sub> S	ммс	TRS	
Percei			
56.5%		56.5%	EQLBASIN
56.5%	56.5%	56.5%	DITCH1
			ASB1 <sup>(b)</sup>
			ASB2 <sup>(b)</sup>
			ASB3 <sup>(b)</sup>
56.4%	56.5%	56.4%	DITCH2(c)
56.5%		56.5%	SLDGLAGN
56.7%	56.5%	56.5%	HOLDPOND
56.1%	56.5%	56.4%	DITCH0

H <sub>2</sub> S	ммс	TRS	
Percent Change due to ALS			
55.6%	56.5%	56.5%	CLARIFY

IE.

H & Emissions	ММС	TRS
	Emissions	Emissions
(g/s/m²)	(g/s/m²)	(g/s/m²)
3.70352E-06	3.96E-08	6.94E-06

## **RE: New-Indy Catawba LLC Construction Permit Application**

McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

Thu 10/26/2023 9:56 AM To:Ryan Cleary <rcleary@all4inc.com>

## **McAvoy, Bryan P.** reacted to your message:

From: Ryan Cleary <rcleary@all4inc.com>
Sent: Thursday, October 26, 2023 10:59:20 AM
To: Buckner, Katharine <bucknekk@dhec.sc.gov>; McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>
Cc: bob.tourville@new-indycb.com <BOB.TOURVILLE@NEW-INDYCB.COM>; rachel.davis@new-indycb.com
<rachel.davis@new-indycb.com>; Caleb Fetner <cfetner@all4inc.com>; Sheryl Watkins <swatkins@all4inc.com>; Steven
Moore <smoore@all4inc.com>
Subject: RE: New-Indy Catawba LLC Construction Permit Application

Subject. RE. New-Indy Calawba LLC Construction Permit Application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Bryan,

On behalf of New-Indy Catawba LLC, ALL4 LLC has populated a shared file directory with air dispersion modeling files supporting the new condensate steam stripper application. The files are updated with modified ASB spatial footprints. In addition to an invitation message you should have received, the files may be accessed via the link below.

https://all4.box.com/s/okxys150e2qs73nyusl7lxkvm1x0p1uw

If you have any issues accessing the air dispersion modeling files, please let me know.

Regards, Ryan



**Ryan Cleary** / Consulting Scientist 919.230.0716 (o) / <u>Profile</u> / <u>LinkedIn</u>

www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Friday, October 6, 2023 10:58 AM
To: Ryan Cleary <rcleary@all4inc.com>; McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>
Cc: bob.tourville@new-indycb.com; rachel.davis@new-indycb.com; Caleb Fetner <cfetner@all4inc.com>; Sheryl Watkins
<swatkins@all4inc.com>; Steven Moore <smoore@all4inc.com>
Subject: RE: New-Indy Catawba LLC Construction Permit Application

Hey Ryan and/or Caleb,

Bryan and I have some questions about the ASB, particularly zone 1, and the air dispersion modeling. Which of you do we need to talk with? And are you available today for a Teams chat?

Thanks,

Katharine K. Buckner Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> <u>Facebook</u> <u>Twitter</u>



From: Ryan Cleary <<u>rcleary@all4inc.com</u>>
Sent: Thursday, October 5, 2023 9:53 AM
To: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: bob.tourville@new-indycb.com; rachel.davis@new-indycb.com; Caleb Fetner <<u>cfetner@all4inc.com</u>>; Sheryl Watkins
<<u>swatkins@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>
Subject: New-Indy Catawba LLC Construction Permit Application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Bryan,

On behalf of New-Indy Catawba LLC, ALL4 LLC has created the link below to access the revised air dispersion modeling files supporting the construction air permit application for the new condensate steam stripper. In addition to the link, you should have received an invitation this morning to access the shared file directory.

#### https://all4.box.com/s/yln0q56piag1exqm5qa7wv6720zzl1ze

If you have any issues accessing the air dispersion modeling files, please let me know.

Regards, Ryan



**Ryan Cleary** / Consulting Scientist 919.230.0716 (o) / <u>Profile</u> / <u>LinkedIn</u>

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## Ryan Cleary has invited you to work together in "AQM" folder on Box

Ryan Cleary <noreply@box.com> Thu 10/26/2023 6:55 AM To:McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

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Go to Folder

## Ryan Cleary invited you to collaborate on:

"Good Morning Bryan, You are invited to access the shared directory for updated AERMOD modeling files in support of the New-Indy Catawba, LLC new condensate steam stripper application. If you encounter any issues accessing the files, please let me know. Regards, Ryan Cleary ALL4"

## AERMAP

Meteorology

NIC\_Strip\_H2S\_1\_05b

NIC\_Strip\_H2S\_24\_05b

NIC\_Strip\_MMC\_1\_24\_05b

NIC\_Strip\_TRS\_1\_24\_05b

Delivered Modeling Files - 20231026.xlsx

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## Ryan Cleary has invited you to work together in "AQM" folder on Box

Ryan Cleary <noreply@box.com> Thu 10/5/2023 9:51 AM To:McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

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Go to Folder

## Ryan Cleary invited you to collaborate on:

"Good Morning Bryan, You are invited to access the shared directory for revised modeling files in support of the New-Indy Catawba, LLC new condensate steam stripper application. If you encounter any issues accessing the directory or files, please contact me. Regards, Ryan Cleary ALL4 (919) 230-0716"

## AERMAP

Meteorology

NIC\_Strip\_H2S\_1\_05

NIC\_Strip\_H2S\_24\_05

NIC\_Strip\_MMC\_1\_24\_05

NIC\_Strip\_TRS\_1\_24\_05

Delivered Modeling Files - 20231005.xlsx

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## **RE: TRS rates in model**

#### Buckner, Katharine <bucknekk@dhec.sc.gov>

#### Mon 7/17/2023 8:35 AM

To:McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>;Caleb Fetner <cfetner@all4inc.com> Cc:Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>;Steven Moore <smoore@all4inc.com>;Sheryl Watkins <swatkins@all4inc.com>;Ryan Cleary <rcleary@all4inc.com>

#### 2 attachments (15 MB)

Supporting Spreadsheets.zip; July 6 2022 modeled rates reviewed.xlsx;

Hey Caleb,

I have had several competing spreadsheets submitted the last couple of years for use in verifying the emission rates used in the modeling for H2S, TRS, and methyl mercaptan.

I have attached several versions. Here are the explanations of these.

On 6/30/2022, I received an email from Dan Mallet that (forwarded under separate email to you) had pdfs of the spreadsheets with the actual emissions shown. Somewhere along the way, these were expanded to include the maximum production rate and the maximum emission rates for H2S, TRS, and MM. These were the latest rates that were used in the modeling; attached and titled "July 6, 2022 modeled rates reviewed". The WATER9 results tab is the one in question. This appears to be a sheet I put together, but it uses the actual rates from the pdf spreadsheet from Dan Mallett and I suppose I scaled up those rates by the maximum production rate. The rates from this sheet were used in the last modeling. If these maximum rates are not accurate, please let me know and why. It is just a demonstration of the actual rates supplied by the facility and scaled to the maximum production.

I also have actual spreadsheets as supporting information around January 2022. These have lower rates than the 6/30/22 versions. The compressed folder of these is attached. See in the zip file titled "TRS and H2S Emission Rates".

Sorry for the confusion. Thank you for the help,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> Facebook Twitter



From: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>
Sent: Friday, July 14, 2023 2:23 PM
To: Caleb Fetner <cfetner@all4inc.com>; Buckner, Katharine <bucknekk@dhec.sc.gov>
Cc: Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>; Steven Moore <smoore@all4inc.com>; Sheryl Watkins
<swatkins@all4inc.com>; Ryan Cleary <rcleary@all4inc.com>
Subject: Re: TRS rates in model

Hi Caleb,

Sorry for the delay. It's been a busy day. Unfortunately, I'm just not as familiar with the emissions calculations as Katharine, nor do I know the exact documents that she used. Therefore I cannot provide the information. We'll have to wait for her return on Monday.

-Bryan @ BAQ

From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Friday, July 14, 2023 8:02 AM
To: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins
<<u>swatkins@all4inc.com</u>>; Ryan Cleary <<u>rcleary@all4inc.com</u>>;
Subject: RE: TRS rates in model

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Good morning Bryan, happy Friday.

We are trying to look into Katharine's question below on the emissions rates from the ditches, but I believe Katharine is out yesterday/today. Can you please send the "outputs from H2SSIM model and Water 9 that were dated June 27, 2022" that she is referencing below, so we can verify the rates she is requesting?

Thanks in advance, Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / Profile / LinkedIn

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From: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Sent: Wednesday, July 12, 2023 3:43 PM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Subject: Fw: TRS rates in model

Sheryl can you address?

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Wednesday, July 12, 2023 3:39 PM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: TRS rates in model

#### **External Email**

Hey Bob,

I left a voice mail earlier. I am following up with this email.

We are trying to verify the rates for H2S, TRS as H2S, and methyl mercaptan (MM) used in the modeling. Specifically, we are interested in the rates for the three ditches – Ditch 0 + splitter, Ditch 1, and Ditch 2. The last time modeling was done, rates from July 2022 were used. These rates are different from those used in Oct and Dec 2021 and they are different than those submitted as part of the new stripper project.

As I mentioned in the voice mail, I had outputs from H2SSIM model and Water 9 that were dated June 27, 2022. These rates were used in the last modeling.

Can you verify if the rates from June 27, 2022 are accurate and should be used in the model? Or are these not accurate and why?

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> <u>Facebook</u> <u>Twitter</u>



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## RE: SC DHEC Modeling Section comments on New Indy's stripper project application

## Caleb Fetner <cfetner@all4inc.com>

Thu 7/6/2023 6:24 PM

To:Buckner, Katharine <bucknekk@dhec.sc.gov>;Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM> Cc:McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>;Steven Moore <smoore@all4inc.com>;Ryan Cleary <rcleary@all4inc.com>

2 attachments (72 KB)

Response to Comments - Modeling Tables - July 6 2023.xlsx; July 6 Response to BAQ Modeling Section's Comments.docx;

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Hi Katharine,

Please see attached documents with responses to your questions below. Please reach out if anything is unclear.

Thanks, Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / Profile / LinkedIn

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>

Sent: Friday, June 30, 2023 3:56 PM

To: Caleb Fetner <cfetner@all4inc.com>; Tourville, Bob <BOB.TOURVILLE@NEW-INDYCB.COM>

Cc: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>; Steven Moore <smoore@all4inc.com>; Ryan Cleary <rcleary@all4inc.com> Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

Hey Caleb,

Thank you for the information on the splits. I will review and let you know if I have any questions.

I have been reviewing and verifying rates used in the modeling and have a couple questions/comments for you.

- 1. For all 3 Ditches, please provide the information used and the calculations for the rates used in the model.
- 2. On the Clarifier, an incorrect diameter may have been used. In Response to Comments Modeling Tables sheet, the Vol Area tab, the diameter is listed as 42 m. Previously a diameter of 84 m has been used. Please review and either provide a revised table or explain why 42 m is correct.

Please submit this information by Thursday, July 6, 2023.

Thanks,

#### Katharine K. Buckner

Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Caleb Fetner <<u>cfetner@all4inc.com</u>>

Sent: Friday, June 30, 2023 12:48 PM

To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>

**Cc:** McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Ryan Cleary <<u>rcleary@all4inc.com</u>> **Subject:** RE: SC DHEC Modeling Section comments on New Indy's stripper project application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Hi Katharine,

Apportioning the total ASB emissions between the three zones for the purposes of modeling was estimated based on the WATER9 results for the TRS compounds in the worst-case scenario (No Stripper Scenario) for TRS compounds. Based on the WATER9 results for each zone, ~98% of the total ASB emissions were apportioned to zone 1.

H2SSIM/WATER9 Results	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.57	0.22	8.40E-03
ASB Zone 2	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	1.85E-04	1.70E-04	5.26E-06
Total ASB	0.58	0.22	8.56E-03

This is a similar calculation to what you outlined in your question for H2S, but with the sum of the TRS compounds from the No Stripper Scenario (worst-case for TRS). The % splits were first developed for TRS as H2S, but was conservatively also applied to the H2S emissions rates as well due to the expected maximum receptor being closer to zone 1.

Please let me know if you have any further questions.

Caleb



**Caleb Fetner** / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Friday, June 30, 2023 8:23 AM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>; Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

Thank you. I was just making sure you saw the request.

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street

Connect: www.scdhec.gov Facebook Twitter



From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Friday, June 30, 2023 8:22 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Hi all – pulled together the information to answer Katherine's question and will be sending later today.



Caleb Fetner / Consulting Engineer 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u> www.all4inc.com / <u>Locations</u> / <u>Articles</u> / <u>Podcast</u> / <u>Training</u> ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Sent: Friday, June 30, 2023 8:17 AM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>
Subject: Re: SC DHEC Modeling Section comments on New Indy's stripper project application

I did.

Caleb

Please let me know where we stand with information to Katharine?

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Friday, June 30, 2023 8:12 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Subject: RE: SC DHEC Modeling Section comments on New Indy's stripper project application

Hey Bob,

Resending this to make sure you saw this earlier this week.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201



From: Buckner, Katharine
Sent: Wednesday, June 28, 2023 3:50 PM
To: Robert Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: McAvoy, Bryan P. <<u>MCAVOYBP@dhec.sc.gov</u>>
Subject: FW: SC DHEC Modeling Section comments on New Indy's stripper project application

Hey Bob,

Thak you for all this information and responses. I have been working on verifying rates and stuff. I have one question. In the "Revised Emission Calculations (6-26-23)...", in the "WWTP Factors" tab, how were the Zone splits calculated? What data was used to determine this? Please explain the rationale on these. I tried to come up with these but did not follow how they were done, etc.

For instance, Backup Stripper is the worst for H2S. Using page B-76 from the app, if you total the H2S for all 3 zones, then divide zone 1 by the total, I get 62%.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Steven Moore <<u>smoore@all4inc.com</u>> Sent: Tuesday, June 27, 2023 1:23 PM To: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>; Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Bob Tourville <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>> Co: Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Byan Cleany <<u>creleany@all4inc.com</u>>; Caleb Fetner <<u>creteany@all4inc</u>

**Cc:** Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Ryan Cleary <<u>rcleary@all4inc.com</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>; **Subject:** FW: SC DHEC Modeling Section comments on New Indy's stripper project application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* On behalf of and at the request of New-Indy Catawba, please find the attached responses to the comments received on June 20, 2023.

If you have any additional questions please contact Bob Tourville at New-Indy Catawba.



Steven Moore / Senior Managing Consultant

D: <u>919.234.5981</u> / C: <u>864.616.4711</u> / <u>Profile</u>

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From: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Sent: Tuesday, June 20, 2023 11:09 AM
To: Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Subject: FW: SC DHEC Modeling Section comments on New Indy's stripper project application

Just in. Can you follow up and respond by next Tuesday, June 27.

From: McAvoy, Bryan P. <<u>mcavoybp@dhec.sc.gov</u>>
Sent: Tuesday, June 20, 2023 11:04 AM
To: Tourville, Bob <<u>BOB.TOURVILLE@NEW-INDYCB.COM</u>>
Cc: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Subject: SC DHEC Modeling Section comments on New Indy's stripper project application

#### External Email

Hello,

I'm in the modeling section of the SCDHEC's Bureau of Air Quality. We've reviewed the facility's application for the installation of a new condensate stripper. Attached are some comments related to that review.

The first two questions are simply a request for a more complete of the Standard 2 and Standard 8 emission rates data related to the project.

The third question points out an emission factor error. Correcting the error would result in lower methyl mercaptan emission rates from one source.

The final two questions relate to the Std. 8 air toxics emissions calculations from the ASB's and ditches. Katharine will be able to help with questions related to emission factors, and I can help with questions about the air compliance averaging period referenced in question 5.

I work from home a few days a week, so please try my cell if you cannot reach me in the office.

We request a reply to these questions by Tuesday, June 27th.

Bryan McAvoy

Meteorologist

S.C. Dept. of Health & Environmental Control

Office: (803) 898-1275

Cell: (864) 350-0930

Email: mcavoybp@dhec.sc.gov

### Connect:

https://url.avanan.click/v2/ www.scdhec.gov .YXAzOm5ld2luZHk6YTpvOjNiZjJjN2M2MmU4MmFhZWV mNWFjNDM2NzM2NTE2OTImOjY6YjUyYjo1YjE3ZGZiODk2ODZINmNhMWEwZmVhNTcxMjYxNDc3MjIIMzII YzdhMjIIN2E3ODZkODA1N2RkNDA2ZTY0YmI3OnQ6VA

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SCDHEC's Modeling Section Comments to New Indy Concerning the March 23, 2023 Construction Permit Application for the Installation of a New Condensate Stripper. Dated June 20, 2023.

1) We request that the facility provide a table, preferably in the form of a spreadsheet, listing the facilitywide, post stripper project maximum allowable South Carolina Standard 2 emission rates, and stack parameters, from each emission point ID which has been previously modeled. This list should include all sources found in the table labeled "STANDARD NO. 2 – AMBIENT AIR QUALITY STANDARDS EMISSION RATES (LBS/HR)" in the 7-10-2019 "Air Compliance Summary Sheet" (henceforth, Summary) composed by the Modeling Section of SCDHEC as part of the compliance demonstration for Project Columbia.

Note that this request does not include sources which have been removed from the facility. These are retained in the Summary to keep track of sources that have been used in previous Other Information compliance demonstrations. As listed in the Summary, the requested emission points are CAUST, FAUMU, FUTCB1, FUTCB2, FUTLK2, FUTNCG1, FUTRF2, FUTRF3, FUTST2, and FUTST3. Emission rates from FUTPM2 and FUTPM3 are not subject to this request if they remain 50% or more below the Standard 2 exemption threshold.

**New-Indy Catawba Response:** Updated modeled source parameters and Standard No. 2 emissions rates for the sources listed above are provided in the workbook, "June 27 Response to Question 1.xlsx". The workbook contains tables with relevant parameters based on source type.

2) Furthermore, we request that the facility also provide a table, preferably in the form of a spreadsheet, listing the facility-wide, post stripper project maximum allowable emission rates, and stack parameters, for the Standard 8 three air toxics for which modeling was submitted as part of the construction permit application. These toxics are Total Reduced Sulfur, Hydrogen Sulfide, and Methyl Mercaptan. These are the three air toxics subject to the consent order. While these emission rates were included in the modeling files, they were not included in the application.

**New-Indy Catawba Response:** Post stripper project modeled source parameters and maximum allowable emissions for Total Reduced Sulfur (TRS), Hydrogen Sulfide (H<sub>2</sub>S), and Methyl Mercaptan (MMC) are provided in the workbook, "Response to Comments – Modeling Tables – June 27 2023.xlsx". The workbook contains tables with relevant parameters based on source type.

Unless otherwise noted, all source parameters and modeled emissions rates were provided by DHEC in a February 14, 2023 email from Bryan McAvoy to Ryan Cleary (ALL4). The DHEC-provided files reflect those used in the September 26, 2022 modeling conducted by DHEC as part of the Order to Correct Undesirable Level of Air Contaminants (May 7, 2021). DHEC directed that the post stripper project modeling demonstration should utilize the emissions rates and stack parameters as provided, including the incorporation of DHEC-modified vertices for the DITCH2 source for H<sub>2</sub>S modeling with the 1-hour averaging period only.

3) The permit writer found an error in the calculation of the emissions from the LD and HD tanks for methyl mercaptan. An emission factor of 3.7E-2 was used, while the correct emission factor appears to be 3.7E-03. This would decrease the emission rate from source PULPSTOR by approximately 0.40 lb/hr. As the modeling still passed with the higher value, the results are conservative and do not require a

revision to the modeling analysis. However, SCDHEC would still like to bring the error to the facility's attention as the MM modeling was so close to the standard.

**New-Indy Catawba response:** New-Indy Catawba agrees that the methyl mercaptan emissions factor used to represent maximum emissions from the low and high density pulp storage tanks results in an overestimate of the maximum emissions from these sources. As the facility wide modeling impact is below the maximum ambient air concentration for methyl mercaptan, New-Indy Catawba will continue to use this conservative approach in support of the dispersion modeling demonstration for the New Steam Stripper air construction permit application. New-Indy Catawba will adjust the emissions factor as part of any future modeling demonstration.

4) The permit writer was not able to arrive at the same emission rates for the three ASB's that were submitted in the facility's compliance order mandated modeling for the three Standard 8 air toxics of Total Reduced Sulfur, Hydrogen Sulfide, and Methyl Mercaptan. This discrepancy should be resolved. The ditches should also be included in these calculations as the emission rates provided in the modeling files indicate potentially substantive differences in the emission rates used in the current modeling and those used in previous runs for some of the ditches.

**New-Indy Catawba Response:** – Modeled emissions rates for sources characterized as area sources, including the three ASBs and the ditches, incorporate the size of each respective source, in square meters (m<sup>2</sup>), to provide the model with emissions rates in the appropriate units of grams per second per square meters (g/s/m<sup>2</sup>). Refer to the workbook, "Response to Comments – Modeling Tables – June 27 2023.xlsx" for the sizes of each modeled area source.

5) As a modeling compliance demonstration for South Carolina Standard 8 is based on a 24 hour averaging period, we want to ensure that the worst case emission rates from the ASB and ditches are being calculated for Total Reduced Sulfur, Hydrogen Sulfide, and Methyl Mercaptan for the new stripper project. We request that the facility use, for its air compliance demonstration, the worst case emissions from the three operating scenarios (New Steam Stripper Operating Scenario; Backup Stripper Online Scenario) for each respective air toxic, based on 24 hours of continuous operation for each scenario. This may not be necessary for a scenario which can be demonstrated to have a high likelihood of running for considerably less than 24 hours consecutively over the course of a year.

**New-Indy Catawba Response:** The WWTP Factors tab of the attached "REVISED Emissions Calculations (6-26-23)\_Modeling Emissions Rates" spreadsheet show how the worst-case gram per second emissions rates were calculated.

## Fw: New-Indy Catawba LLC Construction Permit Application

McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

Fri 3/24/2023 10:08 AM

To:Quina III, Gregory <quinags@dhec.sc.gov>

The NI stripper project modeling has arrived! I have not looked at it yet. I suppose I might not even get the project, but I certainly wanted you to know they have sent it in.

-Bryan

From: Ryan Cleary <rcleary@all4inc.com>
Sent: Thursday, March 23, 2023 3:50 PM
To: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>; Buckner, Katharine <bucknekk@dhec.sc.gov>
Cc: Pete Cleveland <pete.cleveland@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; Steven Moore
<smoore@all4inc.com>
Subject: RE: New-Indy Catawba LLC Construction Permit Application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Bryan,

On behalf of New-Indy Catawba LLC, ALL4 LLC has created the link below to access the air dispersion modeling files supporting the construction air permit application submitted today (March 23, 2023) for the new condensate steam stripper in accordance with the Consent Order to Correct Undesirable Levels of Air Contaminants signed on November 23, 2023.

https://all4.box.com/s/kjbaj7xiul8w4bsmqqt1pph6vqb77ppw

If you have any issues accessing the air dispersion modeling files, please let me know.

Ryan Cleary



**Ryan Cleary** / Consulting Scientist 919.230.0716 (o) / <u>Profile</u> / <u>LinkedIn</u>

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## Fw: New-Indy Catawba LLC Construction Permit Application

McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

Fri 3/24/2023 10:08 AM

To:Quina III, Gregory <quinags@dhec.sc.gov>

The NI stripper project modeling has arrived! I have not looked at it yet. I suppose I might not even get the project, but I certainly wanted you to know they have sent it in.

-Bryan

From: Ryan Cleary <rcleary@all4inc.com>
Sent: Thursday, March 23, 2023 3:50 PM
To: McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>; Buckner, Katharine <bucknekk@dhec.sc.gov>
Cc: Pete Cleveland <pete.cleveland@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; Steven Moore
<smoore@all4inc.com>
Subject: RE: New-Indy Catawba LLC Construction Permit Application

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\* Bryan,

On behalf of New-Indy Catawba LLC, ALL4 LLC has created the link below to access the air dispersion modeling files supporting the construction air permit application submitted today (March 23, 2023) for the new condensate steam stripper in accordance with the Consent Order to Correct Undesirable Levels of Air Contaminants signed on November 23, 2023.

https://all4.box.com/s/kjbaj7xiul8w4bsmqqt1pph6vqb77ppw

If you have any issues accessing the air dispersion modeling files, please let me know.

Ryan Cleary



**Ryan Cleary** / Consulting Scientist 919.230.0716 (o) / <u>Profile</u> / <u>LinkedIn</u>

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## Ryan Cleary has invited you to work together in "AQM" folder on Box

Box <noreply@box.com> Thu 3/23/2023 3:49 PM To:McAvoy, Bryan P. <mcavoybp@dhec.sc.gov>

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Go to Folder

# Ryan Cleary invited you to view:

"Bryan, On behalf of New-Indy Catawba LLC, ALL4 LLC has created this file sharing directory to access the air dispersion modeling files supporting the construction air permit application submitted today (March 23, 2023) for the new condensate steam stripper in accordance with the Consent Order to Correct Undesirable Levels of Air Contaminants signed on November 23, 2023. "

## AERMAP

Meteorology

NIC\_Strip\_H2S\_1\_03

NIC\_Strip\_H2S\_24\_03

NIC\_Strip\_MMC\_1\_24\_03

NIC\_Strip\_TRS\_1\_24\_03

Delivered Modeling Files - 20230323.xlsx

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## **Buckner**, Katharine

From:	Lowell, Randy <rlowell@burr.com></rlowell@burr.com>
Sent:	Monday, December 18, 2023 12:49 PM
То:	Buckner, Katharine
Cc:	Cobery, Jim; Rachel Davis; Martinez, Sara; Stephanie Blackman (Schwarz); Parrish, Sara
Subject:	New Indy Cmts
Attachments:	12-6-2023_2440-0005_c2 sob draft for facility (New-Indy Cmts).docx; Doc#_52603367 _v_1_12-6-2023_2440-0005_c2 cp draft for facility (New-Indy Cmts).DOCX

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katherine:

Attached are comments to the documents related to the stripper construction for New-Indy.

I apologize for the delay in getting this to you today. One of my daughters had an outpatient procedure this morning and I got behind.

Please do not hesitate to contact me or Rachel about these comments, and it may be prudent for you and Rachel to have a discussion after the holidays about a number of outstanding issues, and I will leave that scheduling to you and Rachel for what is convenient for y'all.

If I do not get a chance to speak with you before the holidays, I hope you and your family have a Happy Holiday season and we will speak in the New Year!

Randy

Randolph R. Lowell

Partner

115 Fairchild St, Suite 300 Daniel Island, South Carolina 29492

direct 843-973-6801 mobile 803-361-4783 fax 843-805-5735 <u>rlowell@burr.com</u> <u>Web</u> The information contained in this email is intended for the individual or entity above. If you are not the intended recipient, please do not read, copy, use, forward or disclose this communication to others; also, please notify the sender by replying to this message, and then delete this message from your system. Thank you.

## **Buckner**, Katharine

From:	Buckner, Katharine
Sent:	Wednesday, December 6, 2023 3:37 PM
То:	Rachel Davis; Sheryl Watkins; Steve Moore (smoore@all4inc.com); Robert Tourville
Cc:	Caleb Fetner; Hardee, Christopher; McCaslin, Steven
Subject:	revised drafts of c/p and SOB for the new stripper project
Attachments:	12-6-2023_2440-0005_c2 cp draft for facility.docx; 12-6-2023_2440-0005_c2 sob draft
	for facility.docx

Hello Rachel and all,

Attached are the revised draft construction permit and revised statement of basis (SOB). Please review and provide comments by Wednesday, December 13, 2023.

In the SOB, the project emissions table is still be worked on.

I apologize for not getting these out earlier today. I had issues with downloading the drafts from ePermitting so I had to create a new c/p and SOB, then cut and paste from the old ones into the new ones. I reviewed the new ones and they seem to be in order. Please let me know if you see any issues with either the c/p or SOB.

A complete revised application may be needed before this project goes on public notice. If the application would change extensively based on the comments made, please provide a revised application. I know the emission calculations changed. Let me know what you think on if a revised application is necessary.

#### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



## **Buckner**, Katharine

From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Friday, December 1, 2023 5:34 PM
То:	Buckner, Katharine; Rachel Davis; Robert Tourville; Steven Moore
Cc:	Caleb Fetner; Hardee, Christopher; McCaslin, Steven
Subject:	RE: Revised, draft c/p and SOB for the new stripper project
Attachments:	11-17-2023_2440-0005_c2 cp draft for facility NIC.docx; 11-17-2023_2440-0005_c2_sob
	draft for facility NIC.docx

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Hi, Katharine! On behalf and at the request of New-Indy Catawba LLC, please find the attached comments on the revised construction permit for the New Stripper and the associated statement of basis. The comments are in track changes and in the comment margins, including answers to your questions. Once you have had a chance to review, New-Indy Catawba can schedule a call to address any questions or where additional information, or discussion is needed. If it makes sense, we can discuss the revised drafts in the call that is already scheduled for Monday December 4<sup>th</sup> at 10:00 am. Thanks, and have a good weekend!



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>

Sent: Friday, November 17, 2023 1:51 PM

**To:** Rachel Davis <Rachel.Davis@new-indycb.com>; Robert Tourville <BOB.TOURVILLE@NEW-INDYCB.COM>; Steven Moore <smoore@all4inc.com>; Sheryl Watkins <swatkins@all4inc.com>

**Cc:** Caleb Fetner <cfetner@all4inc.com>; Hardee, Christopher <hardeecd@dhec.sc.gov>; McCaslin, Steven <mccaslsd@dhec.sc.gov>

Subject: Revised, draft c/p and SOB for the new stripper project

Hello Everyone,

Attached is the revised draft construction permit and statement of basis for the new stripper project. Please review and provide comments by Friday, December 1, 2023.

Thank you for your assistance working through the comments.

I wish you all a Happy Thanksgiving.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> Facebook Twitter



## **Buckner**, Katharine

From: Sent:	Rachel Davis <rachel.davis@new-indycb.com> Friday, November 10, 2023 3:54 PM</rachel.davis@new-indycb.com>
То:	Buckner, Katharine
Cc:	Caleb Fetner; Sheryl Watkins; smoore@all4inc.com
Subject:	RE: Question on new stripper app calculations
Importance:	High

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Ms. Katharine, please see the answers to your questions.

Questions:

- 1. I was looking over the construction application for the new stripper. Should NOx and CO emissions have been estimated from routing the existing LVHC gases to the No. 3 Recovery Furnace? NOx and CO were estimated from the new LVHC gases from the methanol condenser that will be routed to the No. 3 Recovery Furnace.
- 2. Should NOx and CO also be estimated from the Combination Boilers when the existing LVHCs are routed to them? Just like NOx and CO were estimated from the Combo Boilers when the new LVHC gases (from the methanol condenser) are routed to the boilers.

If it is determined that emissions do not need to be estimated from these scenarios for both the No. 3 Recovery Furnace and the Combinations Boilers, please provide an explanation why.

Answer: NOx and CO emissions have only been quantified from incinerating stripper off-gases (SOG), not normal kraft pulp mill LVHC gases. The new SRL LVHC gases are the non-condensable gases remaining after the SOG goes through the SRL condenser system, so emissions from SRL LVHC incineration were quantified based on the following:

- Combination Boilers:
  - NOx: SOG emissions factor (conservatively assuming ammonia isn't condensed into rectified methanol.)
  - CO: SOG emissions factor (assumes SRL LVHC is characteristic of SOG)
- RF3:
  - NOx: 1% increase to the established Title V emissions factor to account for small quantities of ammonia remaining in the SRL LVHC.
  - CO: SOG emissions factor (assumes SRL LVHC is characteristic of SOG)

Based on available published emissions factors, there is no appreciable difference in NOx/CO emissions expected from burning other fuels or incinerating the normal LVHC gases (consisting of the evaporators and turpentine system) with other fuels. For NOx, the ammonia is expected to condense out of the LVHC gases into the pulping condensates, which is why NOx emissions are expected from incinerating SOG, but not from kraft LVHCs.

If you have further questions, please don't hesitate to let me know.

Thanks and have a blessed weekend!

Rachel G. Davis Environmental Manager O: 803-981-8206 rachel.davis@new-indycb.com



From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Thursday, November 2, 2023 4:15 PM
To: Rachel Davis <Rachel.Davis@new-indycb.com>
Subject: RE: Question on new stripper app calculations

No ma'am. I sent that "nevermind" to the wrong person. Sorry for the confusion.

Please do respond to the earlier questions and disregard the "nevermind"

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Sent: Thursday, November 2, 2023 4:03 PM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Subject: Re: Question on new stripper app calculations

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Ms. Katharine, you're good on both questions?

Rachel
From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Thursday, November 2, 2023 3:49:51 PM
To: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Subject: RE: Question on new stripper app calculations

## **External Email**

Nevermind. I see it now.

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Buckner, Katharine
Sent: Thursday, November 2, 2023 1:33 PM
To: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Subject: Question on new stripper app calculations

Hey Rachel,

I was looking over the construction application for the new stripper. Should NOx and CO emissions have been estimated from routing the existing LVHC gases to the No. 3 Recovery Furnace? NOx and CO were estimated from the new LVHC gases from the methanol condenser that will be routed to the No. 3 Recovery Furnace.

## Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



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## **Buckner**, Katharine

From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Friday, November 3, 2023 2:52 PM
То:	Buckner, Katharine; Hardee, Christopher
Cc:	Rachel Davis; Tourville, Bob; Steven Moore; Caleb Fetner
Subject:	New-Indy Catawba – Initial comments on the draft New Stripper c/p and SOB
Attachments:	Draft for facility_NIC comments (11-3-23).docx; 2023-10-30 Addendum to
	comments.docx; SOB Draft_NIC comments (11-3-23).docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine:

On behalf and at the request of New-Indy Catawba LLC, please find the attached initial comments on the draft construction permit for the New Stripper and the associated statement of basis. The comments are in track changes and in the comment margins and we have also included an attachment with proposed alternative monitoring or compliance methodologies for the items discussed in the October 25<sup>th</sup> conference call with you. Once you have had a chance to review, New-Indy Catawba can schedule a call to address any questions or where additional information or discussion is needed. Thanks, and have a good weekend!



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE. In addition to the markup and comments provided in the Microsoft Word file back to DHEC, New-Indy Catawba is expanding on some comments in this document to provide additional information.

### Proposed Conditions C.18 and C.19

### No. 3 Recovery Furnace (RF3); LVHC combustion SO2 emissions.

As an alternative to the stack testing proposed by DHEC, New-Indy proposes to temporarily rent an SO2 CEMS (Method 6C) for RF3 that would be used to document:

1. Emissions from RF3 prior to combustion of any LVHC gases.

2. Emissions after beginning combusting the existing LVHC gases (includes turpentine recovery, Nos. 1-3 Evaporator, and the existing steam stripper feed tank)

3. Emissions after beginning combusting the new steam stripper system LVHC. (Note: once the new stripper is started up the Mill could operate in any of the three scenarios documented in the draft permit).

The duration of operation of the SO2 CEMS will be dependent upon the construction schedule; however, the Mill expects to gather approximately six months of SO2 CEMS data to document baseline SO2 emissions and that the sulfur from the existing LVHC gases or existing LVHC gases with new SRL LVHC is adequately captured in the recovery furnace and ESP.

For the placeholder Condition C.19. with respect to ongoing demonstration of the RF3 SO2 emissions rate, New-Indy proposes to:

- 1. Utilize the SO2 CEMS data (approximately 6 months of data) to establish the baseline and postproject emissions from the existing LVHC gases and the new steam stripper system.
- Perform annual SO2 stack testing if SO2 > 50% of the permitted emission rate or biennial if SO2 < 50% of the permitted emission rate during the most recent stack test.</li>
- 3. More frequent stack testing or installation of an SO2 CEMS could be required if the sulfur makeup exceeds an established baseline sulfur makeup value gathered as part of the SO2 testing under item No. 1.

## Proposed Condition B.22

## New Stripper; Daily sampling for TRS and methanol.

Speciated TRS testing on a daily basis is not practicable at this time. The RSC 02.02 method is only performed in Canada, and no other test method is performed by labs at this time (ALS liquid sulfur method no longer performed by ALS). New-Indy proposes the following:

1. Perform an initial performance test for the new steam stripper upon start up for methanol and speciated TRS compounds in and out of the steam stripper in order document the stripper can meet the design methanol and total TRS removal efficiency vendor guarantees. DI/MeOH 94.03 Method for methanol and NCASI RSC 02.02 Method for speciated TRS compounds.

2. Establish a relationship between the methanol removal efficiency and the TRS removal efficiency at varying steam to feed ratios.

3. Establish the minimum steam to feed ratio that will achieve 98% TRS removal efficiency.

Proposed ongoing compliance would be:

1. Based on daily methanol sampling in and out of the steam stripper until a methanol concentration or methanol factor can be established (inlet methanol) and a minimum steam to feed ratio can be established for the methanol removal efficiency.

2. Daily sampling is not required for TRS unless the steam to feed ratio falls below the minimum value set in the initial performance test that removes at least 98% TRS.

3. Quarterly verification testing for TRS using NCASI RSC 02.02 Method to confirm 98% removal efficiency is achieved at the minimum steam to feed ratio set in the original performance test.

## **Proposed Condition B.23**

## Existing Stripper; Daily sampling for TRS and methanol.

Speciated TRS testing is not practicable at this time (RSC 02.02 method only performed in Canada and no other test method performed by labs at this time. ALS liquid sulfur method no longer performed by ALS). The Mill proposes the following:

1. Perform an initial performance test for the existing steam stripper upon start up for methanol and speciated TRS compounds in and out of the steam stripper that would document the stripper can meet the design percent methanol and total TRS removal efficiency vendor guarantees. DI/MeOH 94.03 Method for methanol and NCASI RSC 02.02 Method for speciated TRS compounds.

2. Establish a minimum steam to feed ratio that will achieve 45% methanol removal efficiency and 98% TRS removal efficiency.

The existing steam stripper will become a back up to the new steam stripper and will only operate when the new stripper is not operational. Since Mill personnel will only be available to sample from 7 am to 4 pm during weekdays, the proposed ongoing compliance would be:

1. The Mill will run the existing steam stripper at or above the minimum steam to feed ratio established in the initial performance test.

2. Collect a sample for methanol in and out of the existing steam stripper (a) when the existing steam stripper is in operation between the hours of 7 am and 4 pm during weekdays; and (b) is in stable operation for a minimum of 6 hours.

3. Sampling is not required for TRS unless the steam to feed ratio falls below the value set in the initial performance test. In this case, testing in and out of the steam stripper the Mill will utilize the onsite HACH method for total sulfides provided (a) the existing steam stripper is in operation between the hours of 7 am and 4 pm during weekdays; and (b) is in stable operation for a minimum of 6 hours.

## **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Thursday, January 11, 2024 3:30 PM
То:	Buckner, Katharine
Cc:	Sheryl Watkins; Steven Moore; Rachel Davis
Subject:	RE: Anything you can send ahead of time
Attachments:	REVISED Emissions Calculations (1-11-24).xlsx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine – here are the updated emissions calculations with updates as follows:

- 1. Increased hardpipe (No Stripper) operating scenario to maximum allowable steam stripper downtime of 460 hours.
- 2. Increased from 1% to 2% SRL by volume mixed with BLS firing, resulting in small change in NOx emissions.
- 3. Added Project Emissions for Statement of Basis on each pollutant tab.

I'm unfortunately going to be out of office on Tuesday during our scheduled time to do final review of permits, but if you're able to review these tomorrow – I'm general available all day to discuss any questions or comments you have on these calculations.

Appreciate it! We are hard at work trying to get you the permit comments ASAP.



Caleb Fetner / Managing Consultant
 678.293.9431 / Profile / LinkedIn
 www.all4inc.com / Locations / Articles / Podcast / Training
 ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Thursday, January 11, 2024 11:52 AM
To: Sheryl Watkins <swatkins@all4inc.com>; Steven Moore <smoore@all4inc.com>; Caleb Fetner
<cfetner@all4inc.com>; Rachel Davis <Rachel.Davis@new-indycb.com>
Subject: Anything you can send ahead of time

Hey Y'all,

Thanks for the time today. Just wanted to add if there is anything you can send to me before tomorrow that will be great – comments on one permit, etc.

## Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street

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## NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operati	ng Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	4.75%	416.0
No Stripper Online	5.25%	460.0

LVHC ControlOperating TimeOperating Scenario%RF3 Available for LVHC75%LVHC to CB1/CB225%LVHC to CB1/CB20

Baseline

Existing Stripper Steam Demand21.1MMBtu/hr(Attachment A to May 22 Response to DHEC Comments on App 1)

was previously

23.9 MMBtu/hr

## Summary of PSD Applicability (tons/year)

Added Project Emissions for Statement of Basis on each pollutant tab.

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	со	H2SO4	TRS	voc	Pb	H <sub>2</sub> S	CO <sub>2</sub>
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3.61	12,275
Projected Actual Emissions	13.3	10.3	8.37	147	605	62.8	2.43	16.2	253	2.06E-03	5.59	48,181
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-131.98	37.6	1.20	3.35	20.1	1.95E-03	1.98	35,906
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

#### SO2 EMISSIONS REFERENCES

	Stripper	Scenario		Operating C	onfiguration		Con	trols				S02	Sulfur		
	Operati	ng Time		Ti	me		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	SO2 Em	hissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE AG	CTUAL EMISSI	ONS (March	2021 - Febru	ary 2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.1
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
SO2 BASELINE ACTUAL EMISSIONS (BAI	E)														737.0
						-	PROJECTED	ACTUAL EMI	SSIONS						
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor / Preliminary Design Information	99%	0.6	2.4
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	99%	0.9	2.7
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	31.0
Backup Stripper Online	4.7%	416.0	NA	100%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	32.7
No Stripper Online	5.3%	460.0	Foul Condensate to Hard Pipe	100%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	5.9	19.4
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	295.2	323.3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.00	0.0
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D,F</sup>	81.6%	339.5	NA	100.0%	339.5	25.3	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.003
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D,F</sup>	18.4%	76.5	NA	100.0%	76.5	24.1	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	53.1	2.0
SO2 PROJECTED ACTUAL EMISSIONS (P	AE)														605.04
						1	NET EMISSION	NS CHANGE (F	PAE - BAE)						
NET EMISSIONS CHANGE (PAE - BAE)															-131.98

Project Emissio

		-,
Uncon	trolled	Contro
lb/hr	TPY	lb/hr
950.8	4164.3	655.5

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

Worst-case short-term (lb/hr) emissions operating, burning SOG and LVHC in CB: burning oil. Worst-case long-term (TPY) emissions c operating all year, but SRL offline, burni and if all of the new stripper steam cam

#### H2SO4 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols			H2SO4		Sulfur		
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Product	tion Rate		Emissions Factor	Capture	H2SO4 I	Emissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/ADTP	Reference	%	lb/hr	tpy
					BASELINI	ACTUAL EMISSIONS (March 202	1 - February 20	)23)							
WHC Collection System	100%	8 760 0	NA	100%	8 760 0		100.0%	8 760 0	1 265	ADTD/day	4 025 02	NCASI Technical Bulletin 858,	NIA	0.2	1.2
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC 10 CB1/CB2	100.0%	8,760.0	1,505	AD IP/uay	4.95E-05	Table 10	NA	0.5	1.2
H2SO4 BASELINE ACTUAL EMISSIONS (BA	AE)											-			1.2
	PROJECTED ACTUAL EMISSIONS														
WHC Collection System	100%	8 760 0	NA	100%	9 760 0	LV/HC to BE2	75.0%	6 5 70 0	2 700	ADTD/day	4 025 02	NCASI Technical Bulletin 858,	NA	0.55	1 02
LVHC Collection System	100%	8,760.0	NA	100%	8,700.0	EVHC to RF3	75.0%	6,570.0	2,700	ADTP/uay	4.95E-05	Table 10	NA	0.55	1.02
WHC Collection System	100%	8 760 0	NA	100%	9 760 0	LV/HC to CB1/CB2	25.0%	2 100 0	2 700	ADTD/day	4 025 02	NCASI Technical Bulletin 858,	NA	0.55	0.61
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	EVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/uay	4.95E-05	Table 10	NA	0.55	0.01
H2SO4 PROJECTED ACTUAL EMISSIONS (	PAE)														2.43
						NET EMISSIONS CHANGE (PAE	- BAE)								
NET EMISSIONS CHANGE (PAE - BAE)															1.20

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

0.55 2.43 No difference in worst-case short-term ( RF3 or CBs. Long-term (TPY) emissions b No true control device (not including req typical control device at stack) so no diff

TPY

Uncontrolled

lb/hr

controlled, or PTE.

Project Emission

lb/hr

Contro

#### NOX EMISSIONS REFERENCES

	Stripper	r Scenario		Oper	rating		Con	trols				NOX	Ammonia		
	Operat	ing Time		Configura	ition Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Increase	NOX Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUA	AL EMISSIONS	(March 2021	- February 2	023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.3	28.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100%	168.3	24.8	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.8	0.7
NOX BASELINE ACTUAL EMISSIONS			•												123.7
			-			PF	ROJECTED ACT	UAL EMISSIO	NS						
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	2.0%	3.6	13.4
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	2.0%	0.4	1.1
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
Backup Stripper Online	5%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.7
No Stripper Online	5%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100%	460.0	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	5%	416.0	Natural Gas <sup>D,F</sup>	81.6%	339.5	NA	100%	339.5	25.3	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.1	1.2
Backup Stripper Steam - No. 6 Oil	5%	416.0	No. 6 Oil <sup>D,F</sup>	18.4%	76.5	NA	100%	76.5	24.1	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.5	0.3
NOX PROJECTED ACTUAL EMISSIONS															147.5
						NET	EMISSIONS CH	ANGE (PAE -	BAE)						
PAE - BAE															23.8

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >2% with maximum addition of SRL of 2% by volume (representative of ~1% by volume pure methanol.)

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

		Project Emission
Uncon	trolled	Contro
lb/hr	TPY	lb/hr
75.8	332.2	

Worst-case short-term (lb/hr) emissions operating, burning SOG in CBs, with steau Worst-case long-term (TPY) emissions co operating all year, but SRL offline, and all from oil.

#### CO EMISSIONS REFERENCES

	Strinner	Scenario		One	rating		Con	trols			1	00	00		
	Operat	ing Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Control	COF	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	LIOM	lb/UOM	Reference	%	lh/hr	tov
	///	1 115	operating configuration	70	111.5	BASELINE ACTUAL EP	VISSIONS (Ma	rch 2021 - Fel	oruary 2023)	00111	15/00111	increased a second s			
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1.365	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	8.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.1
CO BASELINE ACTUAL EMISSIONS															25.2
						PROJE	CTED ACTUAL	EMISSIONS							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Backup Stripper Online	5%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.7
No Stripper Online	5%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	5%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	NA	100.0%	339.5	25.3	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.1	0.4
Backup Stripper Steam - No. 6 Oil	5%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	NA	100.0%	76.5	24.1	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.0
CO PROJECTED ACTUAL EMISSIONS			•												62.8
						NET EMIS	SIONS CHANG	GE (PAE - BAE	)						
PAE - BAE															37.6

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

TPY lb/hr 71.9

Contro

Worst-case short-term (lb/hr) and longcorresponds to New Stripper operating, gas.

lb/hr

16.4

Project Emission Uncontrolled

#### VOC EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Cor	trols				VOC			
	Operati	ng Time		Configura	ition Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EN	ISSIONS (Ma	rch 2021 - Fel	ruary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35	Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	8.51E-01	WATER9 Inputs and Outputs Provided.	NA	48.39	211.96
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC BASELINE ACTUAL EMISSIONS													-		233.11
		-		-		PROJEC	TED ACTUAL	EMISSIONS							
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40	Vendor / Preliminary Design Information	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	10.11
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	7.10
Backup Stripper Online <sup>H</sup>	5%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	7.20	Vendor / Preliminary Design Information	98%	16.20	3.37
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9 Inputs and Outputs Provided.	NA	32.85	129.50
ASB - Backup Stripper Online	5%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100%	416.0	2,700	ADTP/day	1.43	WATER9 Inputs and Outputs Provided.	NA	160.92	33.47
ASB - No Stripper Online	5%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	NA	100%	460.0	2,700	ADTP/day	2.20	WATER9 Inputs and Outputs Provided.	NA	247.14	56.84
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	5.50E-03	2.71E-03
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	5%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	NA	100%	339.5	25.3	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	5%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	NA	100%	76.5	24.1	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS															253.22
						NET EMIS	SIONS CHAN	GE (PAE - BAE							
PAE - BAE															20.11

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - Backup Stripper in TRS Mode removes 45% of the methanol from the foul condensate. The stripped condensate is discharged to the hardpipe for additional methanol treatment in the ASB.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

 1800.5
 7886.4
 247.5

 Worst-case short-term (lb/hr) emissions
 Worst-case long-term (TPY) emissions o maxed out at 460 hours, and New Stripp

Uncontrolled

lb/hr TPY

Project Emiss

lb/hr

Contr

Assumes 90% uptime on new stripper. For uncontrolled, worst-case is new strip steam from natural gas.

#### TRS EMISSIONS REFERENCES

	Stripper	Scenario		Oper	rating		Cor	trols			TRS				
	Operat	ing Time		Configura	ation Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	TRS En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	M Ib/UOM Reference		%	lb/hr	tpy
				-		BASELINE ACTU	JAL EMISSION	IS (March 202	1 - February	2023)					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.88E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
TRS BASELINE ACTUAL EMISSIONS															12.81
							PROJECTED AG	TUAL EMISSI	ONS						
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.33	Vendor / Preliminary Design Information	99.9%	0.04	0.14
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.18
Backup Stripper Online	4.7%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.19
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
ASB - Backup Stripper Online	4.7%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	3.06	0.64
ASB - No Stripper Online	5.3%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	1.88
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															16.16
						NE	TEMISSIONS	CHANGE (PAE	- BAE)						
PAE - BAE															3.35

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline. C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design. G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

#### Project Emission Contro

Uncontrolled lb/hr TPY lb/hr 288.7 1264.3 9.2

Worst-case short-term (lb/hr) emissions scenario. Worst-case long-term (TPY) em Stripper scenario maxed out at 460 hour Stripper SOGs to CBs, along with LVHC. A stripper.

For uncontrolled, worst-case is new strip with steam from natural gas. LVHC vente

#### H2S EMISSIONS REFERENCES

Ì	Stripper	Scenario		Ope	ating		Con	trols				H2S	Sulfur		
	Operat	ing Time		Configura	ition Time		Operati	ng Time	Product	tion Rate		Emissions Factor	Capture <sup>C</sup>	H2S En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	1	<b>r</b>			r	BASELINE ACT	UAL EMISSION	IS (March 202	1 - February	2023)				r	
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.13E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS															3.61
							PROJECTED AG	CTUAL EMISSI	ONS			-			
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.24	Vendor / Preliminary Design Information	99.9%	0.03	0.10
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
Backup Stripper Online	4.7%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
ASB - Backup Stripper Online	4.7%	416.0	H2S Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	9.81E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.23
ASB - No Stripper Online	5.3%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	9.54E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.25
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															5.59
	Mark         Mark <th< td=""><td></td></th<>														
PAE - BAE	visit         visit <th< td=""><td>1.98</td></th<>											1.98			

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline. C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.



Project Emission

Contro

Worst-case short-term (lb/hr) emissions corre Worst-case long-term (TPY) emissions assume 460 hours, and New Stripper operating at 905 For uncontrolled, worst-case is new stripper ! vented (i.e., no control in the CBs).

Uncontrolled

#### PM EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				PM	PM		
	Operati	ng Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Control	PM Em	issions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIO	ONS (March 20	21 - February	2023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	NA	4.0	0.3		
PM BASELINE ACTUAL EMISSIONS															1.1
						PROJECTED	ACTUAL EMISS	SIONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.1	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	3.9	0.1
PM PROJECTED ACTUAL EMISSIONS															13.3
						NET EMISSION	S CHANGE (PA	E - BAE)							
PAE - BAE															12.2

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

 Project Emission

 Uncontrolled
 Control

 lb/hr
 TPY
 lb/hr

 14.9
 65.1
 65.1

#### PM10 EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				PM10	PM10		
	Operati	ng Time		Configura	ation Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	PM10 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	S (March 202:	L - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
PM10 BASELINE ACTUAL EMISSIONS															1.0
	I.0 II.0 II.0 II.0 II.0 II.0 II.0 II.0														
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.1	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.8	0.1
PM10 PROJECTED ACTUAL EMISSIONS															10.3
	NET EMISSIONS CHANGE (PAE - BAE)														
PAE - BAE															9.3

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

lb/hr TPY lb/hr 10.8 47.3

Uncontrolled

Project Emission

Contro

#### PM2.5 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	rols				PM2.5	PM2.5		
	Operati	ng Time		Configura	ition Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	PM2.5 E	missions.
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS (	March 2021 -	February 202	3)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															1.0
	REERCICAL EMISSIONS 10														
Recovery Furnace #3 LVHC Ignitor	Funce #3 LVHC Ignitor         75.0%         6,57.0         Natural Gas <sup>1</sup> 15.0%         985.5         100.0%         985.5         1.0         mmBtu/hr         7.60E-03         AP-42 Table 1.4-2. Filterable and Condensable.         NA         7.60E-03         3.74E-03														
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	25.3	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.1	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.4
						NET EMISSIONS CH	ANGE (PAE - E	AE)							
PAE - BAE															7.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline. C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

Project Emission Uncontrolled Contro lb/hr TPY lb/hr 8.1 35.6

#### LEAD EMISSIONS REFERENCES

í															
	Stripper	Scenario		Oper	ating		Con	trols				Lead	Lead		
	Operat	ing Time		Configura	ition Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	Lead En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	IS (March 202	1 - February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	5.10E-05
												U.S. EPA document "Estimating Air Toxic Emissions			
	01.49/	0.004.0	the start B	2.40/	100.0		100.00/	100.0	24.0	and the second second	2 005 05	from Coal and Oil Combustion Sources" [EPA-450/2-		6.055.04	5 055 05
Backup Stripper Steam	91.4%	8,004.0	NO. 6 OIF	2.1%	168.3		100.0%	168.3	24.8	mmBtu/nr	2.80E-05	89-001] for Uncontrolled Residual Oil-fired Utility	NA	6.95E-04	5.85E-05
												Boilers (Table 4-1)			1
LEAD BASELINE ACTUAL EMISSIONS															1.10E-04
						PROJECTED AG	TUAL EMISSI	ONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility	NA	2.58E-03	1.87E-03
												Boilers (Table 4-1)			
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	25.3	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.27E-05	2.15E-06
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.1	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" (EPA-450/2- 89-001) for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	NA	6.75E-04	2.58E-05
LEAD PROJECTED ACTUAL EMISSIONS															2.06E-03
						NET EMISSIONS	CHANGE (PAE	- BAE)							
PAE - BAE															1.95E-03

#### Project Emission

Uncontrolled Controlled Lb/hr TPY lb/hr 2.58E-03 1.13E-02

Worst-case short-term (lb/hr) and long-t to New Stripper operating, with stripper

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline. C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

#### CO2 EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	trols				CO2	CO2		
	Operat	ng Time		Configura	ation Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	CO2 En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSION	NS (March 202	21 - February	2023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,044.8	11,929
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	346
CO2 BASELINE ACTUAL EMISSIONS															12,275
						PROJECTED A	CTUAL EMISS	IONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	4.7%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	25.3	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	2,958.3	502
Backup Stripper Steam - No. 6 Oil	4.7%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.1	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	3,993.0	153
CO2 PROJECTED ACTUAL EMISSIONS															48,181
						NET EMISSIONS	CHANGE (PAI	E - BAE)							
PAE - BAE															35,906

Project Emission

Uncontrolled Controlled Ib/hr TPY Ib/hr 15,387.8 67,398.4

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

### SUMMARY OF ASB EMISSIONS FACTORS

				ASB Emissions F	actors (Ib/ODTP)			
Scenario	H <sub>2</sub> S	DMDS	DMS	ММС	TRS as $H_2S$	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	3.37E-02	0.89	0.95	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	1.99E-02	0.30	0.32	0.0269
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	2.23E-02	1.53	1.59	0.0302
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	5.81E-02	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

			Con	centration (pp	om)	
		Hydrogen	Methyl	Dimethyl	Dimethyl	
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	<b>Total TRS</b>
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	l data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 of	or 6/25	146.7	16.0	17.0	15.0	194.7

		MW
H2S	Hydrogen Sulfide	34.08 g/mol
Ch4S	Methyl Mercaptan	48.11 g/mol
C2H6S	Dimethyl Sulfide	62.13 g/mol
C2H6S2	Dimethyl Disulfide	94.20 g/mol
S	Sulfur	32.07 g/mol

## Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl
Sulfide	Mercaptan	Sulfide	Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AHL)
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.7001

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

## Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

### CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination			
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total	Total	
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil				
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu	
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309	1,3
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0	1,4
May-21	46,962	38,834	63,467	102,301	0	0	0	0	1,5
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180	1,4
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15	1,5
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0	1,4
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13	1,3
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0	1,5
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0	1,3
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0	1,2
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388	1,4
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112	1,3
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50	1,4
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0	1,3
May-22	38,896	39,982	73,918	113,900	0	0	0	0	1,2
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336	77
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0	1,2
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0	1,7
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4	1,5
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0	1,5
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0	1,3
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511	1,0
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384	1,1
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252	1,4
Total	996,766			3,237,544				69,553	
Annual Average	498,383								
				97.9%				2.1%	

996,766 498,383

New Indy Catawba ASB BAE Methanol Emissions Factor R	REVISED June 7	Response
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Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference
	ADTP	ODTP	lb/ODTP	
Mar-21	42,474	38,226	1.50	
Apr-21	43,075	38,767	1.50	
May-21	46,962	42,266	1.50	
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart
Jul-21	49,371	44,434	1.50	S Performance Tests.
Aug-21	44,614	40,152	1.50	Representative of ASB
Sep-21	40,177	36,159	1.50	operation from March
Oct-21	47,234	42,510	1.50	2021 to February 2022.
Nov-21	39,185	35,266	1.50	
Dec-21	38,734	34,860	1.50	1
Jan-22	43,690	39,321	1.50	1
Feb-22	37,736	33,962	0.33	1
Mar-22	43,944	39,549	0.33	1
Apr-22	40,046	36,041	0.33	1
May-22	38,896	35,006	0.33	1
Jun-22	23,184	20,866	0.33	Average of 2022 Subpart
Jul-22	39,890	35,901	0.33	S Performance Tests.
Aug-22	53,396	48,057	0.33	Representative of ASB
Sep-22	45,044	40,539	0.33	operation from February
Oct-22	47,517	42,765	0.33	2022 to February 2023.
Nov-22	40,133	36,120	0.33	1
Dec-22	33,859	30,474	0.33	1
Jan-23	35,464	31,918	0.33	1
Feb-23	39,276	35,348	0.33	1
Baseline Methanol E	missions Factor (Pul	p Weighted Average)	0.89	lb/ODTP
			<u> </u>	•

Additional information added to spreadsheet on 6/16/2023.

## **BAE Other VOC Emissions Factors**

Date of Subpart S	Acetadehyde,	MEK nom	Bron nom
Performance Testing	ppm	MEK, ppm	μορ., μριτι
7/9/2021	24.3	7.7	1.1
7/10/2021	25.3	5.7	4.0
7/11/2021	25.0	6.5	7.0
10/26/2021	25.0	12.3	0.8
10/27/2021	27.5	13.3	1.0
10/28/2021	10.6	6.6	1.2
10/29/2021	15.0	8.6	0.9
2/14/2022	16.7	7.5	0.7
2/15/2022	17.0	9.5	0.6
2/16/2022	15.7	8.6	1.0
5/4/2022	20.7	7.1	1.0
5/5/2022	16.3	7.3	1.0
5/6/2022	15.0	6.8	1.0
8/9/2022	15.3	5.9	0.7
8/10/2022	25.0	7.2	1.1
8/11/2022	20.3	6.0	1.0
9/27/2022	14.3	5.3	0.7
9/28/2022	15.0	5.2	0.7
9/29/2022	18.0	5.6	0.9
10/18/2022	25.0	5.6	1.0
10/19/2022	23.7	5.5	1.1
10/20/2022	23.0	6.6	0.9
AVG ppm:	19.72	7.28	1.34
Lbs into ASB	55.48	20.49	3.78
Fair estimated from WATER9			
properties	0.55	0.38	0.43
Lbs emitted	30.73	7.73	1.61
Average Pulp Production			
during Subpart S testing		1716	
lb/ODTP	0.018	0.005	0.001

## PAE Other VOC Emissions Factors

			PAE	
			lb/ODTP	
	BAE		Backup	
	lb/ODTP	New Stripper	Stripper	No Stripper
Methanol	0.89	0.30	1.53	2.31
Acetadehyde	0.018	0.006	0.031	0.046
MEK	0.005	0.002	0.008	0.012
Propionaldehyde	0.001	0.000	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504
DMS	0.0185	0.0136	0.0147	0.0192
MMC	3.28E-04	1.88E-04	1.30E-03	7.42E-04
VOC:	0.95	0.32	1.59	2.44

	Combina	tion Boiler No.	1 Stack	Combination Boiler No. 2 Stack					
	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG			
ODTP/hr	77.3	79.0		91.1	92.9				
ADTP/hr	85.9	87.8		101.2	103.2				
lb SO2/hr	342.8	230.7		380.9	309.9				
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00	0.76			

	Controlled	Emissions	Sulfu	r Capture	Uncontrolled Emissions		
	Average	Maximum	Bark Ash <sup>C</sup>	LVHC Scrubber	Average	Maximum	
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP	lb SO2/ADTP	
SOG	1.06	1.36	20%	NA	1.33	1.70	
NCG	2.82	3.00					
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92	5.25	
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06	1.13	

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (0.473 lb SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests  $\sim$ 32% capture).

## WESTER

RESULTS AND DISCUSSION

Combination Boiler #1

Average:

- 2

## TABLE 2-2 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	0844	1029	1206	
Time Ended	0944	1129	1306	
Stack Gas Data				
Temperature, °F	430	435	438	434
Velocity, ft/sec	64	63	63	63
Moisture, %	17	17	17	17
CO <sub>2</sub> Concentration, %	8.8	9.0	8.6	8.8
O2 Concentration, %	10.5	10.5	10.8	10.6
VFR, x 10 <sup>5</sup> dscfin	1.46	1.45	1.44	1.45
Sulfur Dioxide				
Concentration, ppm	280	227	204	237
Emission Rate, lb/hr	407.4	328.3	292.6	342.8

Conditio	n 1 21	With NCGs	with SOGs												
Run N		Start Time	Steam Rate	Bark Rate	Gas Flow (10 <sup>4</sup> SCF/H/)	TOF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condénsate Flow (GPM)	LVHC Flow to Boilers (SCFM)	SOG Flow ta Boilers (SCFM)	HVLC Flow to Bailers (SCFM)	Puip Production (ODT/Hr)	Рир ХАРРА
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	1407	1103	10851	77.3	82,7
	2	1029	265.3	33.0	109.1	1.23	40	10.9	505	213	1409	1200	10885	77.3	85.7
	3	1206	257.7	32.6	100.4	1.23	40	10.9	504	2	1443	1205	10963	77.3	84.8
Average:	:		261.9	31.8	112.1	1.23	40	10.9	507	148	1420	1170	10900	77.3	84.4

#### Condition 2: With NCGs, without SOGs 13-Oct-21

							NCG			Hard Pipe						
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Productio	n	
Run #	3	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPP/	A,
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	1416		11071		/9.0	83.9
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	1414	教授的問題意思	10976	i T	79.0	81.6
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	1430		11061	. 7	79.0	80.3
Average			265.8	33.0	106.4	1.23	40	10.9	505	146	1420		11036	F 7	79.0	81.9
													-			

## TABLE 2-3 No. 1 Combination Boiler Condition 2: NCG Gases Only Summary of SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	10/13/21	10/13/21	10/13/21	
Time Began	1407	1544	1714	
Time Ended	1507	1644	1814	
Stack Gas Data				
Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, %	17	18	16	17
CO2 Concentration, %	9.6	9.9	8.9	9.5
O2 Concentration, %	10.1	9.8	10.7	10.2
VFR, x 105 dscfm	1.37	1.39	1.43	1.40
Sulfur Dioxide				
Concentration, ppm	140	176	180	165
Emission Rate, lb/hr	191.3	243.6	257.0	230.7

K 115730 NEW IND YOOT CATAWIA SCOOPJEE/ORTNEW-IND/Y CATAWIA OCT 2021 1-2 CB 502 EMISSION TEST REPORT.DOCM 28 Onsider 2021 1-50 p.m. Vension

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## WESTON

RESULTS AND DISCUSSION

#### Combination Boiler #2

14-Oct-21

Condition 1: With NCGs, with SOGs

#### TABLE 2-4 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	
Time Began	0830	1026	1222	
Time Ended	0930	1126	1322	
Stack Gas Data				
Temperature, °F	463	477	465	469
Velocity, fl/sec	63	68	61	64
Moisture, %	17	19	16	17
CO <sub>2</sub> Concentration, %	8.2	9.5	7.5	8.4
O2 Concentration, %	10.8	10.1	11.5	10.8
VFR, x 10 <sup>5</sup> dscfm	1.40	1.43	1.35	1.39
Sulfur Dioxide				
Concentration, ppm	275	262	286	274
Emission Rate, lb/hr	383.7	373.7	385.4	380.9

14-Oct	-21														
							NCG			Hard Pipe					
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Run		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209	1409	1203	11071	91.1	94.5
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200	1420	1179	11160	91.1	88.2
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199	1429	1157	11090	91.1	80.7
Average			234	33.8	158.6	1.23	40	10.9	505	203	1419	1180	11107	91.1	87.8

Condition 2:	With NCGs	, without SOGs
14-Oct-21		

						NCG			Hard Pipe						
						Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
		Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
	Start Time	(103 lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
1	1410	198	21.7	174.8	1.23	40	10.9	505	209	1438		11109	92.9	78.8	
2	1547	218	35.4	206.4	1.23	40	10.9	505	224	1435		11060	92.9	78.7	
3	1725	214	49.6	220.6	0.65	40	10.9	505	262	1453		10977	92.9	79.3	
		210	35.6	200.6	1.04	40	10.9	505	232	1442		11049	92.9		
	1 2 3	Start Time 1 1410 2 1547 3 1725	Steam Rate           Start Time         (10 <sup>3</sup> lbs/hr)           1         1410         198           2         1547         218           3         1725         214           :         210         210	Steam Rate         Bark Rate           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)           1         1410         198         21.7           2         1547         218         35.4           3         1725         214         49.6           ::         20         35.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> )           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)           1         1410         198         21.7         174.8           2         1547         218         35.4         206.4           3         1725         214         49.6         220.6           ::         210         35.6         200.6	Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TDF (TPH)           1         1410         198         21.7         174.8         1.23           2         1547         218         35.4         206.4         1.23           3         1725         214         49.6         220.6         0.65           ::         20         35.6         200.6         1.04	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strubber           Start Time (10 <sup>3</sup> lbs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)           1         1410         198         21.7         174.8         1.23         40           2         1547         218         35.4         206.4         1.23         40           3         1725         214         49.6         220.6         0.65         40	NCG           Steam Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG           Strart Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         SCF/Hr)         TOF (TPH)         (GPM)         (SU)           1         1410         198         21.7         174.8         1.23         40         10.9           2         1547         21.8         35.4         206.4         1.23         40         10.9           3         1725         21.4         49.6         220.6         0.65         40         10.9	NCG         Stream Rate         Bark Rate         Gas Flow (10 <sup>3</sup> NCG         Stripper Fault           Start Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STer Time (10 <sup>3</sup> Ibs/hr)         (Ster Time (10 <sup>3</sup> Ibs/hr)         (Tons/Hr)         STER Time (10 <sup>3</sup> Ibs/hr)         STER Time (10 <sup>3</sup> Ibs/Hr)	Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         NCG         Stripper Foul         Foul           Start Time         10 <sup>2</sup> (10 <sup>2</sup> (10 <sup>2</sup> ))         Flow         Scrubber / Scrubber         Condensate         Condensate           1         1410         198         21.7         174.8         1.23         40         10.9         505         209           2         1547         218         35.4         206.4         1.23         40         10.9         505         224           3         1725         214         49.6         220.6         0.65         40         10.9         505         262	Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow Scrubber         NCG         Stripper Foul         Foul         LVHC Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         209         1438           3         1725         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Stripper Foul         Four         Hard Pipe           Start Time (10 <sup>3</sup> lbs/hr)         Bark Rate         Gas Flow (10 <sup>3</sup> )         Flow         Scrubber pH         Condensate         Condensate         Sond Flow to           1         1410         198         21.7         174.8         1.23         40         10.9         505         209         1438           2         1547         218         35.4         206.4         1.23         40         10.9         505         224         1435           3         172.5         214         49.6         220.6         0.65         40         10.9         505         262         1453	NCG         Hard Pipe           NCG         Stripper Fault         Four         NCG         Stripper Fault         Stripper Fault         Stripper Fault         Stripper Fault         Kore Stripper Fault         Stripper Fault <th colspa="6" fault<="" stripper="" td=""><td>NCG         NCG         Net definition of the set of th</td></th>	<td>NCG         NCG         Net definition of the set of th</td>	NCG         NCG         Net definition of the set of th

#### TABLE 2-5 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF SO<sub>2</sub> EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	10/14/21	10/14/21	10/14/21	·
Time Began	1410	1547	1725	
Time Ended	1510	1647	1825	
Stack Gas Data				
Temperature, °F	457	461	460	459
Velocity, ft/sec	59	59	58	59
Moisture, %	15	15	15	15
CO <sub>2</sub> Concentration, %	7.2	7.6	7.0	7.3
O2 Concentration, %	11.9	11.2	11.7	11.6
VFR, x 10 <sup>5</sup> dscfm	1.33	1.33	1.33	1.33
Sulfur Dioxide				
Concentration, ppm	235	234	232	234
Emission Rate, lb/hr	311.3	311.0	307.4	309.9

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#### June 2021 TRS\_H2S Testing - Weston

	Comb	ination Boiler No	. 1 Stack	Combin	ation Boiler No.	2 Stack		Combin	nation Boiler No.	1 Stack	Combin	ation Boiler No.	2 Stack
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG	H2S	NCG+SOG	NCG	SOG	NCG+SOG	NCG	SOG
ODTP/hr	55.9	76.0		88.3	85.2		ODTP/hr	55.9	76.0		88.3	85.2	
ADTP/hr	62.1	84.4		98.1	94.7		ADTP/hr	62.1	84.4		98.1	94.7	
lb TRS (as H2S)/hr	0.75	0.68		0.85	0.92		lb H2S/hr	0.07	0.05		0.07	0.04	
lb TRS (as TRS)/hr	1.07	0.97		1.22	1.32								
Ib TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02	1.39E-02	-1.51E-03	Ib H2S/ADTP	1.13E-03	5.92E-04	5.35E-04	7.13E-04	4.23E-04	2.91E-04
	Controller	Emissions	Sulfur Co	nversion	Uncontrolle	d Emissions		Controlled	Emissions	Sulfur C	onversion	Uncontrolle	d Emissions
	Average	Maximum	Combustion	IVHC Scrubber	Average	Maximum			Maximum	Combustion	IVHC Scrubber		Maximum
TRS as TRS	Ib TRS/ADTP	Ib TRS/ADTP	%	%	Ib TRS/ADTP	Ib TRS/ADTP	H2S	Ib H2S/ADTP	Ib H2S/ADTP	%	%	Ib H2S/ADTP	Ib H2S/ADTP
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA	0.29	0.58	SOG	4.13E-04	5.35E-04	99%	NA	4.13E-02	5.35E-02
NCG	1.27E-02	1.39E-02					NCG	5.07E-04	5.92E-04				
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%	1.60	1.75	LVHC <sup>A,C</sup>	5.03E-04	5.87E-04	99%	50%	1.01E-01	1.17E-01
LIN / CA-B							A.C.						

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HVLC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C). C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and HVLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1			CB1			CB2			CB2						
TRS as S		MW	NCG+SOG			NCG			NCG+SOG			NCG						
sulfur	S	32.065	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	AVG		PLC Cross C	heck back to TRS as H2S
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08	0.07	0.1	0.07	0.07	0.07	0.08	0.08	0.08	0.05	0.05	0.05	0.07	8.0%		0.085742 0.085742
methyl mercaptan	CH <sub>4</sub> S	48.107	0.55	0.53	0.49	0.52	0.52	0.53	0.77	0.63	0.64	0.94	0.91	0.69	0.64	72.6%		0.778738 0.55169
dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	62.134	0.16	0.16	0.16	0.16	0.16	0.17	0.08	0.08	0.08	0.08	0.07	0.07	0.12	13.5%		0.144248 0.079121
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.04	0.04	0.03	0.03	0.03	0.05	5.9%		0.06355 0.045984
															0.89	Total TRS		1.072278 0.762538
															84.8%			

10^6 ACFM Flowrate Basis to Ib/min												
H <sub>2</sub> S	0.007081766	0.006196545	0.008852208	0.006196545	0.006196545	0.006196545	0.007081766	0.007081766	0.007081766	0.004426104	0.004426104	0.004426104
CH <sub>4</sub> S	0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S	0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182

CH <sub>4</sub> S		0.068724286	0.066225221	0.061227091	0.064975688	0.064975688	0.066225221	0.096214	0.078720545	0.079970078	0.117456052	0.113707455	0.08621774
C <sub>2</sub> H <sub>6</sub> S		0.025821922	0.025821922	0.025821922	0.025821922	0.025821922	0.027435792	0.012910961	0.012910961	0.012910961	0.012910961	0.011297091	0.011297091
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>		0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.017127091	0.009786909	0.009786909	0.009786909	0.007340182	0.007340182	0.007340182
	TRS as H2S	0.082325532	0.07966987	0.078784649	0.078784649	0.078784649	0.080555091	0.089407299	0.077014208	0.077899429	0.100029948	0.096489065	0.077014208
	TRS as TRS	0.118755065	0.115370779	0.113028312	0.114121247	0.114121247	0.116984649	0.125993636	0.108500182	0.109749714	0.142133299	0.136770831	0.109281117

Ratio TRS as H2s/TRS a 0.693238074 0.690555015 0.697034647 0.690359171 0.690359171 0.68859596 0.709617575 0.709807177 0.70979163 0.703775603 0.705479846 0.704734816 0.69944568 1.43



RESULTS AND DISCUSSION

### Combination Boiler #1

Condition 1: With NCGs, with SOGs 23-Jun-21

#### TABLE 2-11 NO. 1 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1158	1400	1541	
Time Ended	1258	1500	1641	
Stack Gas Data				
Temperature, *F	415	418	415	416
Velocity, fl/sec	59	57	57	57
Moisture, %	17	18	16	17
CO <sub>2</sub> Concentration, %	7.8	8.4	7.7	8.0
O2 Concentration, %	12.1	11.4	12.0	11.8
VFR, x 105 dscfm	1.35	1.31	1.33	1.33
Hydrogen Sulfide				
Concentration, ppm	0.09	0.08	0.12	0.10
Emission Rate, Ib/hr	0.07	0.06	0.08	0.07
Total Reduced Sulfur				
Concentration, ppm	1.09	1.07	1.03	1.06
Emission Rate, Ib/hr	0.78	0.74	0.73	0.75
Sulfur Dioxide				
Concentration, ppm	195	278	344	272
Emission Rate, Ib/hr	262.7	362.5	457.4	360.9

							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	<b>Pulp Production</b>	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	S	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(lbs/ODT Pulp)	(lbs/hr)
	1	1158	208	25.1	80.8	1.37	40	10.9	458	146	1585	621	11575	49.7	262.7	5.29	0.56
	2	1400	225	29.3	68.8	1.37	40	10.9	491	152	1595	1219	11048	54.0	362.5	6.71	0.49
	3	1541	207	24.8	81.2	1.37	40	10.9	491	45	1578	1136	11009	64.0	457.4	7.15	0.50
Average:			213	26.4	76.9	1.37	40	10.9	480	114	1586	992	11211	55.9	360.9	6.46	0.52

## Condition 2: With NCGs, without SOGs 23-Jun-21

								NCG			Hard Pipe							
								Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Ra	te	Gas Flow (10 <sup>8</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #	5	tart Time	(10 <sup>3</sup> lbs/hr)	(Tons/H	ir)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/OOT Pulp)	(lbs/hr)
	1	1824	23	30	26.3	94.9	1.37	40	10.9	489	123	1587		10515	74.1	404.4	5.46	0.43
	2	2019	21	16	23.7	97.5	1.37	40	10.9	491	184	1593		10377	74.7	7 452.9	6.06	0.42
	з	2202	22	20	25.2	92.4	1.37	40	10.9	490	152	1570		10573	79.3	450.8	5.69	0.46
Average	21		22	22	25.1	94.9	1.37	40	10.9	490	153	1583		10488	76.0	436.1	5.74	0.44

TABLE 2-12
NO. 1 COMBINATION BOILER
CONDITION 2: NCG GASES ONLY
SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, "F	416	411	415	414
Velocity, fl/sec	56	56	56	56
Moisture, %	16	16	17	17
CO <sub>2</sub> Concentration, %	8.3	7.8	8.1	8.1
O <sub>2</sub> Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>8</sup> dscfin	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, Ib/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, Ib/hr	0.67	0.68	0.68	0.68
Sulfer Diaxide				
Concentration, nem	313	348	349	337
Emission Rate, Ib/hr	404.4	452.9	450.8	436.1

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> 15730.001.0 Pulp Dryer, 43 Paper Machia #2-3 SDTV1, & #1-2 C Emission Repo



RESULTS AND DISCUSSION

#### Combination Boiler #2

Average:

16

235

32.4

140.7

1.37

40

10.9

481

Condition 1: With NCGs, with SOGs 24-Jun-21

## TABLE 2-13 NO. 2 COMBINATION BOILER CONDITION 1: NCG AND SOG GASES SUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/24/21	6/24/21	6/24/21	
Time Began	1445	1630	1806	
Time Ended	1545	1730	1906	
Stack Gas Data				
Temperature, *F	475	474	479	476
Velocity, ft/sec	69	69	69	69
Modelham, %6	14	14	15	14
CO <sub>2</sub> Concentration, %	6.6	6.9	7.3	6.9
O2 Concentration, %	13.1	12.7	12.3	12.7
VFR, x 10 <sup>5</sup> dscfm	1.57	1.56	1.54	1.56
Hydrogen Sulfide				
Concentration, ppm	0.09	0.09	0.09	0.09
Emission Rate, Ib/hr	0.07	0.07	0.07	0.07
Total Reduced Sulfur				
Concentration, ppm	1.13	0.97	0.97	1.02
Emission Rate, Ib/hr	0.94	0.80	0.80	0.85
Sulfur Dioxide				
Concentration, ppm	324	327	322	324
Emission Rate Iblar	508.7	507.2	496.1	504.0

## TABLE 2-14 NO. 2 COMBINATION BOILER CONDITION 2: NCG GASES ONLY SUMMARY OF H<sub>2</sub>S, TOTAL TRS, AND SO<sub>2</sub> Emission Results

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, "F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> discfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide				
Concentration, pom	0.05	0.05	0.05	0.05
Emission Rate, Ib/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				
Concentration, perm	1.22	1.18	0.94	1.11
Emission Rate, Ib/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, Ib/hr	383.2	380.0	366.2	376.4

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24-3011																	
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>#</sup>		Flow	Scrubber pH	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run	N	Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1445	219	39.0	125.3	1.37	40	10.9	491	190	1572	1231	10253	87.8	508.7	5.79	0.77
	2	1630	224	31.1	146.4	1.37	40	10.9	490	186	1576	1231	10277	88.6	507.2	5.72	0.63
	3	1806	241	33.6	146.4	1.37	40	10.9	490	190	1580	1231	10300	88.6	496.1	5.60	0.63
Average	e:		228	34.6	139.4	1.37	40	10.9	490	189	1576	1231	10277	88.3	504.0	5.71	0.68
Conditio	on 2	: With NCG	s, without SOG:														
25-Jun	-21																
							NCG			Hard Pipe							
							Scrubber	NCG	Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to				TRS
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	Boiters	Boilers	Boilers	Pulp Production	SO <sub>2</sub> Emissions	SO <sub>2</sub> Emissions	Emissions
Run #		Start Time	(10 <sup>*</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	(lbs/hr)	(Ibs/ODT Pulp)	(lbs/hr)
	1	1000	234	35.7	132.7	1.37	40	10.9	482	155	1579		10475	87.2	383.2	4.39	0.86
	2	1135	225	30.8	147.8	1.37	40	10.9	479	252	1573		10425	84 3	380.0	4.51	0.82
	3	1315	245	30.6	141.7	1.37	40	10.9	482	97	1571		10500	84.2	366.2	4.35	0.63

168

1574

10467

85.2

376.4

4.42

0.77

## NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operating Time				
Stripper Operating Scenario	%	hrs			
New Stripper Online	90%	7,884.0			
Backup Stripper Online	4.75%	416.0			
No Stripper Online	5.25%	460.0			

LVHC Control	Operating Time			
Operating Scenario	%	hrs		
RF3 Available for LVHC	75%	6,570.0		
LVHC to CB1/CB2	25%	2,190.0		

# Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	СО	H2SO4	TRS
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2.43	16.7
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.94
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10
PSD Significant?	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

VOC	Pb	H <sub>2</sub> S	CO2
233	1.10E-04	3.61	12,275
260	2.06E-03	5.59	48,200
26.8	1.95E-03	1.98	35,925
40	0.6	10	75,000
No	No	No	No
#### **SO2 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Operating Configuration Time		
Stripper Operating Scenario	%	hrs	hrs Operating Configuration		hrs	
			[	-		
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	
SO2 BASELINE ACTUAL EMISSIONS (BAE	:)					
				T		
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100%	416.0	
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100%	460.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>J</sup>	4.75%	416.0	Natural Gas <sup>D,F</sup>	81.6%	339.5	

Backup Stripper Steam - No. 6 Oil <sup>J</sup>	4.75%	416.0	No. 6 Oil <sup>d,F</sup>	18.4%	76.5

SO2 PROJECTED ACTUAL EMISSIONS (PAE)

NET EMISSIONS CHANGE (PAE - BAE)

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in
- C Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H The Backup Stripper operating in Methanol Mode would potentially strip less sulfur, but SOG emissions are conservatively base
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.
- H Project Columbia SO2 emissions factor from NCG Combustion applied to October 2021 stack test SO2 emissions distribution be

	Controls Operating Time		Production Rate		
Controls	%	hrs	Value	UOM	lb/UOM
BASELINE AC		ONS (March 2	2021 - Februa	ry 2023)	
SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97
NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04
NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00

PROJECTED ACTUAL EMISSIONS									
SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56				
SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84				
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84				
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40				
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	1.40				
Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA				
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.87				
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87				
NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04				
NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04				
NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00				
NA	100.0%	339.5	26.0	mmBtu/hr	6.00E-04				

NA	100.0%	76.5	24.8	mmBtu/hr	2.20E+00
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Combination Boiliers No. 1 and No. 2 during baseline.

d upon all of the sulfur being captured in the SOG.

tween LVHC, HVLC, and SOG.

\$O2	Sulfur		
Emissions Factor	Capture <sup>c</sup>	SO2 En	nissions
Reference	%	lb/hr	tpy
			-
October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
AP-42 Table 1.4-2.	NA	0.02	0.1
AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
			737.0
			-
Vendor / Preliminary Design Information	99%	0.6	2.4
Vendor / Preliminary Design Information	99%	0.9	2.7
Vendor / Preliminary Design Information	50%	47.2	44.2
Vendor / Preliminary Design Information	0%	157.4	31.0
Vendor / Preliminary Design Information	0%	157.4	32.7
NA	NA	NA	NA
Project Columbia Projected Emissions Factor <sup>H</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	6.6	21.7
Project Columbia Projected Emissions Factor <sup>H</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	330.3	361.7
AP-42 Table 1.4-2.	NA	0.00	0.0
AP-42 Table 1.4-2.	NA	0.06	0.2
AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2
AP-42 Table 1.4-2.	NA	0.02	0.003

AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	2.1
			645.80
			-91.21

#### H2SO4 EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Operating Configuration Time				
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs			
					BASELINE			
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
H2SO4 BASELINE ACTUAL EMISSIONS (B	AE)							
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
H2SO4 PROJECTED ACTUAL EMISSIONS (PAE)								
NET EMISSIONS CHANGE (PAE - BAE)								

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in
- C Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H reserved.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Cont	trols			H2SO4		Sulfur		
	Operating Time		Production Rate		Emissions Factor		Capture		
Controls	%	hrs	Value	UOM	lb/ADTP	Reference	%		
ACTUAL EMISSIONS (March 2021 - February 2023)									
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA		

PROJECTED ACTUAL EMISSIONS									
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA		
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA		

Combination Boiliers No. 1 and No. 2 during baseline.

H2SO4 Emissions					
lb/hr	tpy				
0.3	1.2				
	1.2				
0.55	1.82				
0.55	0.61				
	2.43				
	1.20				

#### NOX EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Oper Configura	ating ation Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
	_	_		_	_
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3
NOX BASELINE ACTUAL EMISSIONS					
	1	1		-	1
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>J</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>J</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5
NOX PROJECTED ACTUAL EMISSIONS					

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Co

C - Ammonia input to recovery furnace increases >2% with maximum addition of SRL of 2% by volume (representative of ~1% by volu

- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.
- H No change in NO<sub>x</sub> emissions factor between Backup Stripper TRS mode and Methanol mode.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

	Controls Operating Time		Product				
Controls	%	hrs	Value	UOM	lb/UOM		
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415		
NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01		
NA	100%	168.3	24.8	mmBtu/hr	3.13E-01		

PROJECTED ACTUAL EMISSIONS									
SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500				
SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500				
SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415				
SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415				
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	0.415				
Hydrogen Peroxide Addition	100%	460.0	NA	NA	NA				
NA	100%	985.5	1.0	mmBtu/hr	2.80E-01				
NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01				
NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01				
NA	100%	339.5	26.0	mmBtu/hr	2.80E-01				
NA	100%	76.5	24.8	mmBtu/hr	3.13E-01				

mbination Boilers No. 1 and No. 2 during baseline.

me pure methanol.)

NOX	Ammonia					
Emissions Factor	Increase <sup>c</sup>	NOX En	nissions			
Reference	%	lb/hr	tpy			
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5			
AP-42 Table 1.4-2.	NA	7.3	28.6			
AP-42 Table 1.3-1.	NA	7.8	0.7			
NCASI Technical Bulletin 884, Table 4.12.	2.0%	3.6	13.4			
NCASI Technical Bulletin 884, Table 4.12.	2.0%	0.4	1.1			
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4			
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2			
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.7			
NA	NA	NA	NA			
AP-42 Table 1.4-2.	NA	0.3	0.1			
AP-42 Table 1.4-2.	NA	27.1	87.2			
AP-42 Table 1.3-1.	NA	28.9	20.9			
AP-42 Table 1.4-2.	NA	7.3	1.2			
AP-42 Table 1.3-1.	NA	7.8	0.3			
			147.54			
			23.82			

#### **CO EMISSIONS REFERENCES**

	Stripper Operati	Scenario ing Time		Oper Configura	ating ation Time	
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs	
	1	-		_	1	
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3	
CO BASELINE ACTUAL EMISSIONS						
	1			_	1	
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	
Backup Stripper Online <sup>c</sup>	4.75%	416.0	NA	100.0%	416.0	
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>G</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	
Backup Stripper Steam - No. 6 Oil <sup>G</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	
CO PROJECTED ACTUAL EMISSIONS						

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combi

C - No change in CO emissions factor between Backup Stripper TRS mode and Methanol mode.

- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.
- H reserved.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Controls Operating Time		Production Rate			
Controls	%	hrs	Value	UOM	lb/UOM	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)						
SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728	
NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	
NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02	

PROJECTED ACTUAL EMISSIONS								
SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA			
SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728			
SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728			
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728			
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.0728			
Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA			
NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02			
NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02			
NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02			
NA	100.0%	339.5	26.0	mmBtu/hr	8.40E-02			
NA	100.0%	76.5	24.8	mmBtu/hr	3.33E-02			

nation Boilers No. 1 and No. 2 during baseline.

СО	СО		
Emissions Factor	Control	CO Em	issions
Reference	%	lb/hr	tpy
	1		1
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
AP-42 Table 1.4-2.	NA	2.2	8.6
AP-42 Table 1.3-1.	NA	0.8	0.1
			25.22
NA	NA	NA	NA
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.7
NA	NA	NA	NA
AP-42 Table 1.4-2.	NA	0.1	0.0
AP-42 Table 1.4-2.	NA	8.1	26.2
AP-42 Table 1.3-1.	NA	3.1	2.2
AP-42 Table 1.4-2.	NA	2.2	0.4
AP-42 Table 1.3-1.	NA	0.8	0.0
			62.81
			37.60

#### VOC EMISSIONS REFERENCES

	Stripper Operati	Stripper Scenario Operating Time		Oper Configura	ating Ition Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper SOG <sup>₄</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>в</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3
VOC BASELINE ACTUAL EMISSIONS					
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7 <i>,</i> 884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7 <i>,</i> 884.0	SRL Offline	5.0%	394.2
Backup Stripper Online (TRS Mode) <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
Backup Stripper Online (Methanol Mode) <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0
ASB - Backup Stripper Online (Methanol Mode) <sup>J</sup>	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>ĸ</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5

Backup Stripper Steam - No. 6 Oil <sup>ĸ</sup>	4.75%	416.0	No. 6 Oil <sup>⊳</sup>	18.4%	76.5
VOC PROJECTED ACTUAL EMISSIONS					
PAE - BAE					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N

- C VOC destruction >98% in vapor phase, 99.9% in liquid phase.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.
- H The Backup Stripper operating in Methanol Mode result in higher SOG emissions, since more VOC are stripped.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in t
- K Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

	Controls Operating Time		Product					
Controls	%	hrs	Value	UOM	lb/UOM			
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)								
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35			
NA	100.0%	8,760.0	1,365	ADTP/day	8.51E-01			
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03			
NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03			
NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03			

PROJECTED ACTUAL EMISSIONS								
SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40			
SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60			
SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60			
SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00			
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	7.20			
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	16.00			
NA	100%	7,884.0	2,700	ADTP/day	0.29			
NA	100%	416.0	2,700	ADTP/day	1.43			
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	1.54			
NA	100%	460.0	2,700	ADTP/day	2.20			
LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03			
LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03			
NA	100%	985.5	1.0	mmBtu/hr	5.50E-03			
NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03			
NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03			
NA	100%	339.5	26.0	mmBtu/hr	5.50E-03			

NA	100%	76.5	24.8	mmBtu/hr	1.87E-03
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No. 1 and No. 2 during baseline.

he table, but ASB emissions are based on methanol mode operation.

VOC			
Emissions Factor	Removal <sup>c</sup>	VOC En	nissions
Reference	%	lb/hr	tpy
	1		
Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
WATER9 Inputs and Outputs Provided.	NA	48.39	211.96
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
AP-42 Table 1.4-2.	NA	0.1	0.6
AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
			233.11
	T		
Vendor / Preliminary Design Information	99.9%	1.62	6.07
Vendor / Preliminary Design Information	98%	3.60	10.11
Vendor / Preliminary Design Information		3.60	3.37
Vendor / Preliminary Design Information		36.00	7.10
Vendor / Preliminary Design Information			
Assume methanol mode captures all VOC in SOG		36.00	7.49
WATER9 Inputs and Outputs Provided.		32.85	129.50
WATER9 Inputs and Outputs Provided.	NA		
WATER9 Inputs and Outputs Provided.	NA	173.15	36.02
WATER9 Inputs and Outputs Provided.	NA	247.14	56.84
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.		0.35	0.38
AP-42 Table 1.4-2.		5.50E-03	2.71E-03
AP-42 Table 1.4-2.	NA	0.5	1.7
AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
AP-42 Table 1.4-2.	NA	0.1	0.0

AP-42 Table 1.3-3. NMTOC for no. 6 oil.		0.0	0.0
			259.88
			26.78

### TRS EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Oper Configura	ating tion Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
TRS BASELINE ACTUAL EMISSIONS			L		
	F		F		
New Stripper Online	90.0%	7 <i>,</i> 884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2
Backup Stripper Online '	4.75%	416.0	NA	100.0%	416.0
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0
ASB - Backup Stripper Online (Methanol Mode) <sup>J</sup>	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
TRS PROJECTED ACTUAL EMISSIONS			•		

# PAE - BAE

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N
- C Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.
- I Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.
- J When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in the

	Controls Operating Time		Controls Operating Time		Controls Operating Time Production Rate		
Controls	% hrs		Value	UOM	lb/UOM		
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.88E-03		
NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02		
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03		

PROJECTED ACTUAL EMISSIONS						
SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.33	
SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.81	
NA	100.0%	7 <i>,</i> 884.0	2,700	ADTP/day	2.42E-02	
NA	100.0%	416.0	2,700	ADTP/day	2.72E-02	
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	5.24E-02	
Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	7.28E-02	
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	

Io. 1 and No. 2 during baseline.

ne table, but ASB emissions are based on methanol mode operation.

TRS	Sulfur		
Emissions Factor	Capture <sup>c</sup>	TRS Em	nissions
Reference		lb/hr	tpy
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
			12.81
Vendor / Preliminary Design Information	99.9%	0.04	0.14
Vendor / Preliminary Design Information	99.9%	0.05	0.15
Vendor / Preliminary Design Information	99%	0.55	0.51
Vendor / Preliminary Design Information	99%	0.91	0.18
Vendor / Preliminary Design Information	99%	0.91	0.19
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	5.89	1.23
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	1.88
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre- control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.		0.20	0.65
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
			16.75

#### **H2S EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Operating Configuration Time	
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
H2S BASELINE ACTUAL EMISSIONS					
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2
Backup Stripper Online <sup>I</sup>	4.75%	416.0	NA	100.0%	416.0
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	H2S Stripped From Foul Condensate	100.0%	416.0
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
H2S PROJECTED ACTUAL EMISSIONS					

PAE - BAE

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N
- C Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.
- I Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.
- J When the Backup Stripper is operating, H2S ASB emissions are higher if the stripper is operating in TRS mode. Both emissions factors are shown in the

	Controls Operating Time		Production Rate		
Controls	% hrs		Value	UOM	lb/UOM
BASELINE ACTUAL EMISS	TUAL EMISSIONS (March 2021 - February 2023)				
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.13E-04
Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04

PROJECTED ACTUAL EMISSIONS							
SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.24		
SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37		
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37		
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61		
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.61		
NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03		
NA	100.0%	416.0	2,700	ADTP/day	9.81E-03		
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	9.45E-03		
Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	9.54E-03		
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01		
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04		
Io. 1 and No. 2 during baseline.

table, but ASB emissions are based on TRS mode operation.

H2S	Sulfur		
Emissions Factor	Capture <sup>c</sup>	H2S Em	nissions
Reference	%	lb/hr	tpy
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
			3.61
		1	
Vendor / Preliminary Design Information	99.9%	0.03	0.10
Vendor / Preliminary Design Information	99.9%	0.04	0.12
Vendor / Preliminary Design Information	99%	0.41	0.39
Vendor / Preliminary Design Information	99%	0.69	0.14
Vendor / Preliminary Design Information	99%	0.69	0.14
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.23
H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.25
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
			5.59

### **PM EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Operating Configuration Time		
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	
PM BASELINE ACTUAL EMISSIONS						
	_	_	_			
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>i</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	
PM PROJECTED ACTUAL EMISSIONS						
PAE - BAE						

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution i

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

	Cont	trols			PM		
	Operating Time		Production Rate		Emissions Factor		
Controls	%	hrs	Value	UOM	Ib/UOM Reference		
BASELINE ACTUAL EMISSION	S (March 202	1 - February 2	2023)				
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	
	100.0%	168.3	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	

PROJECTED AC		ONS				
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	76.5	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).

n Combination Boilers No. 1 and No. 2 during baseline.

PM						
Control	PM Emissions					
%	lb/hr	tpy				
NA	0.2	0.8				
NA	4.0	0.3				
		1.1				
NA	7.60E-03	3.74E-03				
NA	0.7	2.4				
NA	14.8	10.8				
NA	0.2	0.0				
NA	4.0	0.2				
		13.33				
		12.22				

### **PM10 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Oper Configura	ating tion Time
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3
PM10 BASELINE ACTUAL EMISSIONS					
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>⊳</sup>	18.4%	76.5
PM10 PROJECTED ACTUAL EMISSIONS					

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

	Controls Operating Time		Product			
Controls	% hrs		Value	UOM	lb/UOM	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)						
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	
	100.0%	168.3	24.8	mmBtu/hr	1.17E-01	

PROJECTED ACTUAL EMISSIONS								
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03			
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03			
	100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01			
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03			
	100.0%	76.5	24.8	mmBtu/hr	1.17E-01			

in Combination Boilers No. 1 and No. 2 during baseline.

PM10	PM10		
Emissions Factor	Control	PM10 E	missions
Reference	%	lb/hr	tpy
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
			1.02
	_	_	_
AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.1
			10.34
			9.32

#### **PM2.5 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Oper Configura	ating Ition Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>₿</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3
PM2.5 BASELINE ACTUAL EMISSIONS			-		
	_	_			
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5
PM2.5 PROJECTED ACTUAL EMISSIONS					
PAE - BAE					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

	Controls Operating Time		Product		
Controls	% hrs		Value	UOM	lb/UOM
BASELINE ACTUAL EMISSIONS (N	1arch 2021 - F	ebruary 2023	3)		
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03
	100.0%	168.3	24.8	mmBtu/hr	8.80E-02

PROJECTED ACTUAL EMISSIONS								
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03			
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03			
	100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02			
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03			
	100.0%	76.5	24.8	mmBtu/hr	8.80E-02			

Combination Boilers No. 1 and No. 2 during baseline.

PM2.5	PM2.5		
Emissions Factor	Control	PM2.5 E	missions
Reference	%	lb/hr	tpy
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
			0.96
AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.1
			8.37
			7.41

### LEAD EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Operating Configuration Time					
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs				
					B				
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>₿</sup>	97.9%	7,835.7				
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3				
LEAD BASELINE ACTUAL EMISSIONS									
			-						
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>ı</sup>	15.0%	985.5				
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3				
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7				
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5				
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5				
LEAD PROJECTED ACTUAL EMISSIONS									
PAE - BAE	ΔΕ - ΒΔΕ								

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Com

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

	Cont	rols			Lead		
	Operati	ng Time	Production Rate			Emissions Factor	
Controls	%	hrs	Value	UOM	lb/UOM	Reference	
ASELINE ACTUAL EMISSIONS (N	1arch 2021 - F	ebruary 2023	ry 2023)				
	100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	
	100.0%	168.3	24.8	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	

PROJECTED ACTUAL EMISSIONS									
	100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.			
	100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.			
	100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)			
	100.0%	339.5	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.			
	100.0%	76.5	24.8	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)			

bination Boilers No. 1 and No. 2 during baseline.

Lead					
Control	Lead Er	nissions			
%	lb/hr	tpy			
NA	1.30E-05	5.10E-05			
NA	6.95E-04	5.85E-05			
	1.10E-04				
NA	5.00E-07	2.46E-07			
NA	4.84E-05	1.56E-04			
NA	2.58E-03	1.87E-03			
NA	1.30E-05	2.21E-06			
NA	6.95E-04	2.66E-05			
		2.06E-03			
		•			
		1.95E-03			

### **CO2 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Oper Configura	ating Ition Time			
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs			
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7			
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3			
CO2 BASELINE ACTUAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>ı</sup>	15.0%	985.5			
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3			
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7			
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5			
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5			
CO2 PROJECTED ACTUAL EMISSIONS								

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

	Controls Operating Time		Production Rate		
Controls	%	hrs	Value	UOM	lb/UOM
BASELINE ACTUAL EMISSIONS	(March 2021	- February 20	023)		
	100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02
	100.0%	168.3	24.8	mmBtu/hr	1.66E+02

PROJECTED ACTUAL EMISSIONS								
	100.0%	985.5	1.0	mmBtu/hr	1.17E+02			
	100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02			
	100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02			
	100.0%	339.5	26.0	mmBtu/hr	1.17E+02			
	100.0%	76.5	24.8	mmBtu/hr	1.66E+02			

Combination Boilers No. 1 and No. 2 during baseline.

CO2	CO2		
Emissions Factor	Control	CO2 Emissions	
Reference	%	lb/hr	tpy
40 CFR Part 98, Table C-1	NA	3,044.8	11,929
40 CFR Part 98, Table C-1	NA	4,109.9	346
			12,275
	_		
40 CFR Part 98, Table C-1	NA	116.9	58
40 CFR Part 98, Table C-1	NA	11,313.5	36,392
40 CFR Part 98, Table C-1	NA	15,270.9	11,076
40 CFR Part 98, Table C-1	NA	3,044.8	517
40 CFR Part 98, Table C-1	NA	4,109.9	157
			48,200
			35,925

## SUMMARY OF ASB EMISSIONS FACTORS

	ASB Emissions Factors (lb/ODTP)					
Scenario	H <sub>2</sub> S	DMDS	DMS	ММС	TRS as $H_2S$	Methanol
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	3.37E-02	0.89
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	1.99E-02	0.30
Backup Stripper Scenario - TRS Mode	0.0109	0.0033	0.0147	1.30E-03	2.23E-02	1.53
Backup Stripper Scenario - Methanol Mode	0.0105	0.0303	0.0169	5.12E-04	4.20E-02	1.62
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	5.81E-02	2.31

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

VOC <sup>A</sup>	TRS <sup>B</sup>
0.95	0.0453
0.32	0.0269
1.59	0.0302
1.71	0.0582
2.44	0.0809

#### **BAE Other VOC Emissions Factors**

#### PAE Other VOC Emissions Factors

Date of Subpart S	Acetadehyde,	MEK, ppm	Prop., ppm	
Performance Testing	ppm			
7/9/2021	24.3	7.7	1.1	
7/10/2021	25.3	5.7	4.0	
7/11/2021	25.0	6.5	7.0	
10/26/2021	25.0	12.3	0.8	
10/27/2021	27.5	13.3	1.0	
10/28/2021	10.6	6.6	1.2	
10/29/2021	15.0	8.6	0.9	
2/14/2022	16.7	7.5	0.7	
2/15/2022	17.0	9.5	0.6	
2/16/2022	15.7	8.6	1.0	
5/4/2022	20.7	7.1	1.0	
5/5/2022	16.3	7.3	1.0	
5/6/2022	15.0	6.8	1.0	
8/9/2022	15.3	5.9	0.7	
8/10/2022	25.0	7.2	1.1	
8/11/2022	20.3	6.0	1.0	
9/27/2022	14.3	5.3	0.7	
9/28/2022	15.0	5.2	0.7	
9/29/2022	18.0	5.6	0.9	
10/18/2022	25.0	5.6	1.0	
10/19/2022	23.7	5.5	1.1	
10/20/2022	23.0	6.6	0.9	
AVG ppm:	19.72	7.28	1.34	
Lbs into ASB	55.48	20.49	3.78	
Fair estimated from WATER9				
properties	0.55	0.38	0.43	
Lbs emitted	30.73	7.73	1.61	
Average Pulp Production				
during Subpart S testing	g 1716			
lb/ODTP	0.018	0.005	0.001	

		PAE Ib/ODTP			
	BAE lb/ODTP	New Stripper	Backup Stripper	No Stripper	Methanol Mode
Methanol	0.89	0.30	1.53	2.31	1.62
Acetadehyde	0.018	0.006	0.031	0.046	0.033
MEK	0.005	0.002	0.008	0.012	0.008
Propionaldehyde	0.001	0.000	0.002	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504	0.0303
DMS	0.0185	0.0136	0.0147	0.0192	0.0169
ММС	3.28E-04	1.88E-04	1.30E-03	7.42E-04	5.12E-04
VOC:	0.95	0.32	1.59	2.44	1.71

## New Indy Catawba ASB BAE Methanol Emissions Factor

Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference	
	ADTP	ODTP	lb/ODTP		
Mar-21	42,474	38,226	1.50		
Apr-21	43,075	38,767	1.50		
May-21	46,962	42,266	1.50		
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart	
Jul-21	49,371	44,434	1.50	S Performance Tests.	
Aug-21	44,614	40,152	1.50	Representative of ASB	
Sep-21	40,177	36,159	1.50	operation from March	
Oct-21	47,234	42,510	1.50	2021 to February 2022.	
Nov-21	39,185	35,266	1.50		
Dec-21	38,734	34,860	1.50		
Jan-22	43,690	39,321	1.50		
Feb-22	37,736	33,962	0.33		
Mar-22	43,944	39,549	0.33		
Apr-22	40,046	36,041	0.33		
May-22	38,896	35,006	0.33		
Jun-22	23,184	20,866	0.33	Average of 2022 Subpart	
Jul-22	39,890	35,901	0.33	S Performance Tests.	
Aug-22	53,396	48,057	0.33	Representative of ASB	
Sep-22	45,044	40,539	0.33	operation from February	
Oct-22	47,517	42,765	0.33	2022 to February 2023.	
Nov-22	40,133	36,120	0.33		
Dec-22	33,859	30,474	0.33		
Jan-23	35,464	31,918	0.33		
Feb-23	39,276	35,348	0.33		
Baseline Methan	ol Emissions Factor (Pul	p Weighted Average)	0.89	lb/ODTP	

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

		Concentration (ppm)				
Date	Sample Time	Hydrogen Sulfide	Methyl Mercaptan	Dimethyl Sulfide	Dimethyl Disulfide	Total TRS
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 d	or 6/25	146.7	16.0	17.0	15.0	194.7

	MW
Hydrogen Sulfide	34.08 g/mol
Methyl Mercaptan	48.11 g/mol
Dimethyl Sulfide	62.13 g/mol
Dimethyl Disulfide	94.20 g/mol
Sulfur	32.07 g/mol
	Hydrogen Sulfide Methyl Mercaptan Dimethyl Sulfide Dimethyl Disulfide Sulfur

Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dim	ethyl
Sulfide	Mercaptan	Sulfide	Disu	ulfide
138	3.0 10	.7	8.8	10.2
82.3	6.4	% 5	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AH
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP)ª	0.7001

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG
### New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination	
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057
Apr-21	43,075	41,363	75,012	116,376	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199
Jul-21	49,371	67,565	55,824	123,389	3	97	100
Aug-21	44,614	33,863	32,461	66,325	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86
Oct-21	47,234	69,732	75,498	145,230	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412
Mar-22	43,944	62,423	82,083	144,506	335	0	335
Apr-22	40,046	44,634	62,835	107,469	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238
Jul-22	39,890	64,532	86,134	150,666	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24
Oct-22	47,517	70,539	89,760	160,299	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679
Total	996,766			3,237,544			
Annual Average	498,383						
				97.9%			

	1	NO. 1
	Total	
No	o. 6 Fuel (	Dil
	mmBtu	-
	309	
-	0	
	0	
	180	
	15	
	0	
-	13	
	0	
	0	
	0	
	20.388	
	1 112	
	50	
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	336	
	000	
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	0	
	4	
	0	
	25 511	
	15 29/	
	3 252	
	60 553	
	09,000	
	2.1%	

	Combina	tion Boiler No	o. 1 Stack	Combinat	ion Boiler No. 2	
	NCG+SOG	NCG	SOG	NCG+SOG	NCG	
ODTP/hr	77.3	79.0		91.1	92.9	
ADTP/hr	85.9	87.8		101.2	103.2	
lb SO2/hr	342.8	230.7		380.9	309.9	
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00	

	Controlled	Emissions	Sulfu	r Capture	Uncontrolle		
	Average	Maximum	Bark Ash <sup>c</sup>	LVHC Scrubber	Average		
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP		
SOG	1.06	1.36	20%	NA	1.33		
NCG	2.82	3.00					
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92		
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06		

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

Stack
SOG
0.76
0.70
d Emissions
Maximum
lb SO2/ADTP
·
1.70
1.70
1.70 5.25

C (0.473 lb SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C)

.

### October 2021 SO2 Testing - Weston

	Combina	ation Boiler No.	1 Stack	Combinat	ion Boiler No. 2
	NCG+SOG	NCG	SOG	NCG+SOG	NCG
ODTP/hr	77.3	79.0		91.1	92.9
ADTP/hr	85.9	87.8		101.2	103.2
lb SO2/hr	342.8	230.7		380.9	309.9
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00
Columbia lb/ADTP <sup>D</sup>	4.21	2.77	1.44	4.21	3.36

	Controlled	Emissions	Sulfu	r Capture	Uncontrolle
	Average	Maximum	Bark Ash <sup>c</sup>	LVHC Scrubber	Average
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP
SOG	1.14	1.44	20%	NA	1.43
NCG	3.07	3.36			
LVHC <sup>A,B</sup>	2.14	2.35	20%	50%	5.36
HVLC <sup>A,B</sup>	0.92	1.01	20%	NA	1.15

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (0.473

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

D - Columbia lb/ADTP factors denotes scaling up the October 2021 stack test results to the overall NCG+SC

Stack
SOG
0.76
0.85
d Emissions
Maximum
lb SO2/ADTP
1.80
5 87
5.07

Ib SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

)G emissions factor from Project Columbia application of 4.21 lb/ADTP.

Combination Boil Condition 1: Wit 13-Oct-21 Run # Start	1 2 3 Average: Condition 2: Wit	Run # Start	RESULTS Average:	) Discus
	TABL NO. 1 COMBIN CONDITION 1: NCC SUMMARY OF SO2 J	E 2-2 ATION BOILER 3 AND SOG GA 2 MUSSION RESU	LSES	
	Run 1	Run 2	Run 3	Mea
Date Time Began Time Ended	10/13/2 0844 0944	1 10/13/21 1029 1129	10/13/21 1206 1306	111
Stack Gas Data	430	435	438	434
Velocity, ft/sec	64	63	63	63
Moisture, %	17	17	17	17
O <sub>2</sub> Concentration, %	10.5	10.5	0.0 10.8	10.6
Sulfur Dioxide Concentration, ppm	280	227	204	237
	TABL	E 2-3		
	NO. 1 COMBIN CONDITION 2: NO SUMMARY OF SO <sub>2</sub> 1	ATION BOILER CG GASES ONI EMUSSION RESU	LTS	
	Run 1	Run 2	Run 3	Mea
Date Time Began Time Ended	10/13/2 1407 1507	1 10/13/21 1544 1644	10/13/21 1714 1814	111
Stack Gas Data Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, % CO <sub>2</sub> Concentration. %	9.6	9.9	16 8.9	9.5
O <sub>2</sub> Concentration, %	10.1	9.8	10.7	1.40
Treased of at face 1		1.39	1	
Sulfur Dioxide	140	1.39	180	165

#### Combination Boiler #1

## Condition 1: With NCGs, with SOGs 13-Oct-21

							NCG			Hard Pipe	
							Scrubber	NCG	Stripper Foul	Foul	Ľ
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	
	2	1029	266.3	33.0	109.1	1.23	40	10.9	505	213	
	3	1206	257.2	32.6	100.4	1.23	40	10.9	504	2	
Average:			261.9	31.8	112.1	1.23	40	10.9	507	148	

# Condition 2: With NCGs, without SOGs 13-Oct-21

	0.000						100000000000000000000000000000000000000			200 - 10 <u>0</u> 00	
							NCG			Hard Pipe	
							Scrubber	NCG	Stripper Foul	Foul	Ľ
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	į.
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	8
Average:			265.8	33.0	106.4	1.23	40	10.9	505	146	Į.

	Hard Pipe					
Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
511	230	1407	1103	10851	77.3	82.7
505	213	1409	1200	10885	77.3	85.7
504	2	1443	1206	10963	77.3	84.8
507	148	1420	1170	10900	77.3	84.4
Flow (GPM) 511 505 504 507	Flow (GPM) 230 213 2 148	(SCFM) 1407 1409 1443 1420	(SCFM) 1103 1200 1206 1170	(SCFM) 10851 10885 10963 10900	(001/H) 77.3 77.3 77.3 77.3	8 8 8 8 8 8

	Hard Pipe						
Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
506	2	1416		11071	79.0		83.9
504	252	1414		10976	79.0		81.6
505	183	1430		11061	79.0		80.3
505	146	1420		11036	79.0		81.9
Condensate Flow (GPM) 506 504 505 505	Condensate Flow (GPM) 2 252 183 146	Boilers (SCFM) 1416 1414 1430 1420	Boilers (SCFM)	Boilers (SCFM) 11071 10976 11061 11036	Pulp Production (ODT/Hr) 79.0 79.0 79.0 79.0	Pulp KAPPA	8: 8: 8: 8:

15730.001.009 #1-2 CBs SO<sub>1</sub> Emission Report

Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	Stack Gas Data Temperature, °F Velocity, fl/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	Date Time Began Time Ended	NO. SUMMAN	Sulfur Dioxide Concentration, ppm	Stack Gas Data Temperature, °F Velocity, ft/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	Date Time Began Time Ended	NO. CONDET SUMMAI	NATURE N	Combination Bo Condition 1: Wi 14-Oct-21 Run # Star 1 0 2 1 3 1 Average:
235 311.3	457 59 15 7.2 11.9 1.33	<b>Run 1</b> 10/14/21 1410 1510	TABLE 2 .2 COMBINATE OF SO2 EM	275	463 63 17 8.2 10.8 1.40	10/14/21 0830 0930	TABLE 2 .2 COMBINATI 10N 1: NCG A RY OF SO <sub>2</sub> EM		Condition 2: Wi 14-Oct-21
234 311.0	461 59 15 7.6 11.2 1.33	Run 2 10/14/21 1547 1647	100 BOILER GASES ONL ISSION RESU	262	477 68 19 9.5 10.1 1.43	10/14/21 1026 1126	-4 ION BOILER ND SOG GAS ISSION RESUL		Run # Star 1 1 2 1 3 1 Average:
232 307.4	460 58 15 7.0 11.7 1.33	Run 3 10/14/21 1725 1825	CIS X	286	465 61 16 7.5 11.5 1.35	Kun 3 10/14/21 1222 1322	- 75 55 55	RESULTS AND	
234 309.9	459 59 15 7.3 11.6 1.33	Mean		274	469 64 17 8,4 10.8 1.39			Discussion	

28 October 2021 1:00 p.m. Version

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### Combination Boiler #2

### Condition 1: With NCGs, with SOGs 14-Oct-21

							NCG			Hard Pipe
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Scrubber Flow	NCG Scrubber pH	Stripper Foul Condensate	Foul Condensate
Run #		Start Time	$(10^3 lbs/hr)$	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199
Average:			234	33.8	158.6	1.23	40	10.9	505	203

# Condition 2: With NCGs, without SOGs 14-Oct-21

Run #		Start Time	Steam Rate (10 <sup>3</sup> lbs/hr)	Bark Rate (Tons/Hr)	Gas Flow (10 <sup>3</sup> SCF/Hr)	TDF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condensate Flow (GPM)
	1	1410	198	21.7	174.8	1.23	40	10.9	505	209
	Z	1547	218	35.4	206.4	1.23	40	10.9	505	224
	3	1725	214	49.6	220.6	0.65	40	10.9	505	262
Average	ĸ		210	35,6	200.6	1.04	40	10.9	505	232

	Stripper Foul	Hard Pipe Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
н	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	0. I- KA004
	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Рир КАРРА
	505	209	1409	1203	11071	91.1	94.5
	504	200	1420	1179	11160	91.1	88.2
	505	199	1429	1157	11090	91.1	80.7
	505	203	1419	1180	11107	91.1	87.8

н	Stripper Foul Condensate	Foul Condensate	LVHC Flow to Boilers	SOG Flow to Boilers	HVLC Flow to Boilers	Pulp Production	
	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	505	209	1438		11109	92.9	78.8
	505	224	1435		11060	92.9	78.7
	505	262	1453		10977	92.9	79.3
	505	232	1442		11049	92.9	

15730,001,009 #1-2 CBs SO, Emission Report

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15730,001,009 #1-2 CBs SOr Emission Report

#### June 2021 TRS\_H2S Testing - Weston

	Combi	nation Boiler N	o. 1 Stack	Combin
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG
ODTP/hr	55.9	76.0		88.3
ADTP/hr	62.1	84.4		98.1
lb TRS (as H2S)/hr	0.75	0.68		0.85
lb TRS (as TRS)/hr	1.07	0.97		1.22
lb TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02

	Controlled	Emissions	Sulfur Co	nversion
	Average	Maximum	Combustion	LVHC Scrubber
TRS as TRS	lb TRS/ADTP	lb TRS/ADTP	%	%
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA
NCG	1.27E-02	1.39E-02		
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%
HVLC <sup>A,B</sup>	4.69E-03	5.13E-03	99%	NA

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HN

C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and H

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1
TRS as S		MW	NCG+SOG
sulfur	S	32.065	Run 1
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08
methyl mercaptan	$CH_4S$	48.107	0.55
dimethyl sulfide	$C_2H_6S$	62.134	0.16
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07

10^6 ACFM Flowrate Basis to lb/min

0.0070817662

CH₄S	0.0687242857
C <sub>2</sub> H <sub>6</sub> S	0.0258219221
$C_2H_6S_2$	0.0171270909

TRS as H2S	0.0823255325
TRS as TRS	0.1187550649

## Ratio TRS as H2S/TRS as 0.6932380738

ation Boiler No.	2 Stack		Combin	ation Boiler No.	1 Stack
NCG	SOG	H2S	NCG+SOG	NCG	SOG
85.2		ODTP/hr	55.9	76.0	
94.7		ADTP/hr	62.1	84.4	
0.92		lb H2S/hr	0.07	0.05	
1.32					
1.39E-02	-1.51E-03	lb H2S/ADTP	1.13E-03	5.92E-04	5.35E-04
Uncontrolle	ed Emissions		Controlled	l Emissions	Sulfur Co
Uncontrolle Average	ed Emissions Maximum		Controlled Average	l Emissions Maximum	Sulfur Co Combustion
Uncontrolle Average Ib TRS/ADTP	ed Emissions Maximum Ib TRS/ADTP	H2S	Controlled Average lb H2S/ADTP	l Emissions Maximum Ib H2S/ADTP	Sulfur Co Combustion %
Uncontrolle Average Ib TRS/ADTP 0.29	ed Emissions Maximum Ib TRS/ADTP 0.58	H2S SOG	Controlled Average Ib H2S/ADTP 4.13E-04	l Emissions Maximum Ib H2S/ADTP 5.35E-04	Sulfur Co Combustion % 99%
Uncontrolle Average Ib TRS/ADTP 0.29	ed Emissions Maximum Ib TRS/ADTP 0.58	H2S SOG NCG	Controlled Average Ib H2S/ADTP 4.13E-04 5.07E-04	l Emissions Maximum Ib H2S/ADTP 5.35E-04 5.92E-04	Sulfur Co Combustion % 99%
Uncontrolle Average Ib TRS/ADTP 0.29 1.60	ed Emissions Maximum Ib TRS/ADTP 0.58 1.75	H2S SOG NCG LVHC <sup>A,C</sup>	Controlled Average Ib H2S/ADTP 4.13E-04 5.07E-04 5.03E-04	Emissions Maximum Ib H2S/ADTP 5.35E-04 5.92E-04 5.87E-04	Sulfur Co Combustion % 99% 99%

/LC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachmer VLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachme

		CB1			CB2	
		NCG			NCG+SOG	
Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2
0.07	0.1	0.07	0.07	0.07	0.08	0.08
0.53	0.49	0.52	0.52	0.53	0.77	0.63
0.16	0.16	0.16	0.16	0.17	0.08	0.08
0.07	0.07	0.07	0.07	0.07	0.04	0.04

0.0061965455 0.0088522078 0.0061965455 0.0061965455 0.0061965455 0.0070817662 0.0070817662

0.06622522080.06122709090.06497568830.06497568830.06622522080.0962140.07872054550.02582192210.02582192210.02582192210.02582192210.02743579220.0129109610.0129109610.01712709090.01712709090.01712709090.01712709090.01712709090.00978690910.0097869091

0.0796698701 0.0787846494 0.0787846494 0.0787846494 0.0805550909 0.0894072987 0.0770142078 0.1153707792 0.1130283117 0.1141212468 0.1141212468 0.1169846494 0.1259936364 0.1085001818

0.6905550146 0.6970346471 0.6903591714 0.6903591714 0.6885953957 0.709617575 0.7098071773

Combination E	Boiler No.	2 Stack
---------------	------------	---------

NCG	SOG
85.2	
94.7	
0.04	
4.23E-04	2.91E-04
	NCG 85.2 94.7 0.04 4.23E-04

nversion	Uncontrolled Emissions					
LVHC Scrubber	Average	Maximum				
%	lb H2S/ADTP	lb H2S/ADTP				
NA	4.13E-02	5.35E-02				
50%	1.01E-01	1.17E-01				
NA	4.45E-04	5.19E-04				

## າt C). nt C).

	CB2				
	NCG				
Run 3	Run 1	Run 2	Run 3	AVG	
0.08	0.05	0.05	0.05	0.07	8.0%
0.64	0.94	0.91	0.69	0.64	72.6%
0.08	0.08	0.07	0.07	0.12	13.5%
0.04	0.03	0.03	0.03	0.05	5.9%
				0.89	Total TRS
				84.8%	

## 0.0070817662 0.0044261039 0.0044261039 0.0044261039

0.07997007790.11745605190.11370745450.08621774030.0129109610.0129109610.01129709090.01129709090.00978690910.00734018180.00734018180.0073401818

0.0778994286 0.1000299481 0.0964890649 0.0770142078 0.1097497143 0.1421332987 0.1367708312 0.1092811169

0.7097916298 0.7037756034 0.7054798462 0.7047348159 0.69944568

1.43

PLC Cross Check back to TRS as H2S 0.0857419 0.0857419 0.7787379 0.5516903 0.1442481 0.0791212 0.0635499 0.0459844 1.0722777 0.7625378



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# TABLE 2-11NO. 1 COMBINATION BOILERCONDITION 1: NCG AND SOG GASESSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date Time Began	6/23/21 1158	6/23/21 1400	6/23/21 1541	
Time Ended	1258	1500	1041	
Stack Gas Data Temperature, °F Velocity, ft/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	415 59 17 7.8 12.1 1.35	418 57 18 8.4 11.4 1.31	415 57 16 7.7 12.0 1.33	416 57 17 8.0 11.8 1.33
Hydrogen Sulfide Concentration, ppm Emission Rate, lb/hr	0.09 0.07	0.08 0.06	0.12 0.08	0.10 0.07
Total Reduced Sulfur Concentration, ppm Emission Rate, Ib/hr	1.09 0.78	1.07 0.74	1.03 0.73	1.06 0.75
Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	195 262.7	278 362,5	344 457.4	272 360.9

# TABLE 2-12NO. 1 COMBINATION BOILERCONDITION 2: NCG GASES ONLYSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, °F	416	411	415	414
Velocity, ft/sec	56	56	56	56
Moisture, %	16	16	17	17
CO2 Concentration, %	8.3	7.8	8.1	8.1
O2 Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>5</sup> dscfm	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, lb/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				1.1.1.1.1.1
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, lb/hr	0.67	0.68	0.68	0.68
Sulfur Dioxide				
Concentration, ppm	313	348	349	337
Emission Rate, lb/hr	404.4	452.9	450.8	436.1

K-115730 NEW INDY-001 CATAWBA SC/008/REPORT/NEW-INDY CATAWBA JULY 2021 EMISSION TEST REPORT VER 3.DOCM

1 October 2021 8:00 a.m. Version

Combination Boiler #1

	TRS		ssions Emissions	ssions Emissions 7 Pulp) (Ibs/hr)	ssions Emissions r Pulp) (lbs/hr) 5.29 0.56	sisions Emissions Pulp) (Ibs/hr) 5.29 0.56 6.71 0.49	sions Emissions Pulp) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50	sions Emissions Pulp) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52	sions Emissions Pulp) (lbs/hr) 5.29 (0.56 6.71 0.49 7.15 0.50 7.46 0.52	sions Emissions Pulp) (lbs/hr) 5.29 (0.56 6.71 0.49 7.15 0.50 6.46 0.52	Fulp) (Ibs/hr) 5.29 (Ibs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 FRS	revip) (Ibs/hr) 5.29 (Ibs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 6.46 0.52 TRS	relipions Emissions sions Emissions (lbs/hr) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 6.46 0.52 6.46 0.52 nrs Emissions urb (lbs/hr) (lbs/hr)	Emissions Emissions   Pulp) (lbs/hr)   5.29 0.56   5.11 0.49   7.15 0.50   6.46 0.52   6.46 0.52   6.46 0.52   6.46 0.52   6.46 0.52   115 0.50   6.46 0.43   5.46 0.43	Silons Emissions   Pulp) (Ibs/hr)   5.29 0.56   6.71 0.49   7.15 0.50   6.46 0.52   6.46 0.52   6.46 0.52   6.46 0.52   6.46 0.52   17RS 0.43   019) (Ibs/hr)   5.46 0.43   6.06 0.42	Silons Emissions   Pulp) (Ibs/hr)   5.29 0.56   5.11 0.49   7.15 0.50   6.46 0.52   6.46 0.52   files/hr) 0.50   7.15 0.50   6.46 0.52   6.46 0.43   0ns Emissions   uip) (Ibs/hr)   5.46 0.43   6.06 0.43   5.40 0.43
		missions SO, Emis	s/hr) (lbs/ODT	262.7	362.5	457.4	360.9				issions 50 <sub>2</sub> Emissio	(Ibs/ODT Pu	404.4	452.9	450.8	
		ulp Production SO <sub>2</sub> E	(ODT/Hr) (Ib	49.7	54.0	64.0	55.9				Ilp Production 502 Em	DT/Hr) (Ibs/hr)	74.1	74.7	79.2	
	HVLC Flow to	Boilers P	(SCFM)	11575	11048	11009	11211			HVLC Flow to	Boilers Pu	(SCFM) (O	10515	10377	10573	
	SOG Flow to	Boilers	(SCFM)	621	1219	1136	666			SOG Flow to	Boilers	(SCFM)				
	LVHC Flow to	Boilers	(SCFM)	1585	1595	1578	1586			LVHC Flow to	Boilers	(SCFM)	1587	1593	1570	
Hard Pipe	Foul	Condensate	Flow (GPM)	146	152	45	114		Hard Pipe	Foul	Condensate	Flow (GPM)	123	184	152	
	Stripper Foul	Condensate	Flow (GPM)	458	491	491	480			Stripper Foul	Condensate	Flow (GPM)	489	491	490	
	NCG	Scrubber pH	(ns)	10.9	10.9	10.9	10.9			NCG	Scrubber pH	(Ins)	10.9	10.9	10.9	
NCG	Scrubber	Flow	(GPM)	40	40	40	40		NCG	Scrubber	Flow	(GPM)	40	40	40	
			TDF (TPH)	1.37	1.37	1.37	1.37					TDF (TPH)	1.37	1.37	1.37	
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	80.8	68.8	81.2	76.9				Gas Flow (10 <sup>3</sup>	SCF/Hr)	94,9	5.76	92.4	
		Bark Rate	(Tons/Hr)	25.1	29.3	24.8	26.4				Bark Rate (	(Tons/Hr)	26.3	23.7	25.2	
		Steam Rate	(10 <sup>3</sup> lbs/hr)	208	225	207	213	without 50Gs			team Rate	10 <sup>3</sup> lbs/hr)	230	216	220	
			Start Time	1158	1400	1541		: With NCGs,			S	Start Time (1	1824	2019	2202	
			# un	-	2	ŝ	rage:	dition 2	Jun-21			-	1	2	ŝ	

nbination Boiler #1

ulition 1: With NCGs, with SOGs -Jun-21

	-21	With NCGs	, with SOGs	
			Steam Rate	Ba
Run	-	Start Time	(10 <sup>3</sup> lbs/hr)	E
	-	1158	208	
	2	1400	225	
	m	1541	207	
Average			213	
Conditio 23-Jun	21 -21	With NCGs	, without 50Gs	
			steam Rate	Bar
Run #		Start Time	10 <sup>3</sup> lbs/hr)	(To
	-	1824	230	
	2	2019	216	
	ŝ	2202	220	
Average			222	

15730.001.008 Pulp Dryer, #3 Paper Machine, #2-3 SDTVs, & #1-2 CBa Emission Report



### **RESULTS AND DISCUSSION**

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# TABLE 2-13NO. 2 COMBINATION BOILERCONDITION 1: NCG AND SOG GASESSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date Time Began Time Ended	6/24/21 1445 1545	6/24/21 1630 1730	6/24/21 1806 1906	
Stack Gas Data Temperature, °F Velocity, fl/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	475 69 14 6.6 13.1 1.57	474 69 14 6.9 12.7 1.56	479 69 15 7.3 12.3 1.54	476 69 14 6.9 12.7 1.56
Hydrogen Sulfide Concentration, ppm Emission Rate, lb/hr	0.09 0.07	0.09 0.07	0.09 0.07	0.09 0.07
Total Reduced Sulfur Concentration, ppm Emission Rate, lb/hr	1.13 0.94	0.97 0.80	0.97 0.80	1.02 0.85
Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	324 508.7	327 507.2	322 496.1	324 504.0

# TABLE 2-14NO. 2 COMBINATION BOILERCONDITION 2: NCG GASES ONLYSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, °F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> dscfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide	and the second se	1		
Concentration, ppm	0.05	0.05	0.05	0.05
Emission Rate, lb/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				1
Concentration, ppm	1.22	1.18	0.94	1.11
Emission Rate, lb/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, lb/hr	383.2	380.0	366.2	376.4

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1 October 2021 8:00 a.m. Version

Combination Boiler #2

Providence 1. Notes are control

Combination Boiler #2

Combination Boiler #2

Condition 1: With NCGs, with SOGs 24-Jun-21

	TRS	Emissions	(lbs/hr)	0.77	0.63	0.63	0,68
		SO <sub>2</sub> Emissions	(ibs/ODT Pulp)	5.79	5.72	5,60	5.71
		SO <sub>2</sub> Emissions	(lbs/hr)	508.7	507.2	496.1	504.0
		Pulp Production	(ODT/Hr)	87.8	88,6	88.6	88.3
	HVLC Flow to	Boilers	(SCFM)	10253	10277	10300	10277
	SOG Flow to	Boilers	(SCFM)	1231	1231	1231	1231
	LVHC Flow to	<b>Boilers</b>	(SCFM)	1572	1576	1580	1576
Hard Pipe	Foul	Condensate	Flow (GPM)	190	186	190	189
	Stripper Foul	Condensate	Flow (GPM)	491	490	490	490
	NCG	Scrubber pH	(ns)	10.9	10.9	10.9	10.9
NCG	Scrubber	Flow	(GPM)	40	40	40	40
			TDF (TPH)	1.37	1.37	137	1.37
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	125.3	146.4	146.4	139.4
		Bark Rate	(Tons/Hr)	39.0	31.1	33.6	34.6
		Steam Rate	(10 <sup>3</sup> lbs/hr)	219	224	241	228
			Start Time	1445	1630	1806	
			Run #	-1	2	3	Average:

Condition 2: With NCGs, without 50Gs 25-Jun-21

	S	issions	s/hr)	0.86	0.82	0.63	0.77
	TR	SO <sub>2</sub> Emissions En	(lbs/ODT Pulp) (lb	4.39	4.51	4.35	4,42
		SO <sub>2</sub> Emissions	(lbs/hr)	383.2	380.0	366.2	376.4
		Pulp Production	(00T/Hr)	87.2	84.3	84.2	85.2
	HVLC Flow to	Boilers	(SCFM)	10475	10425	10500	10467
	SOG Flow to	Boilers	(SCFM)				
	LVHC Flow to	Boilers	(SCFM)	1579	1573	1571	1574
Hard Dine	Foul	Condensate	Flow (GPM)	155	252	16	168
	Stripper Foul	Condensate	Flow (GPM)	482	479	482	481
	NCG	Scrubber pH	(su)	10.9	10.9	10.9	10.9
NLC	Scrubber	Flow	(GPM)	40	40	40	40
			TDF (TPH)	1.37	137	137	1.37
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	132.7	147.8	141.7	140.7
		Bark Rate	(Tons/Hr)	35,7	30.8	30,6	32.4
		team Rate	10 <sup>3</sup> lbs/hr)	234	225	245	235
		S	Start Time (1	1000	1135	1315	
			# UN	1	2	m	verage:
Compil	atio	n Boiler #2					
--------------------	------	-------------	-------------------------				
Conditi 24-Jun	21 P	: With NCG	is, with SO				
			Steam P				
Run	-	Start Time	(10 <sup>3</sup> lbs,				
	-	1445	219				
	2	1630	224				
	3	1806	241				
Average			228				
Conditio 25-Jun	21	With NCG	s, without				
			Steam Rat				
Bun #		Start Time	(10 <sup>2</sup> lbs/hi				
	-	1000	234				
	2	1135	225				
	-	1315	245				
Average			235				

15730.001.008 Pulp Dryer, #3 Paper Machine, #2-3 SDTVs, & #1-2 CBs Emission Report

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Saturday, March 16, 2024 1:37 PM
То:	Buckner, Katharine
Cc:	Rachel Davis; Steven Moore; Sheryl Watkins
Subject:	Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs
Attachments:	2024-2-12_2440-0005_c2.sob NIC.docx; UPDATED Emissions Calculations (3-13-24).xlsx;
	Supporting Info for Methanol Mode ASB Emissions.pdf

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email.

Hi Katharine,

On behalf of New-Indy Catawba, here are the following files for your review. Please let us know if you have any questions.

- 1. Updated Emissions Calculations
  - a. Incorporated emissions calculations for the Backup Stripper operating in Methanol Mode.
  - b. For the uncontrolled SO2 PAE emissions factor for LVHC incineration, we scaled up the October 2021 results to the Project Columbia NCG emissions factor of 4.21 lb/ton to add an additional level of conservatism. We still show a PSD decrease in SO2 emissions.
- 2. Supporting Info for Methanol Mode ASB emissions
  - a. H2SSIM (for H2S), WATER9 (for other TRS), and Form XIII (for methanol) for the ASB when the backup stripper is in methanol mode.
  - b. During methanol mode, we estimated 500 gpm of foul condensate down the hardpipe. Essentially, for the ASB when the backup stripper is in methanol mode, it is similar to the No Stripper scenario except with 500 gpm instead of 850 gpm.
- 3. Comments on the latest SOB provided. We also updated PSD and project emissions consistent with the updated calculations.
- 4. Justification for the annual averaging period for compliance with the SO2 BACT limit (50 ppmvd @ 8% O2).

The 2006 SO2 best available control technology (BACT) limit for the No. 3 Recovery Furnace was proposed as good combustion practices during black liquor solids combustion. The BACT limit was not proposed during co-firing of fossil fuels. The SO2 BACT limit (condition DA.18) is 50 ppmvd @ 8% O2 and/or 551 tons per year (three 1-hour averages). The compliance demonstration method associated with the BACT limit (condition DA.18) is one source test every four years.

The SO2 BACT limit is expressed as an annual average value (50 ppm which equates to 551 tpy) when firing black liquor solids. The basis for the 551 tpy emissions rate is as follows: 50 ppmvd ×  $(20.9 - 5.5)/(20.9 - 8) \times 64/385.3E6 \times 211,600 \text{ dscf/min} \times 60 \text{ min/hr} \times 8,760 \text{ hr/yr} \times 1 \text{ ton/}2,000 \text{ lb} = 551 \text{ tons/yr}$ 

The BACT limit does not reflect fossil-fuel firing, which was not impacted by the permitted modifications. The SO2 CEMS data should be treated in the same manner as the NOx CEMS data, as a reasonable assurance of continuous compliance with the SO2 BACT limit, and a

representation of average emissions over a period of time during normal operation while burning black liquor solids.

The justification for the annual averaging period is provided below and is based on the expected variability in SO2 concentrations during startup and shutdown, planned maintenance (such as water washes), and inherent variability in the SO2 emissions that can occur with process upsets and variability in process conditions and/or operation. New-Indy Catawba expects periods of elevated SO2 emissions (i.e. greater than 50 ppmvd @ 8% O2 on a 3-hour average) to occur as a result of the following process/operating conditions:

- Lower temperature smelt bed and/or low black liquor solids loading to the furnace
- High black liquor sulfidity
- Low percent black liquor solids firing
- Unbalanced air distribution in the boiler

The following paragraphs describe each condition and the expected observed duration of high SO2 emissions, keeping in mind that these events are not mutually exclusive and can occur simultaneously or in close proximity in time.

### Lower temperature smelt bed and/or low black liquor solids loading to the furnace

A lower temperature smelt bed can occur during abnormal or upset conditions, which are typically associated with black liquor firing loads below 50% of the maximum furnace load, which can occur when starting up from a cold shutdown (i.e., when there is little to no smelt in the bottom of the boiler upon startup), when shutting down (i.e., when the smelt bed is burned out), or during periods of low/lower black liquor inventories. Low black liquor loads have reduced air requirements which will naturally reduce the air pressure at each air level. This can dramatically decrease the air penetration, decrease air/gas mixing, decrease bed temperatures and/or bed height, and increase the amount of localized cold spots in the bed. To counter these impacts, corrective action is necessary to increase the ratio of primary and/or secondary air, firing of auxiliary fuel to maintain proper operation and steam load, and manage the smelt bed. Upset conditions can last anywhere from a few hours to more than several days in duration and startup operations from a cold smelt bed are typically 8 to 16 hours in duration.

## High black liquor sulfidity

The sulfur to sodium ratio in the cooking liquor is important for maintaining the reaction rate and pulp quality in the digester. If the sulfidity is too low, then pulp yield and pulp quality will be reduced. To maintain the proper sulfidity, saltcake from the recovery furnace electrostatic precipitator (ESP) is recycled back into the liquor cycle for sodium and sulfur make-up. Additional make-up chemicals are also typically added (i.e., sodium hydrosulfide, emulsified sulfur, sodium hydroxide, etc.) when chemical imbalances occur that necessitate adding more sodium and/or sulfur makeup. When the sulfidity is elevated, SO2 emissions are also elevated. If sulfidity is determined to be above the target level, corrective action is to stop feeding saltcake and/or make-up sulfur chemicals. A sulfidity imbalance is typically corrected within two to three days.

## Low percent black liquor solids firing

Low percent black liquor solids firing is most often caused by periodic, but routine, water washes to remove fouling on the recovery furnace steam tubes, water washes to remove fouling on the heat transfer surfaces in the evaporators, upsets to

the evaporators, and/or an upset to upstream process areas. Water washes are necessary to remove inorganic scale and organic sticky material from heat transfer surfaces in the evaporators and to remove the saltcake fouling on the furnace steam tubes to maintain safe operation of the furnace. A water wash on the evaporators is typically performed 3-5 times per week and lasts for a period of two to eight hours (Note: includes the periods of startup, shutdown, and the water wash cycle) and a water wash on the recovery furnace is typically performed semi-annually and lasts for a period of two to to three days (Note: includes the periods the periods of startup, shutdown, and the water wash cycle). Reduced black liquor solids content can last anywhere from a few hours to more than 16 hours in duration.

Unbalanced air distribution in the furnace (primary, secondary, tertiary, and quaternary air)

Each recovery furnace design is unique. The New-Indy Catawba Mill has established air systems guidelines for the No. 3 Recovery Furnace that manage NOx and TRS emissions to achieve permitted emissions limits. These include targets for air splits on the primary, secondary, tertiary, and quaternary air ports, desired air duct pressures, and placement and angle of the liquor guns. In addition, the Mill has established guidelines for keeping the air ports and smelt spouts clean. With these guidelines air distribution imbalances are typically resolved within 6 to 12 hours. With feedback from the future SO2 CEMS, the Mill will need flexibility to manage the air distribution within the furnace to achieve the NOx, TRS, and SO2 permitted emissions limits.

Caleb Fetner / Managing Consultant 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u> www.all4inc.com / <u>Locations</u> / <u>Articles</u> / <u>Podcast</u> / <u>Training</u> ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

## Backup Stripper (Methanol Mode) Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings				
(prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.29	0.92	0.24	6.93E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.35	0.19	5.81E-03
ASB Zone 2	0.03	5.66E-08	4.06E-03	1.06E-04
ASB Zone 3	0.02	1.09E-04	1.45E-04	3.51E-06
Total ASB	0.12	0.35	0.19	5.92E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, lb/ODTP	MMC, lb/ODTP
Total ASB	1.05E-02	3.03E-02	1.69E-02	5.12E-04

Post-Project Foul Condensate Flow: 500 gpm Post-Project Foul Condensate Flow: 0.72 MGD Post-Project ASB Influent Flow: 25.48 MGD Total ASB Flow: 26.20 MGD Total ASB Flow: 1148 L/s Pulp Production 2200 ODTP/day MW H2S 34 DMDS 94 DMS 62

MMC

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#### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

#### Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3 –
Zone Location of Hardpipe	1
Type of Basin	ASB 🚽

#### Data Type 3. Load Characteristics

Loading	Main		
Characteristics	Influent	Hardpipe	Units
Flow	25.48	0.72	MGD -
Total Sulfide	0.252	1.47	mg/L 🚽
Sulfate	390	390	mg/L 🚽

Data Ty	pe 4. Atmos	pheric Conditions
---------	-------------	-------------------

Windspeed	3.55	mph 🚽
Ambient Temperature	79	F 🚽

Data Type 5. Zone Physical and Chemical Conditions							
Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units		
Dissolved Oxygen	1.57	4.63	4.66		mg/L		
Temperature	93.34	89.74	86.02		F		
рН	7.04	7.24	7.42		s.u.		
Redox Condition	Aerobic 🗖	Aerobic 🗖	Aerobic -	Aerobic 🔻			
Length	968	1208	1235		feet 🚽		
Width	968	604	617		feet 🚽		
Depth	4.5	3.2	3		feet 🔫		
Mixing	Moderat	Moderat -	Moderat				
Number of Aerators	31	15	6				
Total Horsepower	2325	1125	450		HP		
Impellor Size	1.625	1.625	1.625		feet		
Impellor RPM	1200	1200	1200		RPM		
Diffused Air Flow	0	0	0		cms 🚽		
Weir Height	0	0	0		feet 🚽		

Model Controls	
Run H2SSIM	
View Parameters	
Clear Input Sheet	

## **H2SSIM Results**

#### Backup Stripper Methanol Mode Scenario

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.121	gms/s
Total Emissions (H <sub>2</sub> S)	8417.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.2	tons/yr
Total Emissions (H <sub>2</sub> S)	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.9	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5132.3	1762.9	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	26.7	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	39.300	6.400	5.600		lbs/yr

<b>Current Parameters</b>				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	272.2			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

Percent Inlet Sulfide Removed 63.0%

SUMMARY FOR EMISSIONS AT UNIT 11 ASB Z 03-14-2024 09:38:13	Zone 1 aerated	d biotreatm	ent		
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	8.367e-1	0.36428	0.61827	1.46e-2	3.499e-1
DIMETHYL SULFIDE (DMS)	2.074e-1	0.80097	0.17688	4.593e-3	1.907e-1
HYDROGEN SULFIDE	2.835e-1	0.98155	0.	5.231e-3	3.195e-1
METHANETHIOL(methyl mercaptan)	5.699e-3	0.8877	0.09361	1.065e-4	5.808e-3
Total rate for all compounds					8.658e-1
SUMMARY FOR EMISSIONS AT UNIT 17 ASB 2 03-14-2024 09:38:13	Zone 3 aerated	d biotreatm	ent		
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	5.231e-4	0.18124	0.76948	2.578e-5	1.088e-4
DIMETHYL SULFIDE (DMS)	2.136e-4	0.58962	0.31941	1.943e-5	1.446e-4
HYDROGEN SULFIDE	2.231e-4	0.88747	0.	2.511e-5	2.273e-4
METHANETHIOL(methyl mercaptan)	4.197e-6	0.72787	0.18714	3.567e-7	3.507e-6
Total rate for all compounds SUMMARY FOR EMISSIONS AT UNIT 18 ASB 2 03-14-2024 09:38:13	Zone 2 aerated	d biotreatm	ient		4.842e-4
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	1.46e-2	0.3375	0.62668	5.231e-4	5.658e-3
DIMETHYL SULFIDE (DMS)	4.593e-3	0.7705	0.183	2.136e-4	4.063e-3
HYDROGEN SULFIDE	5.231e-3	0.95735	0.	2.231e-4	5.749e-3
METHANETHIOL(methyl mercaptan)	1.065e-4	0.86336	0.09723	4.197e-6	1.056e-4
Total rate for all compounds					1.558e-2

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date:

PAE - Backup Stripper (Methanol Mode)

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIP	I. BIOTREATMENT UNIT DESCRIPTION							flows
	Units	Zone 1	Zone 2	Zone 3			Flow MGD	MeOH mg/L
Number of 75 HP Aerators	#	31	15	6				
Number of 100 HP Aerators	#	0	0	0				
Total Horsepower	HP	2325	1125	450	Inlet Strea	am **	25.48	59.5
Temperature	С	35.4	33.5	31.3	Condense	ate Stream	0.7	3,809
Length	ft	968	1,208	1,235	Outlet		26.2	5.1
Width	ft	968	604	617		** except cond	ensate flow	
Average Depth	ft	4.5	3.2	3				
Aerator Rotation	rpm	1200	1200	1200				
Agitation Area per 75 HP aerator	ft2	1452	1452	1452				
Agitation Area per 100 HP aerator	ft2	2206	2206	2206				
Impellor Diameter	in	19.5	19.5	19.5	NA - indiv	idual flow/cond	c data not av	ailable

II. OVERALL PARAMS - total flows			III. HAP DA	ТА						
Flow	Flow	MeOH	Methanol			Average	Zone Conc	entration		Detect
m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3		Limit
	26.2	162.5	Conc.	mg/L	162.5	44.6	25.8	8.1		0.5
			Temp.	F		95.7	92.3	88.3		
		5.09824								
mph		3.8								
	<b>vs</b> Flow m3/sec mph	<b>vs</b> Flow Flow <u>m3/sec MGD</u> 26.2 mph	vs Flow Flow MeOH <u>m3/sec MGD mg/L</u> 26.2 162.5 5.09824 mph 3.8	vs Flow Flow MeOH <u>m3/sec MGD mg/L</u> 26.2 162.5 5.09824 mph 3.8	III.     HAP DATA       Flow     Flow     MeOH <u>m3/sec     MGD     mg/L       26.2     162.5     Conc.       5.09824     F       mph     3.8  </u>	III.     HAP DATA Methanol       Flow     Flow     MeOH       m3/sec     MGD     mg/L       26.2     162.5       5.09824       mph     3.8	III.         HAP DATA           Flow         Flow         MeOH           m3/sec         MGD         mg/L         Methanol         Average           26.2         162.5         Inlet         Zone 1           5.09824         5.09824         F         95.7	III.         HAP DATA           Flow         Flow         MeOH           m3/sec         MGD         mg/L         Methanol         Average Zone Conce           26.2         162.5         Conc.         mg/L         162.5         44.6         25.8           5.09824         5.09824         F         95.7         92.3	III. HAP DATA           Flow         Flow         MeOH           m3/sec         MGD         mg/L           26.2         162.5           5.09824           mph         3.8	III. HAP DATA           Flow         MeOH           m3/sec         MGD         mg/L           26.2         162.5           5.09824           mph         3.8

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	10.1
Fraction remaining in unit effluent	3.1

27% 16% Avg. 2021/2022 Zone Reductions

5%

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - Backup Stripper (Methanol Mode)

	Equil. Ratio (Hc)							
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoin	e Eqtn
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

#### General

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	VW
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT KL Params

		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 <b>AND</b> U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	<b>-</b>			

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - Backup Stripper (Methanol Mode)

Surface Aeration												
		T	urbulent Area	1				Quiescient Are	a			
								kL, m/s				
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	Н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s
Zone1						_						
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - Backup Stripper (Methanol Mode)

COMPOUND for site specific biorate determination Number of zones in the biological treatment unit VOLUME of full-scale system (cubic meters) Average DEPTH of the full-scale system (meters) FLOW RATE of wastewater to the unit (m3/s) FLOW RATE of condensate to the unit (m3/s) <b>Total wastewater flowrate - (including condensates) (m3/s)</b> ESTIMATE OF KL (m/s) Concentration in the wastewater treated in the unit (mg/L) Concentration in the condensates (mg/L) <b>Concentration in wastewater (total - inc. cond) in (mg/L)</b> Concentration in the effluent (mg/L) TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A) TOTAL RESIDENCE TIME (s) line 2 divided by line 10. TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3					thanol 50372.98 0878333 1.116 0.032 1.148 ee table 5511413 3809 52.53984 0982378 1.148 218116 230157	2.52 days
<b></b>	Lines 13 through 15 Not Lise	d				
	Lines 13 though 10 Not 03e	ŭ	Estimate of KL			
Zone	Concentration for zone,	Area of the	in the zone	AIR STF	RIPPING	
Number	Ci (mg/L)	zone, A (m2)	(m/s)	KL A Ci	(g/s)	
1	44.62519102	87091.1501	3.54365E-06		13.7723	0.308621
2	25.78937099	67793.7816	2.39719E-06		4.1912	0.162515
3 4 5 6	8.06308953	70821.6825	1.37942E-06		0.788	0.097693
TOTALS - s	um for each zone.	15 225706.614		16	18.75	
Removal by	air stripping (g/s). Line 1	6.		17	18.75	
Loading in effluent (g/s). Line 9 times line 10.					5.85	
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.					186.6	
Removal by	biodegradation (g/s) Line	19 minus (line 17 +	⊦ line 18).	20	162.0	
Fraction bio	degraded: Divide line 20 l	by line 19.		21	0.868	
Fraction air	emissions: Divide line 17	by line 19.		22	0.101	
Fraction ren	naining in unit effluent. Div	vide line 18 by 19.		23	0.031	

From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Tuesday, February 6, 2024 6:08 PM
То:	Buckner, Katharine; Rachel Davis; Steven Moore; Caleb Fetner
Subject:	RE: production rates

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi, Katherine! Thanks for sending the updated testing conditions for the strippers – we will review and let you know if we have any questions or comments.

There is no difference between air dried tons of pulp and air dried tons of unbleached pulp (i.e., they mean the same thing/are interchangeable). You are also correct that ADTFP = air dried tons of finished paper. When the Mill produced bleached pulp, you may have also seen the unit of measure "air dried tons bleached pulp" (ADTBP) with some of the bleaching process equipment emissions factors and throughput.

Regarding the No. 2 Recovery Furnace (RF2): There are no modifications planned for RF2 with the new stripper project. RF2 is only impacted by combustion of the SRL, which will be added to the black liquor (BL) that is fired in both RF2 and RF3 at no more than 2% of the total volume of BL (Note: the original application indicated adding SRL at no more than 1% BL by volume, so we will be sending you revised emissions calculations at the 2% value). We have estimated that the total maximum emissions increase at RF2 and RF3 from combustion of the SRL @ 2% BL volume is 2.4 tpy SO2 and 13.4 tpy NOx. RF2 is not currently subject to any regulations that limit SO2 or NOx emissions and the emissions increase is small. Therefore, we do not believe that verification of the NOx and SO2 emissions increases at RF2 with an SO2 and NOx CEMS is necessary nor would that approach be effective/valuable.



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Tuesday, February 6, 2024 10:53 AM
To: Rachel Davis <Rachel.Davis@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; Steven Moore
<smoore@all4inc.com>; Caleb Fetner <cfetner@all4inc.com>
Subject: production rates

#### Hey everyone,

We will show emissions from both rates in the SOB. An explanation of the current limit of 1825 and the expected emissions based on the 1825 ADTUP/day will be shown in addition to the rates at the projected actual production used in the application.

A side question, is there any difference between ADTP (air dried tons of pulp) and ADTUP (air dried tons of unbleached pulp)? If so, please explain. I know there is still another unit of ADTFP (air dried tons of finished paper (?)), right? I understand that this is based on the tons of finished paper

I have included as an attachment the latest version of the testing conditions for the strippers and the SOB write up for each.

Also, do you have some rationale you can provide for not requiring SO2 and NOx CEMs on #2 recovery furnace? We didn't mention this yesterday. This is one of the EPA's comments. When we discussed previously it was mentioned such a small increase would be hard to see on the CEMS for either pollutant.

#### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: <u>www.scdhec.gov</u> <u>Facebook</u> <u>Twitter</u>



From:	Rachel Davis <rachel.davis@new-indycb.com></rachel.davis@new-indycb.com>
Sent:	Friday, February 2, 2024 5:10 PM
То:	Buckner, Katharine
Cc:	Martinez, Sara; jimc@thekraftgroup.com; Stephanie Blackman (Schwarz); Golden,
	Rebecca; Lowell, Randy
Subject:	Construction Permit Discussion

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Ms. Katharine,

To follow-up on our conversation the other day regarding comments made on the draft stripper construction permit, I wanted to offer the following response.

There has been the suggestion that New-Indy Catawba should re-run emission factors for 1825 tons per day (TPD) in addition to the 2700 TPD that was run under the original 2019 construction application (as amended in 2020) for the mill and what was run for the stripper construction permit.

There seems to be some confusion over the appropriate TPD. Before New-Indy Catawba converted to using unbleached pulp to manufacture containerboard, the Mill used bleached pulp to make paper. The bleached pulp process was based on an 1825 TPD factor. However, this changed to 2700 TPD when the Mill converted to using unbleached pulp for containerboard. It's understandable that there may be some confusion over the correct limit given this history.

The original 2019 construction application (as amended in 2020) for unbleached pulp included a typo that referenced the old limit for bleached pulp operations of 1825 TPD. But all the calculations for the substantive analysis was based on 2700 TPD. While the typo was not formally corrected, everyone understood it was 2700 TPD since that was the substantive analysis. And New-Indy Catawba has operated at an emissions factor for 2700 TPD since commencement.

Because the 2700 TPD is greater than the 1825 TPD, it seems better for the agencies and the public to run the numbers at the higher limit and having two models – one of which (i.e., 1825 TPD) has no real meaning – would only lead to further confusion and provide no useful data.

Thus, New-Indy stands by the analysis done and requests that the Department issue the stripper construction permit as soon as possible based on the 2700 TPD. The installation of the new stripper was mandated by the Department and further delay only negatively impacts the public.

Have a wonderful weekend!

Rachel

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From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Wednesday, January 17, 2024 7:20 PM
То:	Buckner, Katharine; Rachel Davis; Steven Moore; Caleb Fetner
Subject:	RE: couple follow up questions

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Hi, Katharine. I spoke with Rachel this evening regarding your follow-up item below on the existing steam stripper, and we believe that you are on the right track. We would like to propose "periodic readiness testing" in lieu of periodic performance testing when the existing steam stripper becomes a back up to the new stripper. We would also propose that the readiness testing procedure and schedule be submitted as part of the initial performance test report. Justification for this approach is as follows:

- Since the existing stripper will be a back up to the new stripper, it will not be operating most of the time and will not have a firm preventative maintenance schedule, but rather will have a firm "readiness testing" schedule that ensures the system is in good operating condition when it is needed to operate. Think of an emergency fire pump engine, which only operates when there is a fire, but facilities are required to perform readiness testing periodically (I believe this is for insurance purposes) to ensure that when there is a fire and the pump is needed, that it will start-up and run properly to deliver water to fight the fire.
- Determination of the required readiness test items, and the procedures and schedule for each item, will require input from Mill personnel as well as the stripper vendor. We believe that some items may be required to be performed monthly, while others could be quarterly, for example.
- We are not aware of any other facility that operates a back-up steam stripper, and there are operational, and potentially safety, considerations that would need to be discussed, evaluated, and possibly trialed.

We wanted to get this out to you as soon as possible - Let us know if you would like to discuss in more detail tomorrow. Again, thank you for your time and consideration of these requests.

p.s. comments on the draft permit and sob for the dry ash system were provided in a separate email response.



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Tuesday, January 16, 2024 4:54 PM
To: Rachel Davis <Rachel.Davis@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; Steven Moore <smoore@all4inc.com>; Caleb Fetner <cfetner@all4inc.com>
Subject: couple follow up questions

Hey everyone,

For the existing stripper, is there preventative, periodic maintenance that can be done on the existing stripper to ensure it would be in good operating condition when it has to run? I don't mean maintenance right before it needs to be used. Is there anything that can be done month to month (or some other timing) to ensure it can

operate properly when it needs to be operated? We would consider this in lieu of the periodic testing as long as the initial performance test and operating and monitoring parameters are established.

For the Ash Handling project, we can be more generic on the project description. The emission calculations in the consent decree application were based on amount conveyed from each boiler. The emission factors used are related to conveying the material to silos. Do these need to be revised to be consistent with how you plan to calculate the actual emissions?

#### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

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From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Wednesday, January 17, 2024 3:02 PM
То:	Caleb Fetner; Buckner, Katharine
Cc:	Steven Moore; Rachel Davis
Subject:	RE: Anything you can send ahead of time

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine: Here is the next item (additional information around total VOC question) for your review:

VOC emissions from the pulping condensates are determined as the sum of the following pollutants: methanol, acetaldehyde, methyl ethyl ketone, propionaldehyde, and TRS VOCs [i.e., methyl mercaptan (MMC), dimethyl disulfide (DMDS), and dimethyl sulfide (DMS)]. New-Indy Catawba proposes that DHEC approve that the removal efficiency of methanol demonstrated across the steam stripper is representative of the removal efficiency for acetaldehyde, methyl ethyl ketone, and propionaldehyde based on the following information:

- Methanol and the TRS VOCs comprise more than 95% of the total VOC emissions in the pulping condensates treated in the Aerated Stabilization Basin (ASB). This is based on historical liquid concentration data, site-specific ASB configuration, and 40 CFR 63 Appendix C/Form XIII (Methanol) and EPA's WATER9 model (all other VOC).
- Methanol is highly soluble in water and is less volatile/more difficult to remove from water than acetaldehyde, methyl ethyl ketone, and propionaldehyde. This is evident from the henry's law constants that represent the volatility of each compound in water at lower concentrations (Note: Henry's Law states that the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas above the liquid). The higher the Henry's Law value, the more volatile the compound is. From 40 CFR 63 Appendix C, the Henry's law constants in atm/mole fraction at 25 C are as follows, showing that methanol is the least volatile of these compounds:
  - o Acetaldehyde: 4.87
  - o Methanol: 0.289
  - Methyl ethyl ketone: 7.22
  - Propionaldehyde: 3.32
- Therefore, we can assume that the removal efficiency of acetaldehyde, methyl ethyl ketone, and propionaldehyde across the steam stripper will be at or above the removal efficiency of methanol. Let us know if you have any questions or need additional information.

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From: Sheryl Watkins

Sent: Wednesday, January 17, 2024 12:01 PM

To: Caleb Fetner <cfetner@all4inc.com>; Buckner, Katharine <bucknekk@dhec.sc.gov> Cc: Steven Moore <smoore@all4inc.com>; Rachel Davis <Rachel.Davis@new-indycb.com> Subject: RE: Anything you can send ahead of time Katharine: Attached are the proposed markups for condition B.20 per our discussion yesterday. Let us know if you have any questions.

Still working on the additional information around total VOC, periodic maintenance around the existing stripper, and comments on the ash handling system draft permit and sob.



Sheryl Watkins, PE / Sr. Technical Manager / ATL Office swatkins@all4inc.com / Direct: 678.293.9428 / Cell: 386.503.0266 / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training

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From: Caleb Fetner <<u>cfetner@all4inc.com</u>> Sent: Wednesday, January 17, 2024 10:56 AM To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>> Cc: Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>> Subject: RE: Anything you can send ahead of time

Hi Katharine – here is the explanation. Let me know if you have any questions or need more information.

The New Stripper emissions calculations were updated in the version dated 1-11-24 as follows: (1) the hardpipe (no stripper online) operating scenario was increased to the maximum allowable steam stripper downtime of 460 hours to reflect worst-case annual emissions; (2) the recovery furnace NOX increase expected from mixing SRL and black liquor was increased from 1% to 2% to reflect up to 2% SRL by volume.

Neither of these changes impact the short-term hourly emissions rates of hydrogen sulfide (H2S), methyl mercaptan (MMC), or total reduced sulfur (TRS). Therefore, a revision to the ambient air dispersion modeling analysis (last provided to DHEC via email on 10/2/2023) is not necessary.



**Caleb Fetner** / Managing Consultant 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>> Sent: Tuesday, January 16, 2024 5:18 PM To: Caleb Fetner <<u>cfetner@all4inc.com</u>> Cc: Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>

Subject: RE: Anything you can send ahead of time

Hello Caleb,

Forgot to include this. Will you explain why the modeling will not need to be updated based on the latest emissions changes?

Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

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From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Thursday, January 11, 2024 3:30 PM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Rachel Davis <<u>Rachel.Davis@new-</u>
indycb.com>

Subject: RE: Anything you can send ahead of time

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Hi Katharine – here are the updated emissions calculations with updates as follows:

- 1. Increased hardpipe (No Stripper) operating scenario to maximum allowable steam stripper downtime of 460 hours.
- 2. Increased from 1% to 2% SRL by volume mixed with BLS firing, resulting in small change in NOx emissions.
- 3. Added Project Emissions for Statement of Basis on each pollutant tab.

I'm unfortunately going to be out of office on Tuesday during our scheduled time to do final review of permits, but if you're able to review these tomorrow – I'm general available all day to discuss any questions or comments you have on these calculations.

Appreciate it! We are hard at work trying to get you the permit comments ASAP.



**Caleb Fetner** / Managing Consultant 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>

Sent: Thursday, January 11, 2024 11:52 AM

**To:** Sheryl Watkins <<u>swatkins@all4inc.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Caleb Fetner

<<u>cfetner@all4inc.com</u>>; Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>

Subject: Anything you can send ahead of time

Hey Y'all,

Thanks for the time today. Just wanted to add if there is anything you can send to me before tomorrow that will be great – comments on one permit, etc.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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From:	Buckner, Katharine
Sent:	Friday, January 12, 2024 8:59 AM
То:	Rachel Davis; Sheryl Watkins; Steve Moore (smoore@all4inc.com); Caleb Fetner
Subject:	permit items

Hey y'all,

Thinking about the various projects we have going on. Here are some thoughts/items to be addressed:

- With the changes to the methanol to be combusted (1% to 2%) and the PSD review using the limit on the downtime hours of 460 hour , I believe the application will have to be updated accordingly.
- Based on the changes that get made to condition B.20, will B.21 need to be updated any?
- Also, I am revamping condition B.20. Going back to the drawing board, the purpose of the testing is to show that the performance guarantees are being met since these values were used in the PSD analysis. I could not find in the application where removal efficiencies were given for the new stripper. 98% for TRS was mentioned for the existing stripper. The video on how the new steam stripper will operate says 98% TRS and 95% methanol. If I missed where efficiencies were mentioned in the application please let me know where. So I don't think efficiencies are what need to be proven. The vendor guarantees need to be proven. How should the performance test be performed grab sample? Or a composite sample over what period of time to catch fluctuations in the streams? It needs to be a meaningful test. Is there language in MACT S that can be used. Since compliance with MACT S is already required to be demonstrated, I thought we could use, where we can, MACT s as a basis so as not to require/include new or entirely different in the condition. Not sure I will have the condition completed today. I will send it to you for review when it is done.

I haven't seen anything else this morning.

Caleb, I will try to look at the calculations today. Thank you for sending those.

Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

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#### NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operating Time		
Stripper Operating Scenario	%	hrs	
New Stripper Online	90%	7,884.0	
Backup Stripper Online	4.75%	416.0	
No Stripper Online	5.25%	460.0	

LVHC Control	Operating Time		
Operating Scenario	%	hrs	
RF3 Available for LVHC	75%	6,570.0	
LVHC to CB1/CB2	25%	2,190.0	

# Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	СО	H2SO4	TRS
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2.43	16.8
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.95
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10
PSD Significant?	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

VOC	Pb	H <sub>2</sub> S	CO <sub>2</sub>
233	1.10E-04	3.61	12,275
260	2.06E-03	5.59	48,200
26.8	1.95E-03	1.98	35,925
40	0.6	10	75,000
No	No	No	No

#### **SO2 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time		pper Scenario erating Time		Operating Configuration Time	
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	
			[	-		
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	
SO2 BASELINE ACTUAL EMISSIONS (BAE	:)					
				T		
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100%	416.0	
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100%	460.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>J</sup>	4.75%	416.0	Natural Gas <sup>D,F</sup>	81.6%	339.5	

Backup Stripper Steam - No. 6 Oil <sup>J</sup>	4.75%	416.0	No. 6 Oil <sup>d,F</sup>	18.4%	76.5

SO2 PROJECTED ACTUAL EMISSIONS (PAE)

NET EMISSIONS CHANGE (PAE - BAE)

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in
- C Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H The Backup Stripper operating in Methanol Mode would potentially strip less sulfur, but SOG emissions are conservatively base
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.
- H Project Columbia SO2 emissions factor from NCG Combustion applied to October 2021 stack test SO2 emissions distribution be

	Controls Operating Time		Product		
Controls	%	hrs	Value	UOM	lb/UOM
BASELINE AC		ONS (March 2	2021 - Februa	ry 2023)	
SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97
NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04
NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00

PROJECTED ACTUAL EMISSIONS							
SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56		
SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84		
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84		
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40		
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	1.40		
Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA		
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.87		
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87		
NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04		
NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04		
NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00		
NA	100.0%	339.5	26.0	mmBtu/hr	6.00E-04		

NA	100.0%	76.5	24.8	mmBtu/hr	2.20E+00
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#### **NET EMISSIONS CHANGE (PAE - BAE)**

Combination Boiliers No. 1 and No. 2 during baseline.

d upon all of the sulfur being captured in the SOG.

tween LVHC, HVLC, and SOG.

\$O2	Sulfur		
Emissions Factor	Capture <sup>c</sup>	SO2 En	nissions
Reference	%	lb/hr	tpy
			-
October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
AP-42 Table 1.4-2.	NA	0.02	0.1
AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
			737.0
	•		
Vendor / Preliminary Design Information	99%	0.6	2.4
Vendor / Preliminary Design Information	99%	0.9	2.7
Vendor / Preliminary Design Information	50%	47.2	44.2
Vendor / Preliminary Design Information	0%	157.4	31.0
Vendor / Preliminary Design Information	0%	157.4	32.7
NA	NA	NA	NA
Project Columbia Projected Emissions Factor <sup>H</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	99%	6.6	21.7
Project Columbia Projected Emissions Factor <sup>H</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) from 2012 stack test.	50%	330.3	361.7
AP-42 Table 1.4-2.	NA	0.00	0.0
AP-42 Table 1.4-2.	NA	0.06	0.2
AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2
AP-42 Table 1.4-2.	NA	0.02	0.003

AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	2.1
			645.80
			-91.21

#### H2SO4 EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Operating Configuration Time				
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs			
					BASELINE			
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
H2SO4 BASELINE ACTUAL EMISSIONS (BAE)								
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0			
H2SO4 PROJECTED ACTUAL EMISSIONS (PAE)								
NET EMISSIONS CHANGE (PAE - BAE)								

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in
- C Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H reserved.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Cont	trols			H2SO4		Sulfur	
	Operati	ng Time	Product	ion Rate	Emissions Factor		Capture	
Controls	%	hrs	Value	UOM	lb/ADTP	Reference	%	
ACTUAL EMISSIONS (March 2021 - February 2023)								
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	

PROJECTED ACTUAL EMISSIONS								
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	

## NET EMISSIONS CHANGE (PAE - BAE)

Combination Boiliers No. 1 and No. 2 during baseline.
H2SO4 Emissions					
lb/hr	tpy				
0.3	1.2				
	1.2				
0.55	1.82				
0.55	0.61				
	2.43				
	1.20				

#### NOX EMISSIONS REFERENCES

	Stripper Operati	Scenario ng Time		Oper Configura	ating ation Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
	_	_		_	_
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3
NOX BASELINE ACTUAL EMISSIONS					
	1	1		-	1
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>J</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>J</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5
NOX PROJECTED ACTUAL EMISSIONS					

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Co

C - Ammonia input to recovery furnace increases >2% with maximum addition of SRL of 2% by volume (representative of ~1% by volu

- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.
- H No change in NO<sub>x</sub> emissions factor between Backup Stripper TRS mode and Methanol mode.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

	Controls Operating Time		Product				
Controls	% hrs		Value	UOM	lb/UOM		
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415		
NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01		
NA	100%	168.3	24.8	mmBtu/hr	3.13E-01		

PROJECTED ACTUAL EMISSIONS									
SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500				
SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500				
SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415				
SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415				
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	0.415				
Hydrogen Peroxide Addition	100%	460.0	NA	NA	NA				
NA	100%	985.5	1.0	mmBtu/hr	2.80E-01				
NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01				
NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01				
NA	100%	339.5	26.0	mmBtu/hr	2.80E-01				
NA	100%	76.5	24.8	mmBtu/hr	3.13E-01				

mbination Boilers No. 1 and No. 2 during baseline.

me pure methanol.)

NOX	Ammonia		
Emissions Factor	Increase <sup>c</sup>	NOX En	nissions
Reference	%	lb/hr	tpy
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5
AP-42 Table 1.4-2.	NA	7.3	28.6
AP-42 Table 1.3-1.	NA	7.8	0.7
			123.72
NCASI Technical Bulletin 884, Table 4.12.	2.0%	3.6	13.4
NCASI Technical Bulletin 884, Table 4.12.	2.0%	0.4	1.1
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.7
NA	NA	NA	NA
AP-42 Table 1.4-2.	NA	0.3	0.1
AP-42 Table 1.4-2.	NA	27.1	87.2
AP-42 Table 1.3-1.	NA	28.9	20.9
AP-42 Table 1.4-2.	NA	7.3	1.2
AP-42 Table 1.3-1.	NA	7.8	0.3
			147.54
			23.82

#### **CO EMISSIONS REFERENCES**

	Stripper Operati	Scenario ing Time		Oper Configura	ating ation Time			
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs			
	1	-		_	1			
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0			
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7			
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3			
CO BASELINE ACTUAL EMISSIONS								
	1			_	1			
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2			
Backup Stripper Online <sup>c</sup>	4.75%	416.0	NA	100.0%	416.0			
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0			
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5			
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3			
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7			
Backup Stripper Steam - Natural Gas <sup>G</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5			
Backup Stripper Steam - No. 6 Oil <sup>G</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5			
CO PROJECTED ACTUAL EMISSIONS								

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combi

C - No change in CO emissions factor between Backup Stripper TRS mode and Methanol mode.

- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.
- H reserved.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Cont Operati	trols ng Time	Production Rate				
Controls	% hrs		Value	UOM	lb/UOM		
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728		
NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02		
NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02		

PROJECTED ACTUAL EMISSIONS									
SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA				
SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728				
SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728				
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728				
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.0728				
Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA				
NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02				
NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02				
NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02				
NA	100.0%	339.5	26.0	mmBtu/hr	8.40E-02				
NA	100.0%	76.5	24.8	mmBtu/hr	3.33E-02				

nation Boilers No. 1 and No. 2 during baseline.

СО	СО		
Emissions Factor	Control	CO Em	issions
Reference	%	lb/hr	tpy
	1		1
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
AP-42 Table 1.4-2.	NA	2.2	8.6
AP-42 Table 1.3-1.	NA	0.8	0.1
			25.22
NA	NA	NA	NA
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.7
NA	NA	NA	NA
AP-42 Table 1.4-2.	NA	0.1	0.0
AP-42 Table 1.4-2.	NA	8.1	26.2
AP-42 Table 1.3-1.	NA	3.1	2.2
AP-42 Table 1.4-2.	NA	2.2	0.4
AP-42 Table 1.3-1.	NA	0.8	0.0
			62.81
			37.60

#### VOC EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Oper Configura	ating Ition Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper SOG <sup>₄</sup>	91.4%	8,004.0	NA	100.0%	8,004.0
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>в</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3
VOC BASELINE ACTUAL EMISSIONS					
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7 <i>,</i> 884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8
New Stripper Online	90%	7 <i>,</i> 884.0	SRL Offline	5.0%	394.2
Backup Stripper Online (TRS Mode) <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
Backup Stripper Online (Methanol Mode) <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0
ASB - Backup Stripper Online (Methanol Mode) <sup>J</sup>	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>ĸ</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5

Backup Stripper Steam - No. 6 Oil <sup>ĸ</sup>	4.75%	416.0	No. 6 Oil <sup>⊳</sup>	18.4%	76.5
VOC PROJECTED ACTUAL EMISSIONS					
PAE - BAE					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N

- C VOC destruction >98% in vapor phase, 99.9% in liquid phase.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.
- H The Backup Stripper operating in Methanol Mode result in higher SOG emissions, since more VOC are stripped.
- I Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
- J When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in t
- K Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

	Cont Operati	rols ng Time	Product				
Controls	%	hrs	Value	UOM	lb/UOM		
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35		
NA	100.0%	8,760.0	1,365	ADTP/day	8.51E-01		
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03		
NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03		
NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03		

PROJECTED ACTUAL EMISSIONS								
SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40			
SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60			
SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60			
SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00			
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	7.20			
SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	16.00			
NA	100%	7,884.0	2,700	ADTP/day	0.29			
NA	100%	416.0	2,700	ADTP/day	1.43			
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	1.54			
NA	100%	460.0	2,700	ADTP/day	2.20			
LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03			
LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03			
NA	100%	985.5	1.0	mmBtu/hr	5.50E-03			
NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03			
NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03			
NA	100%	339.5	26.0	mmBtu/hr	5.50E-03			

NA	100%	76.5	24.8	mmBtu/hr	1.87E-03
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No. 1 and No. 2 during baseline.

he table, but ASB emissions are based on methanol mode operation.

VOC			
Emissions Factor	Removal <sup>c</sup>	VOC En	nissions
Reference	%	lb/hr	tpy
	1		
Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
WATER9 Inputs and Outputs Provided.	NA	48.39	211.96
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
AP-42 Table 1.4-2.	NA	0.1	0.6
AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
			233.11
	T		
Vendor / Preliminary Design Information	99.9%	1.62	6.07
Vendor / Preliminary Design Information	98%	3.60	10.11
Vendor / Preliminary Design Information	98%	3.60	3.37
Vendor / Preliminary Design Information	98%	36.00	7.10
Vendor / Preliminary Design Information	98%		
Assume methanol mode captures all VOC in SOG	98%	36.00	7.49
WATER9 Inputs and Outputs Provided.	NA	32.85	129.50
WATER9 Inputs and Outputs Provided.	NA		
WATER9 Inputs and Outputs Provided.	NA	173.20	36.03
WATER9 Inputs and Outputs Provided.	NA	247.14	56.84
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
AP-42 Table 1.4-2.	NA	5.50E-03	2.71E-03
AP-42 Table 1.4-2.	NA	0.5	1.7
AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
AP-42 Table 1.4-2.	NA	0.1	0.0

AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
			259.89
			26.79

#### TRS EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Oper Configura	ating tion Time			
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs			
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0			
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0			
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0			
TRS BASELINE ACTUAL EMISSIONS								
	F		F					
New Stripper Online	90.0%	7 <i>,</i> 884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8			
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2			
Backup Stripper Online <sup>I</sup>	4.75%	416.0	NA	100.0%	416.0			
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0			
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0			
ASB - Backup Stripper Online (Methanol Mode) <sup>J</sup>	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0			
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0			
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0			
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0			
TRS PROJECTED ACTUAL EMISSIONS			•					

# PAE - BAE

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N
- C Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.
- I Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.
- J When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in the

	Cont Operati	rols ng Time	Product			
Controls	% hrs		Value	UOM	lb/UOM	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)						
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.88E-03	
NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03	

PROJECTED ACTUAL EMISSIONS								
SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.33			
SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49			
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49			
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81			
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.81			
NA	100.0%	7 <i>,</i> 884.0	2,700	ADTP/day	2.42E-02			
NA	100.0%	416.0	2,700	ADTP/day	2.72E-02			
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	5.28E-02			
Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	7.28E-02			
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00			
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03			

Io. 1 and No. 2 during baseline.

ne table, but ASB emissions are based on methanol mode operation.

TRS	Sulfur		
Emissions Factor	Capture <sup>c</sup>	TRS Em	nissions
Reference	%	lb/hr	tpy
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
			12.81
Vendor / Preliminary Design Information	99.9%	0.04	0.14
Vendor / Preliminary Design Information	99.9%	0.05	0.15
Vendor / Preliminary Design Information	99%	0.55	0.51
Vendor / Preliminary Design Information	99%	0.91	0.18
Vendor / Preliminary Design Information	99%	0.91	0.19
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	5.94	1.24
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	1.88
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre- control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
			16.76

#### **H2S EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Operating Configuration Time			
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs		
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0		
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0		
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0		
H2S BASELINE ACTUAL EMISSIONS							
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8		
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2		
Backup Stripper Online <sup>I</sup>	4.75%	416.0	NA	100.0%	416.0		
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0		
ASB - Backup Stripper Online (TRS Mode) <sup>J</sup>	4.75%	416.0	H2S Stripped From Foul Condensate	100.0%	416.0		
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0		
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0		
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0		
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0		
H2S PROJECTED ACTUAL EMISSIONS	-						

PAE - BAE

- A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
- B Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers N
- C Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.
- D Historically high fuel oil percentage of fossil fuel heat input (2014).
- E Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
- F Projected steam usage at 850 gpm from vendor design.
- G 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.
- H Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.
- I Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.
- J When the Backup Stripper is operating, H2S ASB emissions are higher if the stripper is operating in TRS mode. Both emissions factors are shown in the

	Controls Operating Time		Product			
Controls	% hrs		Value UOM		lb/UOM	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)						
LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.13E-04	
Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	
LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04	

PROJECTED ACTUAL EMISSIONS								
SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.24			
SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37			
SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37			
SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61			
SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.61			
NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03			
NA	100.0%	416.0	2,700	ADTP/day	9.81E-03			
Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	9.45E-03			
Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	9.54E-03			
LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01			
LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04			

Io. 1 and No. 2 during baseline.

table, but ASB emissions are based on TRS mode operation.

H2S	Sulfur		
Emissions Factor	Capture <sup>c</sup>	H2S Em	nissions
Reference	%	lb/hr	tpy
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
			3.61
		1	
Vendor / Preliminary Design Information	99.9%	0.03	0.10
Vendor / Preliminary Design Information	99.9%	0.04	0.12
Vendor / Preliminary Design Information	99%	0.41	0.39
Vendor / Preliminary Design Information	99%	0.69	0.14
Vendor / Preliminary Design Information	99%	0.69	0.14
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.23
H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.25
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
			5.59

#### **PM EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Operating Configuration Time		
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	
PM BASELINE ACTUAL EMISSIONS						
	_	_	_			
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>i</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	
PM PROJECTED ACTUAL EMISSIONS						
PAE - BAE						

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution i

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Controls				PM		
	Operati	ng Time	Production Rate		Emissions Factor		
Controls	%	hrs	Value	UOM	lb/UOM	Ib/UOM Reference	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	
	100.0%	168.3	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	

PROJECTED ACTUAL EMISSIONS						
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.
	100.0%	76.5	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).

n Combination Boilers No. 1 and No. 2 during baseline.

PM					
Control	PM Emissions				
%	lb/hr	tpy			
NA	0.2	0.8			
NA	4.0	0.3			
		1.1			
NA	7.60E-03	3.74E-03			
NA	0.7	2.4			
NA	14.8	10.8			
NA	0.2	0.0			
NA	4.0	0.2			
		13.33			
		12.22			
### **PM10 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Oper Configura	ating tion Time
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3
PM10 BASELINE ACTUAL EMISSIONS					
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>⊳</sup>	18.4%	76.5
PM10 PROJECTED ACTUAL EMISSIONS					

PAE - BAE

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Controls Operating Time		Product		
Controls	%	hrs	Value	UOM	lb/UOM
BASELINE ACTUAL EMISSIONS	(March 2021	- February 20	23)		
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03
	100.0%	168.3	24.8	mmBtu/hr	1.17E-01

PROJECTED ACTUAL EMISSIONS								
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03			
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03			
	100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01			
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03			
	100.0%	76.5	24.8	mmBtu/hr	1.17E-01			

# **NET EMISSIONS CHANGE (PAE - BAE)**

in Combination Boilers No. 1 and No. 2 during baseline.

PM10	PM10		
Emissions Factor	Control	PM10 E	missions
Reference	%	lb/hr	tpy
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
			1.02
	_	_	_
AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.1
			10.34
			9.32

### **PM2.5 EMISSIONS REFERENCES**

	Stripper Scenario Operating Time			Oper Configura	ating Ition Time
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>₿</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3
PM2.5 BASELINE ACTUAL EMISSIONS			-		
	_	_			
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5
PM2.5 PROJECTED ACTUAL EMISSIONS					
PAE - BAE					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Controls Operating Time		Production Rate		
Controls	%	hrs	Value	UOM	lb/UOM
BASELINE ACTUAL EMISSIONS (N	1arch 2021 - F	ebruary 2023	3)		
	100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03
	100.0%	168.3	24.8	mmBtu/hr	8.80E-02

PROJECTED ACTUAL EMISSIONS								
	100.0%	985.5	1.0	mmBtu/hr	7.60E-03			
	100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03			
	100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02			
	100.0%	339.5	26.0	mmBtu/hr	7.60E-03			
	100.0%	76.5	24.8	mmBtu/hr	8.80E-02			

# NET EMISSIONS CHANGE (PAE - BAE)

Combination Boilers No. 1 and No. 2 during baseline.

PM2.5	PM2.5		
Emissions Factor	Control	PM2.5 E	missions
Reference	%	lb/hr	tpy
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
			0.96
AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.1
			8.37
			7.41

### LEAD EMISSIONS REFERENCES

	Stripper Scenario Operating Time			Operating Configuration Time	
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs
					B
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>₿</sup>	97.9%	7,835.7
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3
LEAD BASELINE ACTUAL EMISSIONS					
			-		
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>ı</sup>	15.0%	985.5
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>⊳</sup>	18.4%	1,450.7
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5
LEAD PROJECTED ACTUAL EMISSIONS					
PAE - BAE					

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Com

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Cont	rols			Lead		
	Operati	ng Time	Production Rate			Emissions Factor	
Controls	%	hrs	Value	UOM	lb/UOM	Reference	
ASELINE ACTUAL EMISSIONS (March 2021 - February 2023)							
	100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	
	100.0%	168.3	24.8	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)	

PROJECTED ACTUA	<b>AL EMISSIONS</b>	1				
	100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.
	100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.
	100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)
	100.0%	339.5	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.
	100.0%	76.5	24.8	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and Oil Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual Oil-fired Utility Boilers (Table 4-1)

# **NET EMISSIONS CHANGE (PAE - BAE)**

bination Boilers No. 1 and No. 2 during baseline.

Lead					
Control	Lead Emissions				
%	lb/hr	tpy			
NA	1.30E-05	5.10E-05			
NA	6.95E-04	5.85E-05			
		1.10E-04			
NA	5.00E-07	2.46E-07			
NA	4.84E-05	1.56E-04			
NA	2.58E-03	1.87E-03			
NA	1.30E-05	2.21E-06			
NA	6.95E-04	2.66E-05			
		2.06E-03			
		•			
		1.95E-03			

### **CO2 EMISSIONS REFERENCES**

	Stripper Operati	Scenario ng Time		Operating Configuration Time		
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs	
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	
Backup Stripper Steam <sup>▲</sup>	91.4%	8,004.0	No. 6 Oil <sup>₿</sup>	2.1%	168.3	
CO2 BASELINE ACTUAL EMISSIONS						
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>ı</sup>	15.0%	985.5	
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	
Backup Stripper Steam - No. 6 Oil <sup>c</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	
CO2 PROJECTED ACTUAL EMISSIONS						
PAE - BAE						

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

	Cont Operati	trols ng Time	Production Rate			
Controls	%	hrs	Value	UOM	lb/UOM	
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)						
	100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02	
	100.0%	168.3	24.8	mmBtu/hr	1.66E+02	

PROJECTED ACTUAL EMISSIONS							
	100.0%	985.5	1.0	mmBtu/hr	1.17E+02		
	100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02		
	100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02		
	100.0%	339.5	26.0	mmBtu/hr	1.17E+02		
	100.0%	76.5	24.8	mmBtu/hr	1.66E+02		

# NET EMISSIONS CHANGE (PAE - BAE)

Combination Boilers No. 1 and No. 2 during baseline.

CO2	CO2		
Emissions Factor	Control	CO2 Emissions	
Reference	%	lb/hr tpy	
40 CFR Part 98, Table C-1	NA	3,044.8	11,929
40 CFR Part 98, Table C-1	NA	4,109.9	346
			12,275
	_		
40 CFR Part 98, Table C-1	NA	116.9	58
40 CFR Part 98, Table C-1	NA	11,313.5	36,392
40 CFR Part 98, Table C-1	NA	15,270.9	11,076
40 CFR Part 98, Table C-1	NA	3,044.8	517
40 CFR Part 98, Table C-1	NA	4,109.9	157
			48,200
			35,925

## SUMMARY OF ASB EMISSIONS FACTORS

	ASB Emissions Factors (Ib/ODTP)					
Scenario	H <sub>2</sub> S	DMDS	DMS	ММС	TRS as $H_2S$	Methanol
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	3.37E-02	0.89
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	1.99E-02	0.30
Backup Stripper Scenario - TRS Mode	0.0109	0.0033	0.0147	1.30E-03	2.23E-02	1.53
Backup Stripper Scenario - Methanol Mode	0.0105	0.0308	0.0169	5.12E-04	4.24E-02	1.62
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	5.81E-02	2.31

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

VOC <sup>A</sup>	TRS <sup>B</sup>
0.95	0.0453
0.32	0.0269
1.59	0.0302
1.71	0.0587
2.44	0.0809

#### **BAE Other VOC Emissions Factors**

### PAE Other VOC Emissions Factors

Date of Subpart S	Acetadehyde,	MEK, ppm	Prop., ppm
Performance Testing	ppm		
7/9/2021	24.3	7.7	1.1
7/10/2021	25.3	5.7	4.0
7/11/2021	25.0	6.5	7.0
10/26/2021	25.0	12.3	0.8
10/27/2021	27.5	13.3	1.0
10/28/2021	10.6	6.6	1.2
10/29/2021	15.0	8.6	0.9
2/14/2022	16.7	7.5	0.7
2/15/2022	17.0	9.5	0.6
2/16/2022	15.7	8.6	1.0
5/4/2022	20.7	7.1	1.0
5/5/2022	16.3	7.3	1.0
5/6/2022	15.0	6.8	1.0
8/9/2022	15.3	5.9	0.7
8/10/2022	25.0	7.2	1.1
8/11/2022	20.3	6.0	1.0
9/27/2022	14.3	5.3	0.7
9/28/2022	15.0	5.2	0.7
9/29/2022	18.0	5.6	0.9
10/18/2022	25.0	5.6	1.0
10/19/2022	23.7	5.5	1.1
10/20/2022	23.0	6.6	0.9
AVG ppm:	19.72	7.28	1.34
Lbs into ASB	55.48	20.49	3.78
Fair estimated from WATER9			
properties	0.55	0.38	0.43
Lbs emitted	30.73	7.73	1.61
Average Pulp Production			
during Subpart S testing	g 1716		
lb/ODTP	0.018	0.005	0.001

			PAE lb/ODTP		
	BAE lb/ODTP	New Stripper	Backup Stripper	No Stripper	Methanol Mode
Methanol	0.89	0.30	1.53	2.31	1.62
Acetadehyde	0.018	0.006	0.031	0.046	0.033
MEK	0.005	0.002	0.008	0.012	0.008
Propionaldehyde	0.001	0.000	0.002	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504	0.0308
DMS	0.0185	0.0136	0.0147	0.0192	0.0169
ММС	3.28E-04	1.88E-04	1.30E-03	7.42E-04	5.12E-04
VOC:	0.95	0.32	1.59	2.44	1.71

## New Indy Catawba ASB BAE Methanol Emissions Factor

Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference
	ADTP	ODTP	lb/ODTP	
Mar-21	42,474	38,226	1.50	
Apr-21	43,075	38,767	1.50	
May-21	46,962	42,266	1.50	
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart
Jul-21	49,371	44,434	1.50	S Performance Tests.
Aug-21	44,614	40,152	1.50	Representative of ASB
Sep-21	40,177	36,159	1.50	operation from March
Oct-21	47,234	42,510	1.50	2021 to February 2022.
Nov-21	39,185	35,266	1.50	
Dec-21	38,734	34,860	1.50	
Jan-22	43,690	39,321	1.50	
Feb-22	37,736	33,962	0.33	
Mar-22	43,944	39,549	0.33	
Apr-22	40,046	36,041	0.33	
May-22	38,896	35,006	0.33	
Jun-22	23,184	20,866	0.33	Average of 2022 Subpart
Jul-22	39,890	35,901	0.33	S Performance Tests.
Aug-22	53,396	48,057	0.33	Representative of ASB
Sep-22	45,044	40,539	0.33	operation from February
Oct-22	47,517	42,765	0.33	2022 to February 2023.
Nov-22	40,133	36,120	0.33	
Dec-22	33,859	30,474	0.33	
Jan-23	35,464	31,918	0.33	
Feb-23	39,276	35,348	0.33	
Baseline Methano	ol Emissions Factor (Pul	p Weighted Average)	0.89	lb/ODTP

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

		Concentration (ppm)				
Date	Sample Time	Hydrogen Sulfide	Methyl Mercaptan	Dimethyl Sulfide	Dimethyl Disulfide	Total TRS
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 d	or 6/25	146.7	16.0	17.0	15.0	194.7

	MW
Hydrogen Sulfide	34.08 g/mol
Methyl Mercaptan	48.11 g/mol
Dimethyl Sulfide	62.13 g/mol
Dimethyl Disulfide	94.20 g/mol
Sulfur	32.07 g/mol
	Hydrogen Sulfide Methyl Mercaptan Dimethyl Sulfide Dimethyl Disulfide Sulfur

Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dim	ethyl
Sulfide	Mercaptan	Sulfide	Disu	ulfide
138	3.0 10	.7	8.8	10.2
82.3	6.4	% 5	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AH
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP)ª	0.7001

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

## New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination	
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057
Apr-21	43,075	41,363	75,012	116,376	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199
Jul-21	49,371	67,565	55,824	123,389	3	97	100
Aug-21	44,614	33,863	32,461	66,325	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86
Oct-21	47,234	69,732	75,498	145,230	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412
Mar-22	43,944	62,423	82,083	144,506	335	0	335
Apr-22	40,046	44,634	62,835	107,469	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238
Jul-22	39,890	64,532	86,134	150,666	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24
Oct-22	47,517	70,539	89,760	160,299	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679
Total	996,766			3,237,544			
Annual Average	498,383						
				97.9%			

	No.
Г	otal
No. 6	Fuel Oil
m	mBtu
	309
	0
	0
	180
	15
	0
	13
	0
	0
	0
20	0 1 388
	112
	50
	0
	0
	236
	0
	0
	0
	4
	0
2	5,511
	0,384
	,202
65	9,003
	0 10/2
	2.170

	Combina	tion Boiler No	o. 1 Stack	Combinat	ion Boiler No. 2	
	NCG+SOG	NCG	SOG	NCG+SOG	NCG	
ODTP/hr	77.3	79.0		91.1	92.9	
ADTP/hr	85.9	87.8		101.2	103.2	
lb SO2/hr	342.8	230.7		380.9	309.9	
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00	

	Controlled	Emissions	Sulfu	r Capture	Uncontrolle
	Average	Maximum	Bark Ash <sup>c</sup>	LVHC Scrubber	Average
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP
SOG	1.06	1.36	20%	NA	1.33
NCG	2.82	3.00			
LVHC <sup>A,B</sup>	1.97	2.10	20%	50%	4.92
HVLC <sup>A,B</sup>	0.85	0.90	20%	NA	1.06

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

Stack
SOG
0.76
0.70
d Emissions
d Emissions Maximum
d Emissions Maximum Ib SO2/ADTP
d Emissions Maximum Ib SO2/ADTP 1.70
d Emissions Maximum Ib SO2/ADTP 1.70
d Emissions Maximum Ib SO2/ADTP 1.70
d Emissions Maximum Ib SO2/ADTP 1.70 5.25

C (0.473 lb SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C)

.

### October 2021 SO2 Testing - Weston

	Combina	ation Boiler No.	1 Stack	Combinat	ion Boiler No. 2
	NCG+SOG	NCG	SOG	NCG+SOG	NCG
ODTP/hr	77.3	79.0		91.1	92.9
ADTP/hr	85.9	87.8		101.2	103.2
lb SO2/hr	342.8	230.7		380.9	309.9
lb SO2/ADTP	3.99	2.63	1.36	3.76	3.00
Columbia lb/ADTP <sup>D</sup>	4.21	2.77	1.44	4.21	3.36

	Controlled	Emissions	Sulfu	ir Capture	Uncontrolle
	Average	Maximum	Bark Ash <sup>c</sup>	LVHC Scrubber	Average
	lb SO2/ADTP	lb SO2/ADTP	%	%	lb SO2/ADTP
SOG	1.14	1.44	20%	NA	1.43
NCG	3.07	3.36			
LVHC <sup>A,B</sup>	2.14	2.35	20%	50%	5.36
HVLC <sup>A,B</sup>	0.92	1.01	20%	NA	1.15

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled SO2 emissions from LVHC (1.10 lb SO2/ADTP) and HVLC (0.473

C - Estimated sulfur capture based on 2012 stack test (NCASI data suggests ~32% capture).

D - Columbia lb/ADTP factors denotes scaling up the October 2021 stack test results to the overall NCG+SC

Stack
SOG
0.76
0.85
d Emissions
Maximum
lb SO2/ADTP
1.80
5.87
5107

Ib SO2/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachment C).

)G emissions factor from Project Columbia application of 4.21 lb/ADTP.

Combination Boil Condition 1: Wit 13-Oct-21 Run # Start	1 2 3 Average: Condition 2: Wit	Run # Start	RESULTS Average:	) Discus
	TABL NO. 1 COMBIN CONDITION 1: NCC SUMMARY OF SO2 I	E 2-2 ATION BOILER 3 AND SOG GA 2 MUSSION RESU	LTS	
	Run 1	Run 2	Run 3	Mea
Date Time Began Time Ended	10/13/2 0844 0944	1 10/13/21 1029 1129	10/13/21 1206 1306	111
Stack Gas Data	430	435	438	434
Velocity, ft/sec	64	63	63	53
Moisture, %	17	17	17	17
O2 Concentration, %	10.5	10.5	10.8	10.6
Sulfur Dioxide Concentration, ppm	280	227	204	237
	TABL	E 2-3		
	NO. 1 COMBIN CONDITION 2: NO SUMMARY OF SO <sub>2</sub> I	ATION BOILER CG GASES ONI EMISSION RESU	LTS	
	Run 1	Run 2	Run 3	Mea
Date Time Began Time Ended	10/13/2 1407 1507	1 10/13/21 1544 1644	10/13/21 1714 1814	111
Stack Gas Data Temperature, °F	447	450	444	447
Velocity, ft/sec	61	62	63	62
Moisture, % CO <sub>2</sub> Concentration, %	9.6	9.9	16 8.9	9.5
O <sub>2</sub> Concentration, %	10.1	9.8	10.7	1.40
The second second			1.1	
Sulfur Dioxide			100	-
#### Combination Boiler #1

## Condition 1: With NCGs, with SOGs 13-Oct-21

							NCG			Hard Pipe	
							Scrubber	NCG	Stripper Foul	Foul	Ľ
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	
	1	0844	262.3	29.9	126.9	1.23	40	10.9	511	230	
	2	1029	266.3	33.0	109.1	1.23	40	10.9	505	213	
	3	1206	257.2	32.6	100.4	1.23	40	10.9	504	2	
Average:			261.9	31.8	112.1	1.23	40	10.9	507	148	

## Condition 2: With NCGs, without SOGs 13-Oct-21

							100000000000000000000000000000000000000			200 - 10 <u>0</u> 00	
							NCG			Hard Pipe	
							Scrubber	NCG	Stripper Foul	Foul	Ľ
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Flow	Scrubber pH	Condensate	Condensate	
Run #		Start Time	(10 <sup>3</sup> lbs/hr)	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)	
	1	1407	267.7	34.0	102.0	1.23	40	10.9	506	2	
	2	1544	272.9	34.8	101.3	1.23	40	10.9	504	252	į.
	3	1714	256.9	30.05	115.96	1.23	40	10.9	505	183	8
Average:			265.8	33.0	106.4	1.23	40	10.9	505	146	Į.

	Hard Pipe					
Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	
Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
511	230	1407	1103	10851	77.3	82.7
505	213	1409	1200	10885	77.3	85.7
504	2	1443	1206	10963	77.3	84.8
507	148	1420	1170	10900	77.3	84.4
Flow (GPM) 511 505 504 507	Flow (GPM) 230 213 2 148	(SCFM) 1407 1409 1443 1420	(SCFM) 1103 1200 1206 1170	(SCFM) 10851 10885 10963 10900	(001/H) 77.3 77.3 77.3 77.3	8 8 8 8 8 8

	Hard Pipe						
Stripper Foul	Foul	LVHC Flow to	SOG Flow to	HVLC Flow to			
Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production		
Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA	
506	2	1416		11071	79.0		83.9
504	252	1414		10976	79.0		81.6
505	183	1430		11061	79.0		80.3
505	146	1420		11036	79.0		81.9
Condensate Flow (GPM) 506 504 505 505	Condensate Flow (GPM) 2 252 183 146	Boilers (SCFM) 1416 1414 1430 1420	Boilers (SCFM)	Boilers (SCFM) 11071 10976 11061 11036	Pulp Production (ODT/Hr) 79.0 79.0 79.0 79.0	Pulp KAPPA	8: 8: 8: 8:

15730.001.009 #1-2 CBs SO<sub>1</sub> Emission Report

Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	Stack Gas Data Temperature, °F Velocity, fl/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	Date Time Began Time Ended	NO. SUMMAN	Sulfur Dioxide Concentration, ppm	Stack Gas Data Temperature, °F Velocity, ft/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	Date Time Began Time Ended	NO. CONDET SUMMAI	NATURE N	Combination Bo Condition 1: Wi 14-Oct-21 Run # Star 1 0 2 1 3 1 Average:
235 311.3	457 59 15 7.2 11.9 1.33	<b>Run 1</b> 10/14/21 1410 1510	TABLE 2 .2 COMBINATE OF SO2 EM	275	463 63 17 8.2 10.8 1.40	10/14/21 0830 0930	TABLE 2 .2 COMBINATI 10N 1: NCG A RY OF SO <sub>2</sub> EM		Condition 2: Wi 14-Oct-21
234 311.0	461 59 15 7.6 11.2 1.33	Run 2 10/14/21 1547 1647	100 BOILER GASES ONL ISSION RESU	262	477 68 19 9.5 10.1 1.43	10/14/21 1026 1126	-4 ION BOILER ND SOG GAS ISSION RESUL		Run # Star 1 1 2 1 3 1 Average:
232 307.4	460 58 15 7.0 11.7 1.33	Run 3 10/14/21 1725 1825	CIS X	286	465 61 16 7.5 11.5 1.35	Kun 3 10/14/21 1222 1322	- 75 55 55	RESULTS AND	
234 309.9	459 59 15 7.3 11.6 1.33	Mean		274	469 64 17 8,4 10.8 1.39			Discussion	

28 October 2021 1:00 p.m. Version

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#### Combination Boiler #2

#### Condition 1: With NCGs, with SOGs 14-Oct-21

							NCG			Hard Pipe
			Steam Rate	Bark Rate	Gas Flow (10 <sup>3</sup>		Scrubber Flow	NCG Scrubber pH	Stripper Foul Condensate	Foul Condensate
Run #		Start Time	$(10^3 lbs/hr)$	(Tons/Hr)	SCF/Hr)	TDF (TPH)	(GPM)	(SU)	Flow (GPM)	Flow (GPM)
	1	0830	241	29.8	188.7	1.23	40	10.9	505	209
	2	1026	251	46.3	115.6	1.23	40	10.9	504	200
	3	1222	211	25.4	171.4	1.23	40	10.9	505	199
Average:			234	33.8	158.6	1.23	40	10.9	505	203

## Condition 2: With NCGs, without SOGs 14-Oct-21

Run #		Start Time	Steam Rate (10 <sup>3</sup> lbs/hr)	Bark Rate (Tons/Hr)	Gas Flow (10 <sup>3</sup> SCF/Hr)	TDF (TPH)	NCG Scrubber Flow (GPM)	NCG Scrubber pH (SU)	Stripper Foul Condensate Flow (GPM)	Hard Pipe Foul Condensate Flow (GPM)
	1	1410	198	21.7	174.8	1.23	40	10.9	505	209
	Z	1547	218	35.4	206.4	1.23	40	10.9	505	224
	3	1725	214	49.6	220.6	0.65	40	10.9	505	262
Average	ĸ		210	35,6	200.6	1.04	40	10.9	505	232

	Stripper Foul	Hard Pipe Foul	LVHC Flow to	SOG Flow to	HVLC Flow to		
н	Condensate	Condensate	Boilers	Boilers	Boilers	Pulp Production	0. I- KA004
	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Рир КАРРА
	505	209	1409	1203	11071	91.1	94.5
	504	200	1420	1179	11160	91.1	88.2
	505	199	1429	1157	11090	91.1	80.7
	505	203	1419	1180	11107	91.1	87.8

н	Stripper Foul Condensate	Foul Condensate	LVHC Flow to Boilers	SOG Flow to Boilers	HVLC Flow to Boilers	Pulp Production	
	Flow (GPM)	Flow (GPM)	(SCFM)	(SCFM)	(SCFM)	(ODT/Hr)	Pulp KAPPA
	505	209	1438		11109	92.9	78.8
	505	224	1435		11060	92.9	78.7
	505	262	1453		10977	92.9	79.3
	505	232	1442		11049	92.9	

15730,001,009 #1-2 CBs SO, Emission Report

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15730,001,009 #1-2 CBs SOr Emission Report

#### June 2021 TRS\_H2S Testing - Weston

	Combi	nation Boiler N	o. 1 Stack	Combin
TRS as TRS	NCG+SOG	NCG	SOG	NCG+SOG
ODTP/hr	55.9	76.0		88.3
ADTP/hr	62.1	84.4		98.1
lb TRS (as H2S)/hr	0.75	0.68		0.85
lb TRS (as TRS)/hr	1.07	0.97		1.22
lb TRS (as TRS)/ADTP	1.73E-02	1.15E-02	5.75E-03	1.24E-02

	Controlled	Emissions	Sulfur Co	nversion
	Average	Maximum	Combustion	LVHC Scrubber
TRS as TRS	lb TRS/ADTP	lb TRS/ADTP	%	%
SOG <sup>D</sup>	2.88E-03	5.75E-03	99%	NA
NCG	1.27E-02	1.39E-02		
LVHC <sup>A,B</sup>	8.01E-03	8.76E-03	99%	50%
HVLC <sup>A,B</sup>	4.69E-03	5.13E-03	99%	NA

A - NCG gases include LVHC gases and HVLC gases.

B - NCG gases split using ratio of controlled TRS emissions from LVHC (8.97E-3 lb TRS/ADTP) and HN

C - NCG gases split using ratio of controlled H2S emissions from LVHC (3.82E-3 lb H2S/ADTP) and H

D - Combination Boiler No. 2 SOG averaged as zero (0).

			CB1
TRS as S		MW	NCG+SOG
sulfur	S	32.065	Run 1
hydrogen sulfide	H <sub>2</sub> S	34.081	0.08
methyl mercaptan	$CH_4S$	48.107	0.55
dimethyl sulfide	$C_2H_6S$	62.134	0.16
dimethyl disulfide	$C_2H_6S_2$	94.199	0.07

10^6 ACFM Flowrate Basis to lb/min

0.0070817662

CH₄S	0.0687242857
C <sub>2</sub> H <sub>6</sub> S	0.0258219221
$C_2H_6S_2$	0.0171270909

TRS as H2S	0.0823255325
TRS as TRS	0.1187550649

### Ratio TRS as H2S/TRS as 0.6932380738

ation Boiler No.	2 Stack		Combin	ation Boiler No.	1 Stack
NCG	SOG	H2S	NCG+SOG	NCG	SOG
85.2		ODTP/hr	55.9	76.0	
94.7		ADTP/hr	62.1	84.4	
0.92		lb H2S/hr	0.07	0.05	
1.32					
1.39E-02	-1.51E-03	lb H2S/ADTP	1.13E-03	5.92E-04	5.35E-04
Uncontrolle	ed Emissions		Controlled	l Emissions	Sulfur Co
Uncontrolle Average	ed Emissions Maximum		Controlled Average	l Emissions Maximum	Sulfur Co Combustion
Uncontrolle Average Ib TRS/ADTP	ed Emissions Maximum Ib TRS/ADTP	H2S	Controlled Average lb H2S/ADTP	l Emissions Maximum Ib H2S/ADTP	Sulfur Co Combustion %
Uncontrolle Average Ib TRS/ADTP 0.29	ed Emissions Maximum Ib TRS/ADTP 0.58	H2S SOG	Controlled Average Ib H2S/ADTP 4.13E-04	l Emissions Maximum Ib H2S/ADTP 5.35E-04	Sulfur Co Combustion % 99%
Uncontrolle Average Ib TRS/ADTP 0.29	ed Emissions Maximum Ib TRS/ADTP 0.58	H2S SOG NCG	Controlled Average Ib H2S/ADTP 4.13E-04 5.07E-04	l Emissions Maximum Ib H2S/ADTP 5.35E-04 5.92E-04	Sulfur Co Combustion % 99%
Uncontrolle Average Ib TRS/ADTP 0.29 1.60	ed Emissions Maximum Ib TRS/ADTP 0.58 1.75	H2S SOG NCG LVHC <sup>A,C</sup>	Controlled Average Ib H2S/ADTP 4.13E-04 5.07E-04 5.03E-04	Emissions Maximum Ib H2S/ADTP 5.35E-04 5.92E-04 5.87E-04	Sulfur Co Combustion % 99% 99%

/LC (5.25E-3 lb TRS/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachmer VLC (3.38E-5 lb H2S/ADTP) from Project Columbia Application (July 2019 and April 2020 Addendum - Attachme

		CB1			CB2	
		NCG			NCG+SOG	
Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2
0.07	0.1	0.07	0.07	0.07	0.08	0.08
0.53	0.49	0.52	0.52	0.53	0.77	0.63
0.16	0.16	0.16	0.16	0.17	0.08	0.08
0.07	0.07	0.07	0.07	0.07	0.04	0.04

0.0061965455 0.0088522078 0.0061965455 0.0061965455 0.0061965455 0.0070817662 0.0070817662

0.06622522080.06122709090.06497568830.06497568830.06622522080.0962140.07872054550.02582192210.02582192210.02582192210.02582192210.02743579220.0129109610.0129109610.01712709090.01712709090.01712709090.01712709090.01712709090.00978690910.0097869091

0.0796698701 0.0787846494 0.0787846494 0.0787846494 0.0805550909 0.0894072987 0.0770142078 0.1153707792 0.1130283117 0.1141212468 0.1141212468 0.1169846494 0.1259936364 0.1085001818

0.6905550146 0.6970346471 0.6903591714 0.6903591714 0.6885953957 0.709617575 0.7098071773

Combination E	Boiler No.	2 Stack
---------------	------------	---------

NCG	SOG
85.2	
94.7	
0.04	
4.23E-04	2.91E-04
	NCG 85.2 94.7 0.04 4.23E-04

nversion	Uncontrolle	d Emissions
LVHC Scrubber	Average	Maximum
%	lb H2S/ADTP	lb H2S/ADTP
NA	4.13E-02	5.35E-02
50%	1.01E-01	1.17E-01
NA	4.45E-04	5.19E-04

### າt C). nt C).

	CB2				
	NCG				
Run 3	Run 1	Run 2	Run 3	AVG	
0.08	0.05	0.05	0.05	0.07	8.0%
0.64	0.94	0.91	0.69	0.64	72.6%
0.08	0.08	0.07	0.07	0.12	13.5%
0.04	0.03	0.03	0.03	0.05	5.9%
				0.89	Total TRS
				84.8%	

### 0.0070817662 0.0044261039 0.0044261039 0.0044261039

0.07997007790.11745605190.11370745450.08621774030.0129109610.0129109610.01129709090.01129709090.00978690910.00734018180.00734018180.0073401818

0.0778994286 0.1000299481 0.0964890649 0.0770142078 0.1097497143 0.1421332987 0.1367708312 0.1092811169

0.7097916298 0.7037756034 0.7054798462 0.7047348159 0.69944568

1.43

PLC Cross Check back to TRS as H2S 0.0857419 0.0857419 0.7787379 0.5516903 0.1442481 0.0791212 0.0635499 0.0459844 1.0722777 0.7625378



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# TABLE 2-11NO. 1 COMBINATION BOILERCONDITION 1: NCG AND SOG GASESSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date Time Began	6/23/21 1158	6/23/21 1400	6/23/21 1541	
Time Ended	1258	1500	1041	
Stack Gas Data Temperature, °F Velocity, ft/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	415 59 17 7.8 12.1 1.35	418 57 18 8.4 11.4 1.31	415 57 16 7.7 12.0 1.33	416 57 17 8.0 11.8 1.33
Hydrogen Sulfide Concentration, ppm Emission Rate, lb/hr	0.09 0.07	0.08 0.06	0.12 0.08	0.10 0.07
Total Reduced Sulfur Concentration, ppm Emission Rate, Ib/hr	1.09 0.78	1.07 0.74	1.03 0.73	1.06 0.75
Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	195 262.7	278 362,5	344 457.4	272 360.9

# TABLE 2-12NO. 1 COMBINATION BOILERCONDITION 2: NCG GASES ONLYSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/23/21	6/23/21	6/23/21	
Time Began	1824	2019	2202	
Time Ended	1924	2119	2302	
Stack Gas Data				
Temperature, °F	416	411	415	414
Velocity, ft/sec	56	56	56	56
Moisture, %	16	16	17	17
CO2 Concentration, %	8.3	7.8	8.1	8.1
O2 Concentration, %	11.4	11.9	11.6	11.6
VFR, x 10 <sup>5</sup> dscfm	1.30	1.31	1.30	1.30
Hydrogen Sulfide				
Concentration, ppm	0.08	0.08	0.08	0.08
Emission Rate, lb/hr	0.05	0.05	0.05	0.05
Total Reduced Sulfur				1.1.1.1.1.1
Concentration, ppm	0.97	0.98	0.99	0.98
Emission Rate, lb/hr	0.67	0.68	0.68	0.68
Sulfur Dioxide				
Concentration, ppm	313	348	349	337
Emission Rate, lb/hr	404.4	452.9	450.8	436.1

K-115730 NEW INDY-001 CATAWBA SC/008/REPORT/NEW-INDY CATAWBA JULY 2021 EMISSION TEST REPORT VER 3.DOCM

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Combination Boiler #1

	TRS		ssions Emissions	ssions Emissions 7 Pulp) (Ibs/hr)	ssions Emissions r Pulp) (lbs/hr) 5.29 0.56	sisions Emissions Pulp) (Ibs/hr) 5.29 0.56 6.71 0.49	sions Emissions Pulp) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50	sions Emissions Pulp) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52	sions Emissions Pulp) (lbs/hr) 5.29 (0.56 6.71 0.49 7.15 0.50 7.46 0.52	sions Emissions Pulp) (lbs/hr) 5.29 (0.56 6.71 0.49 7.15 0.50 6.46 0.52	Fulp) (Ibs/hr) 5.29 (Ibs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 FRS	revip) (Ibs/hr) 5.29 (Ibs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 6.46 0.52 TRS	relipions Emissions sions Emissions (lbs/hr) (lbs/hr) 5.29 0.56 6.71 0.49 7.15 0.50 6.46 0.52 6.46 0.52 6.46 0.52 nrs Emissions urb (lbs/hr) (lbs/hr)	Emissions         Emissions           Pulp)         (lbs/hr)           5.29         0.56           5.11         0.49           7.15         0.50           6.46         0.52           6.46         0.52           6.46         0.52           6.46         0.52           6.46         0.52           115         0.50           6.46         0.43           5.46         0.43	Silons         Emissions           Pulp)         (Ibs/hr)           5.29         0.56           6.71         0.49           7.15         0.50           6.46         0.52           6.46         0.52           6.46         0.52           6.46         0.52           6.46         0.52           11         11           12         0.50           6.46         0.52           6.46         0.52           6.46         0.43           5.46         0.43           5.46         0.43           6.06         0.42	Silons         Emissions           Pulp)         (Ibs/hr)           5.29         0.56           5.11         0.49           7.15         0.50           6.46         0.52           6.46         0.52           files/hr)         0.50           7.15         0.50           6.46         0.52           6.46         0.43           0ns         Emissions           uip)         (Ibs/hr)           5.46         0.43           6.06         0.43           5.40         0.43
		missions SO, Emis	s/hr) (lbs/ODT	262.7	362.5	457.4	360.9				issions 50 <sub>2</sub> Emissio	(Ibs/ODT Pu	404.4	452.9	450.8	
		ulp Production SO <sub>2</sub> E	(ODT/Hr) (Ib	49.7	54.0	64.0	55.9				Ilp Production 502 Em	DT/Hr) (Ibs/hr)	74.1	74.7	79.2	
	HVLC Flow to	Boilers P	(SCFM)	11575	11048	11009	11211			HVLC Flow to	Boilers Pu	(SCFM) (O	10515	10377	10573	
	SOG Flow to	Boilers	(SCFM)	621	1219	1136	666			SOG Flow to	Boilers	(SCFM)				
	LVHC Flow to	Boilers	(SCFM)	1585	1595	1578	1586			LVHC Flow to	Boilers	(SCFM)	1587	1593	1570	
Hard Pipe	Foul	Condensate	Flow (GPM)	146	152	45	114		Hard Pipe	Foul	Condensate	Flow (GPM)	123	184	152	
	Stripper Foul	Condensate	Flow (GPM)	458	491	491	480			Stripper Foul	Condensate	Flow (GPM)	489	491	490	
	NCG	Scrubber pH	(ns)	10.9	10.9	10.9	10.9			NCG	Scrubber pH	(Ins)	10.9	10.9	10.9	
NCG	Scrubber	Flow	(GPM)	40	40	40	40		NCG	Scrubber	Flow	(GPM)	40	40	40	
			TDF (TPH)	1.37	1.37	1.37	1.37					TDF (TPH)	1.37	1.37	1.37	
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	80.8	68.8	81.2	76.9				Gas Flow (10 <sup>3</sup>	SCF/Hr)	94,9	5.76	92.4	
		Bark Rate	(Tons/Hr)	25.1	29.3	24.8	26.4				Bark Rate (	(Tons/Hr)	26.3	23.7	25.2	
		Steam Rate	(10 <sup>3</sup> lbs/hr)	208	225	207	213	without 50Gs			team Rate	10 <sup>3</sup> lbs/hr)	230	216	220	
			Start Time	1158	1400	1541		: With NCGs,			S	Start Time (1	1824	2019	2202	
			# un	-	2	ŝ	rage:	dition 2	Jun-21			-	1	2	ŝ	

nbination Boiler #1

ulition 1: With NCGs, with SOGs -Jun-21

	-21	With NCGs	, with SOGs	
			Steam Rate	Ba
Run	-	Start Time	(10 <sup>3</sup> lbs/hr)	E
	-	1158	208	
	2	1400	225	
	m	1541	207	
Average			213	
Conditio 23-Jun	21 -21	With NCGs	, without 50Gs	
			steam Rate	Bar
Run #		Start Time	10 <sup>3</sup> lbs/hr)	(To
	-	1824	230	
	2	2019	216	
	ŝ	2202	220	
Average			222	

15730.001.008 Pulp Dryer, #3 Paper Machine, #2-3 SDTVs, & #1-2 CBa Emission Report



#### **RESULTS AND DISCUSSION**

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# TABLE 2-13No. 2 Combination BoilerCondition 1: NCG and SOG GasesSummary of H2S, Total TRS, and SO2 Emission Results

	Run 1	Run 2	Run 3	Mean
Date Time Began Time Ended	6/24/21 1445 1545	6/24/21 1630 1730	6/24/21 1806 1906	
Stack Gas Data Temperature, °F Velocity, fl/sec Moisture, % CO <sub>2</sub> Concentration, % O <sub>2</sub> Concentration, % VFR, x 10 <sup>5</sup> dscfm	475 69 14 6.6 13.1 1.57	474 69 14 6.9 12.7 1.56	479 69 15 7.3 12.3 1.54	476 69 14 6.9 12.7 1.56
Hydrogen Sulfide Concentration, ppm Emission Rate, lb/hr	0.09 0.07	0.09 0.07	0.09 0.07	0.09 0.07
Total Reduced Sulfur Concentration, ppm Emission Rate, lb/hr	1.13 0.94	0.97 0.80	0.97 0.80	1.02 0.85
Sulfur Dioxide Concentration, ppm Emission Rate, lb/hr	324 508.7	327 507.2	322 496.1	324 504.0

# TABLE 2-14NO. 2 COMBINATION BOILERCONDITION 2: NCG GASES ONLYSUMMARY OF H2S, TOTAL TRS, AND SO2 EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	6/25/21	6/25/21	6/25/21	
Time Began	1000	1135	1315	
Time Ended	1100	1235	1415	
Stack Gas Data				
Temperature, °F	468	470	481	473
Velocity, fl/sec	68	69	69	69
Moisture, %	14	14	14	14
CO <sub>2</sub> Concentration, %	6.9	6.8	7.3	7.0
O2 Concentration, %	12.8	12.7	12.3	12.6
VFR, x 10 <sup>5</sup> dscfm	1.56	1.55	1.56	1.56
Hydrogen Sulfide		1		
Concentration, ppm	0.05	0.05	0.05	0.05
Emission Rate, lb/hr	0.04	0.04	0.04	0.04
Total Reduced Sulfur				1
Concentration, ppm	1.22	1.18	0.94	1.11
Emission Rate, lb/hr	1.01	0.97	0.78	0.92
Sulfur Dioxide				
Concentration, ppm	247	245	235	242
Emission Rate, lb/hr	383.2	380.0	366.2	376.4

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1 October 2021 8:00 a.m. Version

Combination Boiler #2

Providence 1. Notes are control

Combination Boiler #2

Combination Boiler #2

Condition 1: With NCGs, with SOGs 24-Jun-21

	TRS	Emissions	(lbs/hr)	0.77	0.63	69'0	0,68
		SO <sub>2</sub> Emissions	(ibs/ODT Pulp)	5.79	5.72	5,60	5.71
		SO <sub>2</sub> Emissions	(lbs/hr)	508.7	507.2	496.1	504.0
		Pulp Production	(ODT/Hr)	87.8	88,6	88.6	88.3
	HVLC Flow to	Boilers	(SCFM)	10253	10277	10300	10277
	SOG Flow to	Boilers	(SCFM)	1231	1231	1231	1231
	LVHC Flow to	<b>Boilers</b>	(SCFM)	1572	1576	1580	1576
Hard Pipe	Foul	Condensate	Flow (GPM)	190	186	190	189
	Stripper Foul	Condensate	Flow (GPM)	491	490	490	490
	NCG	Scrubber pH	(ns)	10.9	10.9	10.9	6.01
NCG	Scrubber	Flow	(GPM)	40	40	40	40
			TDF (TPH)	1.37	1.37	137	1.37
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	125.3	146.4	146.4	139.4
		Bark Rate	(Tons/Hr)	39.0	31.1	33.6	34.6
		Steam Rate	(10 <sup>3</sup> lbs/hr)	219	224	241	228
			Start Time	1445	1630	1806	
			8un #	-1	2	3	Average:

Condition 2: With NCGs, without 50Gs 25-Jun-21

	S	issions	s/hr)	0.86	0.82	0.63	0.77
	TR	SO <sub>2</sub> Emissions En	(lbs/ODT Pulp) (lb	4.39	4.51	4.35	4,42
		SO <sub>2</sub> Emissions	(lbs/hr)	383.2	380.0	366.2	376.4
		Pulp Production	(00T/Hr)	87.2	84.3	84.2	85.2
	HVLC Flow to	Boilers	(SCFM)	10475	10425	10500	10467
	SOG Flow to	Boilers	(SCFM)				
	LVHC Flow to	Boilers	(SCFM)	1579	1573	1571	1574
Hard Dine	Foul	Condensate	Flow (GPM)	155	252	16	168
	Stripper Foul	Condensate	Flow (GPM)	482	479	482	481
	NCG	Scrubber pH	(su)	10.9	10.9	10.9	10.9
NLC	Scrubber	Flow	(GPM)	40	40	40	40
			TDF (TPH)	1.37	1.37	137	1.37
		Gas Flow (10 <sup>3</sup>	SCF/Hr)	132.7	147.8	141.7	140.7
		Bark Rate	(Tons/Hr)	35,7	30.8	30,6	32.4
		team Rate	10 <sup>3</sup> lbs/hr)	234	225	245	235
		S	Start Time (1	1000	1135	1315	
			# UN	1	2	m	verage:

Compil	atio	n Boiler #2	
Conditi 24-Jun	21 S	: With NCG	s, with SOG
			Steam R
Run	-	Start Time	(10 <sup>3</sup> lbs/
	-	1445	219
	2	1630	224
	3	1806	241
Average	-		228
Conditio 25-Jun	21	With NCG	s, without 5
			Steam Rate
Run #		Start Time	(10 <sup>2</sup> lbs/hr
	-	1000	234
	2	1135	225
	111	1315	245
Average	14		235

15730.001.008 Pulp Dryer, #3 Paper Machine, #2-3 SDTVs, & #1-2 CBs Emission Report

### **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Thursday, March 28, 2024 6:00 PM
То:	Buckner, Katharine
Cc:	Steven Moore; Sheryl Watkins; Rachel Davis
Subject:	RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs
Attachments:	Revised table.pdf; UPDATED Emissions Calculations (3-13-24) R1.xlsx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Katharine – I'm responding to your questions on the calculations. I'm sorry it's taken me so long to get back to you. Here are responses to your questions. Please let me know if this sparks follow-up:

#### 1. Why is the pulp production used 2,200 ODTP/day?

The maximum post-project foul condensate flow of 850 gpm, which is the basis for the PSD applicability calculations, is based on a range of pulp production rates up to a maximum of 2430 ODTP/day, or 2700 ADTP/day.

For all of the post-project ASB emissions scenarios, New-Indy conservatively:

- 1. Calculated gram/second (g/s) ASB emissions rates based on 850 gpm total foul condensate generated as follows:
  - a. New Stripper: no HP flow.
  - b. No Stripper: 850 gpm of foul condensate through hard pipe (HP)
  - c. Existing Stripper (TRS mode): 850 gpm of TRS-stripped condensate through HP.
  - d. Existing Stripper (MeOH mode): 500 gpm of foul condensate through HP.
- 2. Convert the g/s emissions rates to a lb/ODTP basis using the lower end of pulp production (2200 ODTP/day) in order to develop a more conservative lb/ODTP emissions factor than if 2430 ODTP/day (2700 ADTP/day) was used.
- 3. Calculated post-project emissions by multiplying the lb/ODTP emissions factor by 2430 ODTP.

#### 2. DMDS emissions rate from Zone 2:

You are correct that the value should have been 5.66E-03 rather than 5.66E-08. This results in a very small incremental increase in the TRS and VOC emissions factor from the ASB, but no change to conclusions. Updated PDF and emissions calculations spreadsheet is attached.



From: Buckner, Katharine <bucknekk@dhec.sc.gov> Sent: Wednesday, March 27, 2024 2:52 PM To: Rachel Davis <Rachel.Davis@new-indycb.com>; Caleb Fetner <cfetner@all4inc.com> Cc: Steven Moore <smoore@all4inc.com>; Sheryl Watkins <swatkins@all4inc.com> Subject: RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

Hello Everyone,

I am checking in on the comment I made last week on the latest version of the calculations. What have you determined?

Also, I am checking in on the review of the drafts c/ps and SOBs for the EPA Consent Decree and the Ash Handling System I sent 2 weeks ago. I really don't expect there to be any comments. I sent them so you could see the restructuring of the SOBs. I do need an email that states you have no comments for the record.

I am also looking for your proposal on the SO2 CEMS for the No. 3 Recovery Furnace.

Please provide a status update on the items above.

Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Buckner, Katharine
Sent: Thursday, March 21, 2024 2:51 PM
To: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>
Cc: Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Subject: RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

Hello All,

I have finished reviewing the calculations. I do not have any further comments. I just want to make note of one more place where the DMDS value that is in question was used, on the PAE Other VOC Emission Factors sheet for the methanol mode.

#### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Sent: Thursday, March 21, 2024 8:50 AM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>; Caleb Fetner <<u>cfetner@all4inc.com</u>>
Cc: Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>
Subject: Re: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

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Thanks Ms. Katharine!

Rachel

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Thursday, March 21, 2024 7:56:26 AM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins
<<u>swatkins@all4inc.com</u>>
Subject: RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

I have not finished going through the calculations yet. I will let you know if I have any other questions on these.

#### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

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From: Caleb Fetner <<u>cfetner@all4inc.com</u>> Sent: Wednesday, March 20, 2024 12:30 PM To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>> Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>>

**Subject:** RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

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Got it downloaded. I'll take a look and get back to you. Thanks!



From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Wednesday, March 20, 2024 12:15 PM
To: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins
<<u>swatkins@all4inc.com</u>>
Subject: RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

Sorry about that. Here it is. I verified the circle and comments are there. Not sure why it wants to insert it here in the email instead of like a regular attachment.

MeOH mode - concentration loadings page.pdf

#### Let me know if you can see.

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

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From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Wednesday, March 20, 2024 12:10 PM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins

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Hi Katharine- I don't see any comments or circles on this PDF. Maybe it didn't save.



Caleb Fetner / Managing Consultant
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From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>> Sent: Wednesday, March 20, 2024 12:07 PM To: Caleb Fetner <<u>cfetner@all4inc.com</u>> Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins <<u>swatkins@all4inc.com</u>> Subject: DE: Stripper Permit \_ SOP/Appual Avg CEMS /Updated Cales

Subject: RE: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs

Hello everyone, I am reviewing the revised calculations and have a couple of questions.

See attached: MeOH mode – Concentration loadings sheet. I have circled a value and made two comments.

#### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

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From: Caleb Fetner <<u>cfetner@all4inc.com</u>>
Sent: Saturday, March 16, 2024 1:37 PM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Cc: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>; Steven Moore <<u>smoore@all4inc.com</u>>; Sheryl Watkins
<<u>swatkins@all4inc.com</u>>
Subject: Stripper Permit - SOB/Annual Avg CEMS/Updated Calcs
\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine,

On behalf of New-Indy Catawba, here are the following files for your review. Please let us know if you have any questions.

- 1. Updated Emissions Calculations
  - a. Incorporated emissions calculations for the Backup Stripper operating in Methanol Mode.
  - b. For the uncontrolled SO2 PAE emissions factor for LVHC incineration, we scaled up the October 2021 results to the Project Columbia NCG emissions factor of 4.21 lb/ton to add an additional level of conservatism. We still show a PSD decrease in SO2 emissions.
- 2. Supporting Info for Methanol Mode ASB emissions
  - a. H2SSIM (for H2S), WATER9 (for other TRS), and Form XIII (for methanol) for the ASB when the backup stripper is in methanol mode.
  - b. During methanol mode, we estimated 500 gpm of foul condensate down the hardpipe. Essentially, for the ASB when the backup stripper is in methanol mode, it is similar to the No Stripper scenario except with 500 gpm instead of 850 gpm.
- 3. Comments on the latest SOB provided. We also updated PSD and project emissions consistent with the updated calculations.
- 4. Justification for the annual averaging period for compliance with the SO2 BACT limit (50 ppmvd @ 8% O2).

The 2006 SO2 best available control technology (BACT) limit for the No. 3 Recovery Furnace was proposed as good combustion practices during black liquor solids combustion. The BACT limit was not proposed during co-firing of fossil fuels. The SO2 BACT limit (condition DA.18) is 50 ppmvd @ 8% O2 and/or 551 tons per year (three 1-hour averages). The compliance demonstration method associated with the BACT limit (condition DA.18) is one source test every four years.

The SO2 BACT limit is expressed as an annual average value (50 ppm which equates to 551 tpy) when firing black liquor solids. The basis for the 551 tpy emissions rate is as follows: 50 ppmvd ×  $(20.9 - 5.5)/(20.9 - 8) \times 64/385.3E6 \times 211,600 \text{ dscf/min} \times 60 \text{ min/hr} \times 8,760 \text{ hr/yr} \times 1 \text{ ton/}2,000 \text{ lb} = 551 \text{ tons/yr}$ 

The BACT limit does not reflect fossil-fuel firing, which was not impacted by the permitted modifications. The SO2 CEMS data should be treated in the same manner as the NOx CEMS data, as a reasonable assurance of continuous compliance with the SO2 BACT limit, and a representation of average emissions over a period of time during normal operation while burning black liquor solids.

The justification for the annual averaging period is provided below and is based on the expected variability in SO2 concentrations during startup and shutdown, planned maintenance (such as water washes), and inherent variability in the SO2 emissions that can occur with process upsets and variability in process conditions and/or operation. New-Indy Catawba expects periods of elevated SO2 emissions (i.e. greater than 50 ppmvd @ 8% O2 on a 3-hour average) to occur as a result of the following process/operating conditions:

- $\circ\,$  Lower temperature smelt bed and/or low black liquor solids loading to the furnace
- High black liquor sulfidity

- o Low percent black liquor solids firing
- Unbalanced air distribution in the boiler

The following paragraphs describe each condition and the expected observed duration of high SO2 emissions, keeping in mind that these events are not mutually exclusive and can occur simultaneously or in close proximity in time.

#### Lower temperature smelt bed and/or low black liquor solids loading to the furnace

A lower temperature smelt bed can occur during abnormal or upset conditions, which are typically associated with black liquor firing loads below 50% of the maximum furnace load, which can occur when starting up from a cold shutdown (i.e., when there is little to no smelt in the bottom of the boiler upon startup), when shutting down (i.e., when the smelt bed is burned out), or during periods of low/lower black liquor inventories. Low black liquor loads have reduced air requirements which will naturally reduce the air pressure at each air level. This can dramatically decrease the air penetration, decrease air/gas mixing, decrease bed temperatures and/or bed height, and increase the amount of localized cold spots in the bed. To counter these impacts, corrective action is necessary to increase the ratio of primary and/or secondary air, firing of auxiliary fuel to maintain proper operation and steam load, and manage the smelt bed. Upset conditions can last anywhere from a few hours to more than several days in duration and startup operations from a cold smelt bed are typically 8 to 16 hours in duration.

#### High black liquor sulfidity

The sulfur to sodium ratio in the cooking liquor is important for maintaining the reaction rate and pulp quality in the digester. If the sulfidity is too low, then pulp yield and pulp quality will be reduced. To maintain the proper sulfidity, saltcake from the recovery furnace electrostatic precipitator (ESP) is recycled back into the liquor cycle for sodium and sulfur make-up. Additional make-up chemicals are also typically added (i.e., sodium hydrosulfide, emulsified sulfur, sodium hydroxide, etc.) when chemical imbalances occur that necessitate adding more sodium and/or sulfur makeup. When the sulfidity is elevated, SO2 emissions are also elevated. If sulfidity is determined to be above the target level, corrective action is to stop feeding saltcake and/or make-up sulfur chemicals. A sulfidity imbalance is typically corrected within two to three days.

#### Low percent black liquor solids firing

Low percent black liquor solids firing is most often caused by periodic, but routine, water washes to remove fouling on the recovery furnace steam tubes, water washes to remove fouling on the heat transfer surfaces in the evaporators, upsets to

the evaporators, and/or an upset to upstream process areas. Water washes are necessary to remove inorganic scale and organic sticky material from heat transfer surfaces in the evaporators and to remove the saltcake fouling on the furnace steam tubes to maintain safe operation of the furnace. A water wash on the evaporators is typically performed 3-5 times per week and lasts for a period of two to eight hours (Note: includes the periods of startup, shutdown, and the water wash cycle) and a water wash on the recovery furnace is typically performed semi-annually and lasts for a period of two to three days (Note: includes the

periods of startup, shutdown, and the water wash cycle). Reduced black liquor solids content can last anywhere from a few hours to more than 16 hours in duration.

Unbalanced air distribution in the furnace (primary, secondary, tertiary, and quaternary air)

Each recovery furnace design is unique. The New-Indy Catawba Mill has established air systems guidelines for the No. 3 Recovery Furnace that manage NOx and TRS emissions to achieve permitted emissions limits. These include targets for air splits on the primary, secondary, tertiary, and quaternary air ports, desired air duct pressures, and placement and angle of the liquor guns. In addition, the Mill has established guidelines for keeping the air ports and smelt spouts clean. With these guidelines air distribution imbalances are typically resolved within 6 to 12 hours. With feedback from the future SO2 CEMS, the Mill will need flexibility to manage the air distribution within the furnace to achieve the NOx, TRS, and SO2 permitted emissions limits.

Caleb Fetner / Managing Consultant 678.293.9431 / Profile / LinkedIn www.all4inc.com / Locations / Articles / Podcast / Training ALL4 // STRATEGY WITH SOLUTION. PARTNERSHIP WITH A PURPOSE.

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#### Backup Stripper (Methanol Mode) Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm	
Design Foul Condensate Loadings					
(prior to H2O2)	147	15.00	17.00	16.00	
Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99	
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16	
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026	
Flow Weighted Loading:	0.29	0.92	0.24	6.93E-03	
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s	
ASB Zone 1	0.07	0.35	0.19	5.81E-03	
ASB Zone 2	0.03	5.66E-03	4.06E-03	1.06E-04	
ASB Zone 3	0.02	1.09E-04	1.45E-04	3.51E-06	
Total ASB	0.12	0.36	0.19	5.92E-03	
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, lb/ODTP	MMC, lb/ODTP	
Total ASB	1.05E-02	3.08E-02	1.69E-02	5.12E-04	

MW

34

94

62

48

MMC

Post-Project Foul Condensate Flow: 500 gpm Post-Project Foul Condensate Flow: 0.72 MGD Post-Project ASB Influent Flow: 25.48 MGD Total ASB Flow: 26.20 MGD Total ASB Flow: 1148 L/s Pulp Production 2200 ODTP/day H2S DMDS DMS

#### **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Monday, April 29, 2024 1:46 PM
То:	Buckner, Katharine
Cc:	Steven Moore; Sheryl Watkins; Rachel Davis; Chris Loach
Subject:	New-Indy Updated New Stripper Construction permit application
Attachments:	UPDATED New Stripper Construction Permit Application (4-29-24).pdf

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine,

Attached is the electronic version of the updated stripper construction permit application. Rachel plans to hand you the wet-ink hard copy tomorrow while you're visiting the mill.

All of the changes in the application are updates that we've discussed before, so nothing should be a surprise, but we wanted to send you this electronic version so that you could review and let us know if anything is unclear.

Also – another quick request on the Ash Hndlg and Consent Decree permits – **can you send us the compiled permit packages that you plan to put on public notice for these two permits once you have them?** We just want to confirm that we have the correct attachments to the permit.

Thank you much! Caleb



**Caleb Fetner** / Managing Consultant 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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# New Condensate Stripper

## **CONSTRUCTION PERMIT APPLICATION**

### NEW-INDY CATAWBA LLC - CATAWBA, SC MILL

March 2023

UPDATED APRIL 2024

Submitted by:



New-Indy Catawba LLC – Catawba, SC Mill 5300 Cureton Ferry Road Catawba, SC 29704



Submitted to:

SC Department of Health and Environmental Control Bureau of Air Quality – Division of Air Permitting 2600 Bull Street Columbia, SC 29201



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- Appendix D Backup Stripper Methanol Mode Addendum



#### 1. INTRODUCTION AND APPLICATION OVERVIEW

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill or the Mill) and currently operates under Title V Operating Permit No. TV-2440-005 (TVOP or TV-2440-0005), effective on July 1, 2019.

New-Indy Catawba has prepared this construction permit application as required by the Consent Order to Correct Undesirable Levels of Air Contaminants ("Consent Order"), issued on November 23, 2022, by the South Carolina Department of Health and Environmental Control (SCDHEC)<sup>1</sup>. For compliance with the provisions of the Consent Order, New-Indy Catawba is proposing a modification to their current foul condensate treatment system (condensate treatment system) to install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper [existing steam stripper (ID 9801)] strictly to backup operation during periods of downtime experienced by the new steam stripper (Project). The Project also includes the installation of a stripper feed tank, methanol storage tank, and hot water tank to serve the new steam stripper. The stripper feed tank and methanol storage tank will be controlled in the LVHC system. The hot water tank is not expected to be a source of emissions. The Project will also satisfy the requirements of Item I.a. of Appendix A of Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (EPA Consent Decree).

This document represents the construction permit application for this Project (Application). This application was originally submitted in March 2023. This application has been updated in April 2024 to reflect the final project description and project emissions calculations at the request of SCDHEC.

<sup>&</sup>lt;sup>1</sup> The November 23, 2022, Consent Order amends and replaces the Order to Correct Undesirable Level of Air Contaminants issued by SCDHEC on May 7, 2021.



#### 2. PROCESS AND PROJECT DESCRIPTION

New-Indy Catawba is comprised of seven distinct process areas that include the following: the woodyard area, the kraft pulp mill area, the paper mill area, the chemical recovery area, the utilities area, the waste treatment area, and a miscellaneous area. A simplified process flow diagram for these process areas is included as Figure 2-1. A description of the process areas is presented below, with more detail provided in the areas that are impacted by the Project.

Southern pine logs and chips are received at the woodyard. Logs are debarked, chipped, and the chips are screened prior to storage for use within the pulping process. Likewise, purchased wood chips received are screened, and processed as needed, prior to use within the pulping processes.

The kraft (sulfate) process area is used to produce pulp. Pulp from the kraft process is produced from "cooking" wood chips in the continuous digester in a caustic solution at an elevated temperature and pressure. The pulp slurry from the continuous digester is sent to the blow tank, then to one of two parallel pulping lines, each consisting of an enclosed deshive refiner and a three-stage drum displacement washer system and associated filtrate tanks. Weak black liquor from the washer filtrate tanks is stored before being recycled to chemical recovery. Rejects from the refiners are sent to the screw presses, with the filtrate being screened and stored before being recycled to chemical recovery. Washed pulp is stored and then sent to the paper mill area. With the exception of the pulp storage tanks after pulp washing, the kraft pulp mill sources are currently collected and routed to the high volume low concentration (HVLC) or low volume, high concentration (LVHC) systems, and emissions are controlled through combustion in the Nos. 1 or 2 Combination Boilers.

Linerboard (the outside layer of a corrugated container) is produced in the paper mill area on one state-of-the-art paper machine. Unbleached market pulp is produced on one pulp dryer. A second paper machine at the Mill is currently idled.

Weak black liquor is concentrated in the Nos. 1-3 Evaporator Sets and is then fired in the recovery furnaces (chemical recovery area) that burn the organics extracted from the chips and recover cooking chemicals. The causticizing area utilizes the chemicals recovered by the recovery furnaces, and after adding lime, provides the cooking chemicals for the kraft process.

Emissions from the Evaporator Sets and Turpentine Recovery System are collected in the LVHC gas collection system and combusted in the Nos. 1 or 2 Combination Boilers. Several weak black liquor tanks are collected in the HVLC system and combusted in the Nos. 1 or 2 Combination Boilers. Evaporator condensates are segregated, with the combined condensates being recycled



to the Brownstock washer system or sewered. The foul condensates are treated in a dual control device configuration: foul condensates are preferentially treated in the existing condensate steam stripper system, with the remaining flow being directed to the aerated stabilization basin (ASB) via the Hardpipe (ID 9802).

Steam and electricity are produced for facility-wide use by two combination boilers. The recovery furnaces also generate steam.

A waste treatment area receives wastewater and mill waste (solid waste) from the various previously mentioned areas of the facility. Wastewater undergoes biological treatment to remove the dissolved organic wastes prior to discharge into the receiving stream. Mill solid waste is deposited in an on-site landfill.

The miscellaneous areas include everything that is not captured in one of the aforementioned process operating areas, such as facility roads and the pulp storage tanks.





Figure 2-1 Simplified Mill Flow Diagram



This document represents the construction permit application for this Project in accordance with the SCDHEC Consent Order. The Project consists of the following new equipment and proposed changes to the existing treatment scenarios:

- 1. Construct and operate a new low-pressure steam foul condensate stripper system that will process the pulping process condensates (foul condensate) for compliance with 40 CFR Part 63, Subpart S. The resultant stripped methanol will be condensed into a liquid [called stripper rectified liquid (SRL)] and combusted along with the black liquor in the Nos. 2 and 3 Recovery Furnaces (ID Nos. 2505 and 5105). The SRL will be added to the black liquor at a maximum amount of 2% by volume. There are no anticipated changes in black liquor firing as a result of the project. The LVHC gases from the SRL condenser system, stripper feed tank, and SRL tank will be combusted in the No. 3 Recovery Furnace. The LVHC system will include a 1.0 mmBtu/hr natural gas ignitor for combustion of the LVHC gases when black liquor firing is less than 50% of capacity. The existing Nos. 1 and 2 Combination Boilers (ID Nos. 2605 and 3705) will serve as back-up control for the new Stripper's LVHC gases when the SRL condenser system is not in operation. Stripped condensates will be recycled to the Brownstock washers (ID 5230), as needed;
- 2. Operate the existing steam stripper (ID 9801) as a backup to the new low-pressure steam stripper. The existing steam stripper will be operated to process the foul condensate and remove 98% of the total reduced sulfur (TRS) compounds; although with reduced methanol removal efficiency (referred to as "TRS Mode"). Further methanol treatment through biological destruction will be accomplished by routing the stripped condensates to the existing Hardpipe system that discharges the foul condensates below the liquid surface of the existing ASB; and
- 3. Modify the No. 3 Recovery Furnace to combust gases collected in the LVHC system. The Nos. 1 and 2 Combination Boilers will serve as backup control for the LVHC gases following the Project. When these LVHC gases are combusted in the combination boilers, a caustic scrubber will be operated to provide 50% removal of the sulfur prior to combustion.

Figure 2-2 presents a simplified process flow with the possible operating scenarios for treatment of the foul condensates and the associated control scenarios for the new and existing steam stripper vent gases. Section 3.2.2.3 presents the prevention of significant deterioration (PSD) analysis that details the basis for the projected actual emissions (PAE) calculations for the proposed future operating scenarios.





#### Figure 2-2 Stripper Operating Scenarios



#### 3. **REGULATORY REVIEW**

This section summarizes Federal and State air quality regulations that potentially apply to the Project. Discussions pertaining to applicable regulatory requirements are separated into three categories:

- Federal Air Quality Regulations
- South Carolina Air Quality Regulations
- Provisions of the SCDHEC Consent Order and EPA Consent Decree

#### 3.1 FEDERAL AIR QUALITY REGULATIONS

For the purpose of this Application, potentially applicable Federal regulations consist of:

- Standards of Performance for New Stationary Sources (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- New Source Review (NSR) and PSD
- Compliance Assurance Monitoring (CAM)
- Requirements for Preparation, Adoption, and Submittal of Implementation Plans
- Title V Operating Permits

A discussion of each specific Federal air quality regulation is provided in the following subsections.

#### **3.1.1** Standards of Performance for New Stationary Sources

U.S. EPA has promulgated NSPS at 40 CFR Part 60. NSPS requirements are promulgated under 40 CFR 60 pursuant to Section 111 of the Clean Air Act.

### 3.1.1.1 40 CFR Part 60, Subparts BB and BBa – Standards of Performance for Kraft Pulp Mills

40 CFR Part 60, Subpart BB – Standards of Performance for Kraft Pulp Mills applies to TRS emissions from digesters, brownstock washers, multiple-effect evaporators, recovery furnaces, smelt dissolving tanks, lime kilns, and condensate strippers that commenced construction, reconstruction, or modification after September 24, 1976, and on or before May 23, 2013.



Subpart BBa applies to the same sources that commence construction, reconstruction, or modification after May 23, 2013.

The No. 3 Multi-effect Evaporator Set with Concentrator is currently subject to 40 CFR 60, Subpart BB for TRS (Standards of Performance for Kraft Pulp Mills). The existing condensate stripper system and No. 1 Multi-effect Evaporator Set with Concentrator are currently subject to 40 CFR 60, Subpart BBa for TRS. Compliance with the TRS standards at §60.283(a)(1) and §60.283a(a)(1) is currently demonstrated by combusting the stripper off-gases and evaporator vent gases in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii) [combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds] and §60.283a(a)(1)(iii) [collect the gases in the existing low volume high concentration (LVHC) closed-vent collection system meeting the requirements of §63.450 and combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds]. As there are no physical modifications to the existing condensate stripper and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators, the Mill will continue to combust the existing stripper off-gases in the Nos. 1 and 2 Combination Boilers; however, following the Project, the vent gases from the Nos. 1-3 Multi-effect Evaporator Sets with Concentrators will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(ii) [gases are collected in the existing LVHC closed-vent collection system meeting the requirements of §63.450 and combusted in a recovery furnace subject to §60.283(a)(2)] or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The No. 2 Multi-effect Evaporator Set with Concentrator is not subject to either Subpart BB or Subpart BBa but gases are collected and controlled in the same manner as the other evaporator sets.

Upon completion of the Project, the new condensate stripper system will be subject to 40 CFR Part 60, Subpart BBa for TRS (Standards of Performance for Kraft Pulp Mill Affected Sources for Which Construction, Reconstruction, or Modification Commenced After May 23, 2013). Compliance with the TRS standard at 60.283a(a)(1) will be demonstrated through collection of the stripper off-gases (SOG) in the existing SOG collection system and SRL gases in the existing LVHC closed-vent collection system meeting the requirements of §63.450. The SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The LVHC collection system gases will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(iii) or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). Emissions from the stripper feed tank will also be collected in the LVHC collection system. The Mill will continuously monitor the incineration of SOG and LVHC gases in the No. 3 recovery furnace, each combination boiler, and venting of the SOG and LVHC closed-vent systems as required by §60.284a(d)(3)(iii) and currently utilized for monitoring compliance with Subpart BB.



New-Indy Catawba will maintain records of excess emissions and malfunctions for the new stripper as required by §60.287a(b)(7) and (c), respectively. The Mill will report periods of excess emissions and malfunctions as required by §60.288a(a) and (d), respectively. As defined in §60.284a(e)(1)(vi), periods of excess emissions from the LVHC closed-vent system (condensate stripper system) that are less than one percent (1%) of operating time during a semi-annual period are not a violation of §60.283a(a)(1)(iii).

The stripper feed tank, methanol tank, hot water tank, Hardpipe, and ASB are not included in the definition of condensate stripper system under §60.281 or §60.281a and are not affected sources under Subparts BB or BBa.

#### 3.1.1.2 40 CFR Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

The Project includes a new stripper feed tank, new methanol tank, and a new hot water tank. 40 CFR Part 60, Subpart Kb includes standards of performance for new storage tanks. However, per 60.111b, the definition of storage tank does not include process tanks (tanks that collect material from one part of a process before sending it to another part of the process). Therefore, the new tanks are not subject to Subpart Kb.

#### 3.1.2 National Emission Standards for Hazardous Air Pollutants

NESHAP found in 40 CFR Part 61 apply to specific compounds emitted from certain listed processes. 40 CFR Part 61 subparts do not apply to the Mill, and there are no Part 61 subparts that apply to the proposed Project. Applicability of Part 63 NESHAP is discussed below.

### 3.1.2.1 40 CFR Part 63, Subpart S – National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry

New-Indy Catawba is subject to 40 CFR Part 63, Subpart S, also referred to as Maximum Achievable Control Technology (MACT) I for the pulp and paper industry. This standard regulates hazardous air pollutant (HAP) emissions from pulping and bleaching systems. The affected source under this standard is the total of all HAP emission points in the pulping and bleaching systems. The Mill does not produce bleached pulp and is therefore not subject to the requirements of §63.445.

The Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine Recovery System were constructed prior to 1993 and are existing affected sources, while the existing condensate



stripper was constructed after 1993, making it a new source under 40 CFR Part 63, Subpart S. Compliance is currently demonstrated by collecting the gases in the existing LVHC closed-vent system meeting the requirements of §63.450 and combustion of the SOG and LVHC system gases in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i) (introduce the HAP emission stream with the primary fuel or into the flame zone). The Mill currently complies with the pulping condensates collection requirements in §63.446(c)(3) [collect the pulping process condensates from equipment systems listed in §63.446(b)(1) through (b)(5) that in total contain a minimum of 7.2 lb HAP per ton oven dried ton of pulp (lb HAP/ODTP)] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill has utilized concurrent use of the existing steam stripper and Hardpipe for compliance with §63.446(e)(4).

Subpart S requires collection of LVHC gases from steam stripper systems, defined to include the stripper column, associated feed tanks, condensers, and any methanol rectification process. The new condensate stripper, stripper feed tank, methanol condenser, and methanol tank will be subject to this rule upon startup.

Following the completion of the proposed Project, SOG from the existing condensate stripper and vent gases from the existing Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine system will continue to be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and §63.453(k)(1-6). The existing SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). However, the vent gases from the LVHC collection system will be combusted in the No. 3 Recovery Furnace or in the Nos. 1 and 2 Combination Boilers (as backup) per §63.443(d)(4)(i). The Mill will update the leak detection and repair (LDAR) site inspection plan as appropriate per §63.454(b).

The Mill plans to demonstrate compliance with the pulping condensates collection requirements in §63.446(c)(3) [collect the pulping process condensates from equipment systems listed in §63.446(b)(1) through (b)(5) that in total contain 7.2 lb HAP/ODTP] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill will utilize the new condensate stripper for compliance with §63.446(e)(4) and will operate a continuous monitoring system for the parameters in §63.453(g)(1-3). Vents from the new condensate stripper (including the stripper feed tank, SRL condenser, and SRL tank) will be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and combusted in the No. 3 Recovery Furnace or Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). The Mill will update the LDAR site inspection plan as appropriate per §63.454(b) and will perform the required inspection and monitoring requirements per §63.453(k)(1-6). The new stripper will be included in semi-annual excess emission reports under §63.455. Per §63.446(g), periods of excess



emissions reported under §63.455 are not considered a violation of §63.446(e)(4) provided that the time of excess emissions divided by the total process operating time in a semi-annual reporting period does not exceed 10 percent.

At the request of SCDHEC, the Mill is providing additional information regarding plans to demonstrate continuous compliance with the pulping condensate collection and treatment in the new steam stripper. These are as follows:

- Pulping condensate collection emissions limit of 7.2 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2);
  - Daily sampling of foul condensates for methanol concentration representative of the inlet to the new stripper;
  - Continuous measurement of new steam stripper inlet foul condensate feed flow (gpm);
  - Daily measurement of pulp production (ODTP); and
  - Daily calculation of a 15-day rolling average collection (lbs methanol/ODTP) [Note: The Mill may use historical and/or collect future foul condensate sampling data to support a longer averaging period].
- Pulping condensate treatment in the new steam stripper to remove 6.6 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2); and
  - Daily sampling of stripped condensates for methanol concentration representative of the outlet of the new stripper.
  - Continuous measurement of:
    - New steam stripper inlet foul condensate feed flow (gpm);
    - New steam stripper steam feed flow (lbs/hr);
    - Foul condensate to new steam stripper feed temperature (°F); and
    - New steam stripper stripped condensate flow (gpm).
  - Daily measurement of pulp production (ODTP).
  - o Daily calculation of the percent methanol removed in the steam stripper .
  - Daily calculation of the treatment in the new steam stripper [15-day (or other averaging period, as justified) rolling average methanol collected (lbs methanol/ODTP) multiplied by the calculated daily methanol percent removal in the new stripper].

Please note that the Mill may choose to establish a methanol concentration factor in lieu of daily methanol sampling at the inlet to the new steam stripper once sufficient data has been collected demonstrating consistency in the foul condensate methanol concentration. In addition, the Mill



may choose to establish an effective steam to feed ratio (ESFR) curve for the new stripper system to be used to establish the methanol removal efficiency across the stripper in lieu of the method described above. The compliance approach will be delineated in the Notification of Compliance Status (NOCS) that will be submitted with the results of the initial compliance demonstration to be conducted within 180 days of startup of the new stripper system.

#### 3.1.2.2 40 CFR Part 63, Subpart MM National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills

New-Indy Catawba is subject to 40 CFR Part 63, Subpart MM, also referred to as MACT II for the pulp and paper industry. This standard regulates particulate matter (PM) emissions from existing recovery boilers, smelt tanks, and lime kilns when processing black liquor or calcium oxide. The Nos. 2 and 3 Recovery Furnaces are currently subject to the existing source requirements of this regulation. The proposed Project will modify the LVHC collection system that delivers the LVHC gases to the No. 3 Recovery Furnace for combustion, but no changes in black liquor firing are expected for the recovery furnaces and PM emissions from black liquor combustion are not expected to increase. The Mill will continue to meet the existing PM emission limits under Subpart MM after completion of the Project.

#### 3.1.2.3 40 CFR Part 63, Subpart EEEE – National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (non-Gasoline)

Subpart EEEE applies to organic liquids distribution (OLD) operations at major sources of HAP. The Project includes installation of a new methanol tank and a new hot water tank. However, these new tanks are not subject to this rule because they are part of the Mill's pulping system as defined under Subpart S. EPA confirmed that tanks in pulp and paper mills that are part of the pulping or bleaching systems are not subject to Subpart EEEE in a December 2004 determination (ADI Control Number M050008).

#### 3.1.2.4 40 CFR Part 63, Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.

New-Indy Catawba is subject to 40 CFR Part 63, Subpart DDDDD, also referred to as Boiler MACT. Boiler MACT sets forth emissions limits and work practice standards; testing and fuel analyses requirements; and monitoring, recordkeeping, notification, and reporting requirements that apply to boilers and process heaters located at major sources of HAP. The Nos. 1 and 2 Combination Boilers are subject to the requirements of 40 CFR Part 63, Subpart DDDDD. The



Nos. 2 and 3 Recovery Furnaces are not subject to the rule per §63.7491(b). The Project will not affect the regulatory applicability of 40 CFR Part 63, Subpart DDDDD, for either combination boiler and will not affect compliance with the applicable emissions limits. The Mill will continue to comply with the currently applicable provisions of 40 CFR Part 63, Subpart DDDDD, in the same manner after completion of the Project.

#### 3.1.3 New Source Review

The Mill is located in York County which is classified as in attainment of or unclassifiable for the National Ambient Air Quality Standards (NAAQS) for regulated NSR pollutants. Therefore, Nonattainment New Source Review (NNSR) regulations do not apply to this Project and the Project is analyzed for applicability as it relates to the PSD requirements. Implementation of the PSD regulations (i.e., 40 CFR §51.166) has been delegated in full to the State of South Carolina. Refer to Section 3.2.2.3 for a discussion of PSD applicability.

#### 3.1.4 Compliance Assurance Monitoring

U.S. EPA developed the CAM rule at 40 CFR Part 64 as a means for providing reasonable assurance that continuous compliance with applicable requirements is achieved for certain emissions units located at major stationary sources subject to Title V permitting. CAM applies to pollutant-specific emissions units (PSEUs) that (1) are subject to an emissions limit or standard (2) use a control device to achieve compliance with that emissions limit or standard, and (3) have potential pre-control device emissions in the amount required to classify the unit as a major source under Part 70 of the Clean Air Act (CAA). Part 64 does not apply to emissions limitations or standards proposed after November 15, 1990 pursuant to Section 111 or 112 of the Clean Air Act (e.g., post-1990 NSPS or NESHAP). The proposed Project is not subject to CAM requirements because the new steam stripper is subject to 40 CFR Part 60, Subpart BBa and 40 CFR Part 63, Subpart S, which are standards proposed after November 15, 1990.

#### 3.1.5 Requirements for Preparation, Adoption, and Submittal of Implementation Plans

U.S. EPA requires air agencies to develop and submit air quality data characterizing maximum 1hour ambient concentrations of sulfur dioxide (SO<sub>2</sub>) through ambient air quality monitoring or air quality modeling analysis at the air agency's election. These requirements are promulgated under 40 CFR Part 51.

#### 3.1.5.1 40 CFR Part 51, Subpart BB—Data Requirements for Characterizing Air



#### Quality for the Primary SO<sub>2</sub> NAAQS (SO<sub>2</sub> Data Requirements Rule or SO<sub>2</sub> DRR)

The Mill submitted facility-wide air dispersion modeling in November 2016 to comply with 40 CFR 51.1203(d). The Mill updated the facility-wide air dispersion modeling in October 2021. The actual SO<sub>2</sub> emissions following the Project are expected to remain below the SO<sub>2</sub> emission rates included in the modeling analysis submitted in 2016 and 2021. The Mill will continue to perform an annual review of the actual SO<sub>2</sub> emission rates against the 2016 and 2021 model emission rates to determine if an updated modeling demonstration is necessary.

#### 3.1.6 Title V Operating Permits

New-Indy Catawba operates under TVOP TV-2440-0005 issued on May 7, 2019, with an effective date of July 1, 2019, and an expiration date of December 31, 2023. New-Indy Catawba submitted a Title V operating permit renewal application on December 1, 2023. SCDHEC determined the Title V operating permit renewal application was complete on December 18, 2023. Through this Application, New-Indy Catawba is requesting a construction permit to perform the Project. Construction permit application forms required by SCDHEC are included in Appendix A. New-Indy Catawba will request a modification to the TVOP within 15 days of startup of the Project, which is required by the Consent Order to be no later than June 30, 2025.

#### 3.2 SOUTH CAROLINA AIR QUALITY REGULATIONS

This section addresses the applicability of state air regulatory requirements to the Project.

#### 3.2.1 Regulation 61-62.1: Section II, Permit Requirements

This regulation specifies the construction and operating permit requirements for new or modified sources. This permit application is intended to satisfy the construction permitting requirements of Regulation 62.1 Section II. Completed SCDHEC construction permit application forms are included in Appendix A. The original application was submitted in March 2023, prior to implementation of the current SCDHEC ePermitting system. This updated application has been re-submitted in the original hardcopy form and is not in the ePermitting system.

#### 3.2.2 Regulation 61-62.5: Air Pollution Control Standards

The list below identifies potentially applicable SC air pollution control regulations and standards associated with the Project.

• Standard No. 2 – Ambient Air Quality Standards



- Standard No. 3 Waste Combustion and Reduction
- Standard No. 4 Emissions from Process Industries
- Standard No. 7 Prevention of Significant Deterioration
- Standard No. 8 Toxic Air Pollutants

#### 3.2.2.1 Standard No. 2 – Ambient Air Quality Standards

SCDHEC Standard No. 2 addresses the National Ambient Air Quality Standards (NAAQS). Except for an ambient air quality standard for gaseous fluorides, the SCHDEC ambient air quality standards are equivalent to the Federal NAAQS. New-Indy Catawba has previously submitted facility-wide air dispersion modeling evaluations to demonstrate compliance with Standard No. 2.

The Project may slightly increase the actual emissions of SO<sub>2</sub>, nitrogen oxides (NO<sub>X</sub>), and carbon monoxide (CO) from the No. 3 Recovery Furnace when burning LVHC gases. However, the maximum SO<sub>2</sub> and NO<sub>X</sub> emissions from the No.3 Recovery Furnace when burning LVHC gases will be less than 10 percent of the emissions from burning the LVHC gases in the Nos. 1 and 2 Combination Boilers. The maximum SO<sub>2</sub> and NO<sub>X</sub> emissions from the CVHC gases from LVHC combustion in the combination boilers are not expected to change as a result of the project. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers.

The emissions of SO<sub>2</sub>, NO<sub>x</sub>, CO, particulate matter (PM), PM less than 10 microns (PM<sub>10</sub>), and PM less than 2.5 microns (PM<sub>2.5</sub>) from the LVHC System natural gas ignitor in the No. 3 Recovery Furnace are well below the 1.14 pounds per hour modeling exemption threshold in the South Carolina Modeling Guidelines<sup>2</sup>, Section 2.2.3. Therefore, the very small emissions increases from the LVHC natural gas ignitor have not been modeled for this permit application.

The additional steam potentially required from the combination boilers to operate the new condensate stripper will not exceed the current steaming capacity of each combination boiler, as reflected in the SO<sub>2</sub>, NO<sub>x</sub>, CO, PM, PM<sub>10</sub>, PM<sub>2.5</sub> and CO emissions rates modeled previously.

<sup>&</sup>lt;sup>2</sup> South Carolina Modeling Guidelines for Air Quality Permits (Revised April 15, 2019).



Therefore, no updates to the modeled emissions rates from the combination boilers are required for this permit application.

The SO<sub>2</sub> emissions from the Project will decrease by approximately 90 tons per year. The reduction in SO<sub>2</sub> emissions meets the single factor emissions netting option 2 in the South Carolina Other Information Guidance<sup>3</sup>. The modeled SO<sub>2</sub> Emissions Rate from black liquor combustion in the 2016 and 2021 SO<sub>2</sub> DRR modeling is 18.70 lb/hr from the No. 3 Recovery Furnace. The maximum SO<sub>2</sub> emissions rate from burning black liquor in the 2023 Title V renewal application is 5.95 pounds per hour. The additional SO<sub>2</sub> emissions from LVHC gases and methanol combustion is 7.4 pounds per hour, making the new total SO<sub>2</sub> emissions rate from black liquor combustion. Therefore, no updates to the SO<sub>2</sub> modeling submitted previously in 2016 and 2021 have been prepared for this permit application.

The NO<sub>x</sub> emissions will increase from the Project approximately 24 tpy, which is slightly over onehalf the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The NO<sub>x</sub> emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The modeled NO<sub>x</sub> Emissions Rate for Ambient Air Standards in the current Title V permit is 146.03 lb/hr from the No. 3 Recovery Furnace. The maximum NO<sub>x</sub> emissions rate from burning black liquor in the 2023 Title V renewal application is 122.4 pounds per hour. The additional NO<sub>x</sub> emissions from LVHC gases and methanol combustion is 4.3 pounds per hour, making the new total NO<sub>x</sub> emissions rate . Therefore, no updates to the NO<sub>x</sub> modeling submitted previously have been prepared for this permit application.

The CO emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The CO emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers. The modeled CO Emissions Rate for Ambient Air Standards in the current Title V permit is 330.96 lb/hr from

<sup>&</sup>lt;sup>3</sup> Guidance Concerning Other Information Used for Permitting Requirements in Demonstrating Emissions Do Not Interfere With Attainment or Maintenance of any State of Federal Standard (Updated December 12, 2018).



the No. 3 Recovery Furnace. The maximum CO emissions rate from burning black liquor in the 2023 Title V renewal application is 102.9 pounds per hour. The additional CO emissions from LVHC gases and methanol combustion is 8.3 pounds per hour, making the new total CO emissions 111.1 pounds per hour, more than 200 pounds per hour lower than the modeled CO emissions rate. Therefore, no updates to the CO modeling submitted previously have been prepared for this permit application.

Therefore, no updates to the previous Standard No. 2 modeling demonstration are required.

#### 3.2.2.1 Standard No. 3 – Waste Combustion and Reduction

Standard No. 3 applies to any source that burns any waste other than virgin fuels for any purpose. The standard contains various exemptions for the pulp and paper source category. Section I.J.1 specifies that recovery furnaces burning black liquor and TRS compounds are not subject to the standard. Section I.J.1 also specifies that gaseous process streams containing TRS compounds that are regulated in accordance with Section XI of Regulation 61-62.5, Standard No. 4, or NSPS are not subject to Standard No. 3. Because the SOG and LVHC collection system gases containing TRS that are regulated in accordance with Standard No. 4 or NSPS Subpart BB/BBa, combustion of those gases in combination boilers or recovery furnaces is not subject to Standard No. 3.

Standard No. 3 specifically states that any "facility with an emission unit and/or control device that complies with all the requirements of an applicable Maximum Achievable Control Technology (MACT) Standard under 40 CFR 63, including the testing and reporting requirements, may request an exemption from this standard." (61 -62.5, Section I.J.3.)

During development of the Pulp and Paper MACT regulations at 40 CFR 63, Subpart S, U.S. EPA reviewed the practice of combusting methanol condensed from stripper-off-gases. The U.S. EPA determined that the methanol condensate "does not appear to contain metal or chlorinated organic HAP's ..." (61 Fed. Reg. 9397) (emphasis added). The U.S. EPA also found that burning methanol condensate "will not increase the potential environmental risk over the burning of the steam stripper vent gases prior to condensation." U.S. EPA reaffirmed this conclusion in 2011 during its Residual Risk and Technology Review (RTR) of the Pulp and Paper (Subpart S) MACT. In the final RTR rule, U.S. EPA stated: "We conclude based on the Residual Risk Assessment cited here that the risks from the subpart S pulp and papermaking source category are acceptable and that the current standard protects the public health with an ample margin of safety. Consequently, we are re-adopting the MACT standards for subpart S pursuant to our 112(f)(2) review." (77 Fed. Reg. 55705)



Therefore, the combustion of black liquor and condensed methanol from stripper-off-gases in the recovery furnaces mill qualifies for the exemption from Standard No. 3 provided in Section I.J.3.

#### 3.2.2.2 Standard No. 4 – Emissions from Process Industries

SCDHEC Regulation 61-62.5, Standard No. 4 establishes standards for opacity and certain other pollutants for specific sources in specific industries and establishes PM and opacity standards for industrial processes not otherwise regulated. The new steam stripper and the new tanks do not cause visible emissions into the atmosphere; therefore, this standard does not apply.

Section XI regulates emissions of TRS from Kraft Pulp Mills where construction or modification commenced prior to September 24, 1976 from recovery furnaces, digester systems, multiple-effect evaporator systems, lime kilns, and condensate stripper systems. The No. 2 Recovery Furnace is currently subject to Standard 4 and will continue to comply with the TRS limits after completion of the Project. The TRS emissions from the No. 3 Recovery Furnace and No. 3 Evaporator Set with Concentrator are subject to 40 CFR Part 60, Subpart BB. The TRS emissions from the No. 1 Evaporator Set with Concentrator, the existing steam stripper, and the new condensate steam stripper are/will be subject to 40 CFR Part 60, Subpart BBa.

## 3.2.2.3 Standard No. 7 – Prevention of Significant Deterioration – Permit Requirements

PSD requirements apply to major stationary sources of regulated NSR pollutants that are located in areas that are in attainment with the NAAQS or unclassifiable. Implementation of the PSD regulations has been delegated in full to the State of South Carolina. These air quality regulations are contained in SCDHEC Regulation 61-62.5, Standard No. 7. The PSD regulations apply to major modifications at major stationary sources, which are considered those sources belonging to any one of the 28 source categories listed in the regulations that have the potential to emit (PTE) 100 tons per year (tpy) or more of an NSR-regulated pollutant, or any other source that has the PTE 250 tpy or more of an NSR-regulated pollutant. The Mill is considered a major stationary source because it emits or has the PTE 100 tpy or more of a regulated NSR pollutant. Because it includes physical changes to the Mill, the installation of the new steam stripper is a "project" as defined in Standard No. 7(b)(40).

New-Indy Catawba has assessed the applicability of PSD to this Project by performing the hybrid test as prescribed under U.S. EPA's PSD rules (as adopted by South Carolina) at 40 CFR 52.21(a)(2)(iv)(f), described as the hybrid test for projects that involve multiple types of emissions



units. The future emissions from the backup steam stripper system, existing foul condensate Hardpipe, existing ASB, existing evaporator and turpentine recovery system LVHC gases, and steam required for the existing steam stripper system are calculated as PAE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41). The future emissions from the new steam stripper and the generation of steam to operate the new steam stripper are PTE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(37).

The PSD applicability analysis has been completed for the applicable NSR regulated air pollutants, including SO<sub>2</sub>, NO<sub>x</sub>, CO, volatile organic compounds (VOC), TRS, H<sub>2</sub>S, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, lead (Pb), sulfuric acid mist, and carbon dioxide (CO<sub>2</sub>). There are no increases in emissions of fluorides from the Project. Emissions calculations used for determining PSD applicability are included in Appendix B.

At this time, New-Indy Catawba has not excluded emissions the mill was capable of accommodating during the baseline period or excluded demand growth from the projected actual emissions as allowed under SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41)(b)(iii). New-Indy Catawba may decide to utilize these two exclusions from PAE during this or future permitting if desirable.

#### 3.2.2.3.1 Baseline Actual Emissions

Baseline actual emissions (BAE) from an existing source are defined by Standard No. 7, paragraph (B)(4)(b) as:

"the average rate, in tpy, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the Department for a permit required under this section or under a plan approved by the Administrator, whichever is earlier, except that the 10-year period shall not include any period earlier than November 15, 1990."

BAE for all existing sources and pollutants are based on the 24-month period following conversion of the mill to manufacturing unbleached paper grades starting in March 2021 and extending through February 2023. For simplicity, baseline annual production rates are assumed to occur over 8,760 operating hours. The BAE for the existing steam stripper (aka future backup stripper) off gases (and the required steam) are adjusted using the actual operating days to reflect that the stripper did not return to service until May 3, 2021.



#### Sulfur Dioxide

The baseline actual SO<sub>2</sub> emissions from burning the SOG from the existing steam stripper and LVHC collection system gases are based on the average emissions factors developed from the most recent (October 2021) source testing for SO<sub>2</sub>. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia SO<sub>2</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Nitrogen Oxides and Carbon Monoxide

The baseline actual NO<sub>X</sub> and CO emissions from burning the SOG from the existing steam stripper are based on the post-Project Columbia NO<sub>X</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The baseline actual VOC emissions from the existing condensate stripper system are based on the actual amount of methanol stripped from the foul condensate during the baseline period for which records are available. The non-methanol VOC emissions (including the TRS compounds that are also VOC as further described in the next section) from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the U.S. EPA WATER9 Model. To calculate methanol emissions from the ASB, New-Indy Catawba used a spreadsheet version of the WATER9 calculations from the National Council for Air and Stream Improvement (NCASI) to calculate the fractions biodegraded and emitted developed from Procedure 5 (Multiple Zone Concentration Measurements) in 40 CFR Part 63, Appendix C, Form XIII ("NCASI Form XIII calculation spreadsheet"). The WATER9 Model and Form XIII calculation utilize site-specific liquid concentration data, the site-specific configuration of the treatment unit [including the area or length of unit, liquid depth, wind speed, aeration type (i.e., mechanical aeration)], and the total amount of aeration to calculate the emissions rate in grams per second (g/s).

Baseline actual methanol emissions from the ASB are based on the NCASI Form XIII calculations for NESHAP Subpart S performance testing conducted during the baseline period. The baseline actual VOC emissions from the LVHC collection system are based on the post-Project Columbia VOC emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.



#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

The baseline hydrogen sulfide ( $H_2S$ ) and total reduced sulfur (TRS) emissions from burning the SOG from the existing steam stripper and the LVHC collection system gases are based on the average emissions factors developed from the June 2021 source testing for  $H_2S$  and TRS. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia  $H_2S$  and TRS emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

The baseline actual H<sub>2</sub>S emissions from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the NCASI Hydrogen Sulfide Emissions Simulator, or "H2SSIM" Model, which utilizes site-specific wastewater configuration, site-specific liquid test results for H<sub>2</sub>S, and site-specific data inputs [e.g., temperature, dissolved oxygen (DO), pH]. H2SSIM inputs are based on May and July 2022 sampling data for H<sub>2</sub>S in the foul condensate, as well as dissolved oxygen (DO) data for the ASB taken during NESHAP Subpart S performance testing during the baseline period. The baseline emissions for methyl mercaptan (MMC), dimethyl disulfide (DMDS), and dimethyl sulfide (DMS) are calculated using WATER9 based on May and July 2022 sample results were representative of the concentrations before chemical oxidant was added. The Mill has been chemically oxidizing the contents of the Hardpipe prior to entry into the ASB since June 2021. For calculating BAE of H<sub>2</sub>S and TRS emissions from the ASB, the May and July 2022 foul condensate samples were adjusted as follows to account for the effects of the chemical oxidant:

- H<sub>2</sub>S concentrations in the Hardpipe effluent were reduced by 99%.
- DMS concentrations in the Hardpipe effluent were reduced by 90%.
- MMC concentrations in the Hardpipe effluent were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed to not be reduced by chemical oxidant. DMDS concentrations in the Hardpipe effluent were increased to account for the oxidation of MMC to DMDS.

These adjustments are based on NCASI Technical Bulletin No. 949, Section 5.3.1 for Hydrogen Peroxide and additional bench scale study results and curves provided by NCASI. Pertinent pages from NCASI Technical Bulletin No. 949 and the bench scale study are attached as supporting information in Appendix B.



#### Steam Baseline

The BAE of products of combustion (NO<sub>X</sub>, CO, VOC, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, Lead, and CO<sub>2</sub>e) for the steam required by the existing steam stripper are based on the actual heat input from fossil fuels to both combination boilers during the baseline period. New-Indy Catawba operates the two recovery furnaces as base-loaded steam generators with the combination boilers handling most swings in steam load. New-Indy Catawba burns all the biomass available in the combination boilers because biomass is the most cost-effective fuel on an MMBtu basis. Additional steam is generated from burning natural gas and No. 6 fuel oil as needed. During the baseline period, natural gas accounted for 97.9% of the fossil fuel heat input to both combination boilers, with No. 6 fuel oil constituting the remaining 2.1% of the fossil fuel heat input.

#### 3.2.2.3.2 Projected Actual Emissions and Potential to Emit

PAE is defined by the SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41) as:

"the maximum annual rate, in tpy, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the five (5) years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the ten (10) years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source."

As described previously, PAE are calculated from the existing steam stripper, existing foul condensate Hardpipe, existing ASB, existing LVHC collection system gases, and steam required for the existing steam stripper.

PTE is defined by the SCDHEC Regulation 61-62.5, Standard No Standard No. 7, paragraph (B)(37) as:

"the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable."

The future emissions from the new steam stripper system and the generation of steam to operate the new steam stripper system are PTE.



PAE and PTE were calculated for three different stripper operating scenarios as shown below in Table 3-1. The new stripper is expected to be online at least 90% of the annual operating time. There backup steam stripper is expected to be online 4.75% of the annual operating time. There will also be periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods until a stripper is returned to service, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds in the condensates will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are required by Part I of Appendix A of the November 16, 2022 EPA Consent Decree to be equal to or less than 460 hours (5.25%) of annual operating time.

The PAE and PTE for all scenarios are based on the design foul condensate sulfur loading [168 parts per million by weight (ppmw)] and maximum design foul condensate flow [850 gallons per minute (gpm)]. Emissions factors [on a pound per air-dried ton of pulp (lb/ADTP) basis] are calculated based on 2,444 ADTP/day, which is at the lower range of production for which the maximum design foul condensate flow is expected. The design foul condensate sulfur loading is based on liquid samples taken during the June 2021 site-specific testing. The sulfur concentration of 168 ppmw at the design foul condensate flow is equivalent to 0.70 pound of TRS as sulfur per ADTP. PAE are calculated for each of the three stripper operating scenarios based on 8,760 hours per year and a maximum pulp production of 2,700 ADTP/day.

The following sections provide further detail and different operating configurations within particular scenarios.

#### New Steam Stripper Online Scenario

While the new steam stripper is operating, the stripped condensate from the new steam stripper will be recycled to the brownstock washers, as needed.

The new stripper has two operating configurations, with and without the rectified methanol system operating. The rectified methanol system will separate methanol from the new stripper's offgases. The rectified methanol is referred to as SRL. As stated previously, the new steam stripper is expected to be online at least 90% of the annual operating time. The rectified methanol system is expected to be online 95% of the time that the new stripper is operating. A summary of the different operating control configurations for when the new stripper is operating is summarized in Table 3-2 below.



#### Table 3-1 Stripper Operating Scenarios

	Operating Time		
Stripper Operating Scenario	%	hrs	
New Stripper Online	90%	7,884.0	
Backup Stripper Online	4.75%	416.0	
No Stripper Online	5.25%	460.0	

#### Table 3-2 New Stripper System Operating Scenarios

Stripper Scenario			Operating			Controls		
Stripper Operating Operating Time		Operating	Configuration Time		Operating Time			
Scenario	%	hrs	Configuration	%	hrs	Controls	%	hrs
	90%	7 994 0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8
Now Strippor Opling			SRL Online	95%	7,489.8	SRL LVHC to RF3	75.0%	5,617.4
New Surpper Online	5076	7,004.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2	25.0%	ng Time hrs 7,489.8 5,617.4 1,872.5 394.2
			SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2



The SRL is expected to contain approximately 40% of the TRS, with the remaining 60% in the LVHC off-gases from the rectified methanol system. The SRL will be blended with black liquor and burned in both recovery furnaces at a maximum concentration of 2%. The sodium fume inside the recovery furnace absorbs the sulfur from combustion of the black liquor and will also absorb the sulfur from combustion of the SRL. We conservatively assumed 99% absorption within the salt fume based on information provided in NCASI Technical Bulletin No. 604. This is expected to occur 100% of the time the rectified methanol system is operating (SRL mode).

When operating in SRL mode, the LVHC off-gases from the rectified methanol system will be vented into the LVHC System. In addition, the LVHC gases from the evaporators and turpentine recovery system will be vented to the No. 3 Recovery Furnace as part of this project. The No. 3 Recovery Furnace is expected to be available for LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive these gases, the LVHC will be combusted in the combination boilers the remaining 25% of the time. The LVHC gases will pass through the LVHC caustic scrubber prior to being combusted in the combination boilers. The LVHC scrubber removes approximately 50% of the sulfur from the gas stream. The LVHC gas scrubber is not necessary and will not be used when the LVHC gases are being combusted in the No. 3 Recovery Furnace because the salt fume in the recovery furnace provides the expected sulfur control.

#### Sulfur Dioxide, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

As previously stated, the SRL is expected to contain approximately 40% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP. The sodium fume inside the recovery furnace absorbs the sulfur produced from combusting black liquor and will also absorb the sulfur produced by combusting the foul condensate present in the methanol. It is conservatively assumed that 99% of the sulfur from combusting the SRL is absorbed by the sodium fume (NCASI Technical Bulletin 604), and the remaining 1% is oxidized to SO<sub>2</sub>. This is expected to occur 100% of the time in SRL mode.

To calculate TRS and  $H_2S$  emissions from burning the SRL in the recovery furnaces, a sulfur capture of 99% is applied with a 99% conversion factor to SO<sub>2</sub>, for a combined capture and conversion factor of 99.9%.

Similarly, the LVHC gases from the rectified methanol system are expected to contain approximately 60% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP and will be vented into the LVHC System. When the LVHC is combusted in the No. 3 Recovery Furnace, the sodium fume inside the recovery furnace is also expected to absorb 99% of the sulfur from the



LVHC gases before it can be converted to  $SO_2$ . When the LVHC is combusted in the combination boilers, the LVHC scrubber will capture 50% of the sulfur before conversion to  $SO_2$ . H<sub>2</sub>S and TRS emissions from the rectified methanol system LVHC are calculated based on conservatively assuming 99.9% capture or conversion to  $SO_2$  in the recovery furnace and 99% conversion to  $SO_2$ in the combination boilers.

When the rectified methanol system is not operating, SOG from the new stripper will be vented to the combination boilers, and the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP is assumed to be 100% converted to SO<sub>2</sub> to calculate SO<sub>2</sub> emissions. H<sub>2</sub>S and TRS emissions from combusting SOGs in the combination boilers are based on conservatively assuming a 99% conversion to SO<sub>2</sub>.

When the new stripper is operating, regardless of SRL status, there will be no foul or stripped condensate flow to the Hardpipe. Projected emissions of TRS compounds (excluding H<sub>2</sub>S) from the ASB are calculated based on the WATER9 Model. Projected emissions of H<sub>2</sub>S from the ASB are calculated based on the H2SSIM Model. Both WATER9 and H2SSIM emissions calculations are based on the average ASB influent concentrations from data collected during the 2021 and 2022 TRS testing efforts.

#### Nitrogen Oxides

When the rectified methanol system is operating, the methanol condenser is expected to condense more than 90% of the methanol in the SOG. The SOG also contains ammonia, which is also expected to be condensed with the methanol. The remaining ammonia will be vented with the SRL off-gases into the LVHC system. As a result, there will be an increase in ammonia when (1) SRL is mixed with liquor and burned in the recovery furnaces and (2) the SRL LVHC off-gases are combusted in the No. 3 Recovery Furnace.

The ammonia in the methanol is expected to contribute less than 2% of the total nitrogen in the black liquor. The NO<sub>x</sub> emissions from the recovery furnaces have been conservatively assumed to increase 2% when burning SRL and the SRL LVHC.

The NO<sub>x</sub> emissions from combustion of the SRL LVHC and SOG in the combination boilers are based on the post-Project Columbia NO<sub>x</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.


## Carbon Monoxide

In SRL mode, the SRL will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 2%. There is no information to suggest the CO emissions will change when the SRL is burned in the recovery furnaces.

The CO emissions from combustion of the SRL LVHC and SOG are based on the post-Project Columbia CO emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the new steam stripper system are based on the theoretical maximum methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day).

In SRL mode, the SRL will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 2%. The SRL will be combusted in the recovery furnace to an expected 99.9% VOC destruction in the liquid phase.

When the new stripper is operating, there will be no foul or stripped condensate flow to the Hardpipe. Non-methanol VOC emissions (acetaldehyde, methyl ethyl ketone, propionaldehyde, and TRS VOCs) from the ASB are calculated based on WATER9, using the average ASB influent concentrations from data collected during 2021 and 2022 TRS and NESHAP Subpart S testing efforts. Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests.

#### **Backup Stripper Online Scenario**

As stated previously, once the new stripper is installed, the existing stripper will be demoted to the backup steam stripper role. For the purposes of calculating projected actual emissions (PAE), the backup steam stripper is projected to be online a minimum of 4.75% of the annual operating time. The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. In TRS mode, the backup stripper will also remove approximately 45% of the methanol from the foul condensate. The SOG from the backup steam stripper will be vented to the combination boilers. The stripped condensate from the backup steam stripper will be



discharged to the Hardpipe where the remaining unstripped methanol will be biologically treated in the ASB.

After the original submittal of this application and further discussions with SCDHEC, an alternate operating scenario for the backup stripper operating in "methanol mode" was established in addition to the "TRS mode" operation described above. Upon completion of the Project, the Mill can operate the existing stripper in either "TRS mode" or "methanol mode" during the periods the backup stripper is projected to operate. The calculations provided in Appendix B of this application include the emissions rates of each pollutant for both the TRS mode and methanol mode backup stripper operating scenarios. For each pollutant, the worst-case backup stripper operating mode was used to determine PSD applicability. For simplicity, this section will only discuss the TRS mode emissions calculations, consistent with the original submittal. Appendix D to this application provides a detailed description of the backup stripper operating in "methanol mode" as well as the supporting calculation documentation provided to SCDHEC after submittal of the original application.

## Sulfur Dioxide

The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. SO<sub>2</sub> emissions from combustion of the backup stripper SOG in the combination boilers are conservatively calculated assuming all of the 0.70 lb S/ADTP of sulfur present in the foul condensate will be captured in the SOG and converted to SO<sub>2</sub> during combustion.

#### Nitrogen Oxides and Carbon Monoxide

The NO<sub>x</sub> and CO emissions from combustion of SOG are based on the post-Project Columbia NO<sub>x</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the backup stripper are based on the maximum expected methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day). To calculate VOC emissions from backup stripper SOG combustion, it is conservatively assumed that the methanol present in the foul condensate will be captured with the SOG and combusted with 98% control at the combination boilers.



Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the stripped condensate from the backup stripper is based on the theoretical maximum methanol collection (16 lb/ODTP) in the foul condensate and an expected 45% removal efficiency from the backup stripper operating in "TRS mode."

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline. Emissions of TRS compounds that are also VOC are calculated using WATER9 with the design foul condensate loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode" before entering the ASB.

#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

To calculate TRS and H<sub>2</sub>S emissions from backup stripper SOG combustion, it is conservatively assumed that the design foul condensate sulfur loading will be captured with the SOG and only 99% will be converted to SO<sub>2</sub> at the combination boilers.

Projected emissions of TRS compounds (excluding H<sub>2</sub>S) from the ASB are based on WATER9. Projected emissions of H<sub>2</sub>S from the ASB are calculated based on H2SSIM. Both WATER9 and H2SSIM emissions are based on the average ASB influent concentrations from data collected during 2021 and 2022 TRS testing and the design foul condensate sulfur loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode."

#### No Stripper Online Scenario

The post-Project emissions also account for brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds will be chemically oxidized to reduce the potential for odors from the ASB when operating during these transition periods, which are required by Item I.a of Appendix A of the November 16, 2022 EPA Consent Decree to be less than 460 hours (5.25%) of annual operating time.

When there is no SOG being created by either stripper, there are no emissions of SO<sub>2</sub>, NOx, or CO corresponding to the periods when all foul condensate is treated in the ASB.



## Volatile Organic Compounds, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

Methanol emissions from the ASB are based on NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the foul condensate is based on the maximum methanol collection (16 lb/ODTP).

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline.

Emissions of TRS compounds are calculated using WATER9 and H2SSIM (H<sub>2</sub>S) with the design foul condensate sulfur loadings of TRS compounds being adjusted based on NCASI Technical Bulletin No. 949 to account for the effects of the chemical oxidant, consistent with how baseline actual emissions are calculated.

- H<sub>2</sub>S concentrations in the Hardpipe were reduced by 99%.
- DMS concentrations in the Hardpipe were reduced by 90%.
- MMC concentrations in the Hardpipe were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed not reduced by chemical oxidant. DMDS concentrations of the Hardpipe were increased to account for the MMC oxidized into DMDS.

#### PAE and PTE Independent from Stripper Operating Scenario

#### LVHC Collection System

As stated previously, the No. 3 Recovery Furnace is expected to provide LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive the LVHC gases, the LVHC gases will then be combusted in the combination boilers the remaining 25% of the time. The emissions from combusting LVHC gases are unaffected by the stripper operating scenario. PAE of SO<sub>2</sub>, H<sub>2</sub>S, and TRS are based on 2021 stack testing and SCDHEC approved emissions factors from Construction Permit DF. The VOC PAE from the LVHC collection system are based on the post-project Columbia VOC emissions factors presented Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF. The New Stripper Project does not impact the generation of HVLC gases and associated emissions (i.e., HVLC sources are not affected or modified as a result of the project); therefore, emissions associated with the combustion of HVLC gases are not included in the PAE (or BAE) emissions.



#### No. 3 Recovery Furnace LVHC Ignitor

The No. 3 Recovery Furnace will also have a 1 MMBtu/hr natural gas-fired LVHC ignitor to be used when the black liquor load is less than 50%. The natural gas ignitor is expected to be required no more than 15% of the time the No. 3 Recovery Furnace is in operation. PAE of products of combustion from the ignitor are based on AP-42 emissions factors.

#### Steam for New Stripper and Backup Stripper

The steam requirements for the new stripper and the backup stripper were provided by the vendor and adjusted for the thermal efficiency of the combination boilers firing natural gas and No. 6 fuel oil. The projected fossil fuel usage reflects the highest No. 6 fuel oil usage occurring during the previous 10 years. The highest fuel oil usage was during calendar year 2014 and accounted for 18.4% of the fossil fuel heat input. The PAE and PTE of products of combustion are based on AP-42 emissions factors.

## 3.2.2.3.3 PSD Non-Applicability

The changes in emissions from the Mill as a result of the Project were compared to the significant emission rates in Standard No. 7, paragraph (B)(49). Based on the emissions calculations described above, presented in Appendix B, and summarized in Table 3-3, the Project is not subject to the PSD permitting requirements in paragraphs (J) through (R) of Standard No. 7.



## Table 3-3 Summary of PSD Applicability for the Project (tpy)

Pollutant <sup>(A)</sup>	РМ	PM <sub>10</sub>	PM <sub>2,5</sub>	NOx	SO <sub>2</sub>	со	H2SO4	TRS	voc	Pb	H <sub>2</sub> S	CO2
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3.61	12,275
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2.43	16.8	260	2.06E-03	5.59	48,200
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.95	26.8	1.95E-03	1.98	35,925
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.



# 3.2.2.4 Standard No. 7 – Prevention of Significant Deterioration – Air Dispersion Modeling Requirements

Standard No. 7 also includes PSD air quality increments that apply to all increases and decreases in PSD pollutant emissions following the PSD minor source baseline date. In York County the minor source baseline dates are December 1, 1981, for PM10 and March 3, 2017 for PM2.5. This Application does not trigger PSD review as discussed above; therefore, the project is unlikely to interfere with attainment or maintenance of State or Federal ambient air quality standards.

## 3.2.2.5 Standard No. 8 – Toxic Air Pollutants

SCDHEC Standard No. 8 regulates emissions of air toxics from new and existing sources. The Standard does not apply to fuel burning sources that burn only virgin fuel or specification used oil. Section I.D(1) of Standard No. 8 exempts sources subject to a Federal NESHAP. The Mill is subject to the Federal NESHAP for the pulp and paper source category (Subparts S and MM), industrial boilers (Subpart DDDDD), and reciprocating internal combustion engines (Subpart ZZZZ). Section I.D(2) of Standard No. 8 exempts non-NESHAP sources after a facility-wide residual risk analysis is completed. U.S. EPA published the results of facility-wide residual risk analyses for Subpart S sources on December 27, 2011, and for Subpart MM sources on December 30, 2017. The residual risk analyses completed by U.S. EPA concluded that there was no unacceptable risk from pulp and paper mills. Therefore, all emissions sources of HAP at New-Indy Catawba are exempt from Standard No. 8 under sections I.D(1) and/or I.D(2).

New-Indy Catawba emits two South Carolina toxic air pollutants (TAP) that are not listed HAP, H<sub>2</sub>S and methyl mercaptan. Both compounds are generated by the Kraft pulping process and are components of TRS gases that are contained in LVHC and HVLC gases and in the pulping process condensates. Section I.D(3) allows sources to request an exemption for non-HAPs controlled by MACT controls to reduce HAP. This Project will improve emissions of H<sub>2</sub>S and MMC from the Mill. However, because SCDHEC recently modeled emissions of H<sub>2</sub>S and MMC and to demonstrate that emissions from these two TAPs following the Project remain below the maximum allowable ambient concentrations (MAAC) in Standard No. 8, the Mill has included an updated modeling demonstration in Appendix C.

The updated modeling analysis for TRS (as H<sub>2</sub>S), H<sub>2</sub>S and MMC in Appendix C focused on the changes to the emissions from the aerated stabilization basin. The TRS, H<sub>2</sub>S and MMC emissions from the No. 3 Recovery furnace were not updated due to the insignificant maximum modeled concentrations from the No. 3 Recovery Furnace when compared to the overall maximum modeled concentrations for the Mill. The TRS (as H<sub>2</sub>S) maximum modeled concentrations from



the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the Mill. Similarly, the MMC concentrations were approximately 0.08% of the maximum concentrations from the Mill, and the TRS (as  $H_2S$ ) maximum concentrations from the No. 3 Recovery Furnace were approximately 0.04% of the maximum mill concentrations.

# **3.2.3** Regulation 61-62.60: South Carolina Designated Facility Plan and New Source Performance Standard

Regulation 61-62.60 incorporates the 40 CFR Part 60 Subparts by reference. Refer to Section 3.1.1 for a discussion of 40 CFR Part 60.

# **3.2.4** Regulation 61-62.61 and 61-62.62: National Emission Standards for Hazardous Air Pollutants

Regulation 61-62.61 incorporates the 40 CFR Part 61 Subparts by reference. Refer to Section 3.1.2 for a discussion of the non-applicability of 40 CFR Part 61. Regulation 61-62.63 incorporates the 40 CFR Part 63 Subparts by reference. Refer to Section 3.1.2 for a discussion of applicability of 40 CFR Part 63.

## 3.2.5 Regulation 61-62.70 – Title V Operating Permit Program

Refer to Section 3.1.6 for discussion of the TVOP Program.

## 3.3 PROVISIONS OF THE SCDHEC CONSENT ORDER AND EPA CONSENT DECREE

This section addresses the provisions of the November 23, 2022 SCDHEC Consent Order and Part I of Appendix A of the November 16, 2022 EPA Consent Decree.

#### 3.3.1 November 23, 2022 SCDHEC Consent Order

Items 4 through 6 of the Consent Order require that New-Indy Catawba:

- Install, operate, and maintain a primary stripper that is adequately sized to collect and treat all foul condensate streams in accordance with applicable state and federal air quality regulations. The proposed new stripper will be sized at 850 gpm, which is designed to process foul condensates generated from producing the maximum pulp production of 2,700 ADTP/d, and New-Indy Catawba will operate the unit in accordance with applicable state and federal air quality regulations.
- The primary stripper shall use low-pressure steam and must be designed for both methanol and sulfur compound removal with the off gases being treated in the recovery boilers to



absorb the sulfur compounds in the stripper off gas. The proposed new stripper will utilize 60 pounds per square inch gauge (psig) steam. *The new stripper off-gases and SRL will be incinerated in the No. 2 or 3 Recovery Furnace, with the exception of when the SRL system is unavailable (5% of the operating time of the new stripper).* 

- Complete preliminary engineering and submit a construction permit application for the primary stripper within one hundred and twenty (120) days of the execution of this order. *Preliminary engineering is complete and this application is being submitted by March 23, 2023.*
- New-Indy must optimize, operate, and maintain the existing stripper at its current design capacity to allow it to be operated independently of the primary stripper. To optimize the existing stripper at its current design, it will be operated in "TRS mode" to remove 98% of the TRS and approximately 45% of the methanol from the foul condensate or in "methanol mode" (see Appendix D).
- The following required events have or will be completed in the future:
  - Order the primary stripper within 30 days of submitting the application for the air construction permit.
  - Within 30 days of receiving the air construction permit, New-Indy Catawba must start civil engineering preparation.
  - Within 30 days of receiving the primary stripper, New-Indy Catawba must start installation and testing.
  - New-Indy Catawba must complete startup operations and place the primary stripper into operation no later than June 30, 2025.
  - New-Indy shall operate its steam stripper system, comprised of the primary stripper and the existing stripper, in accordance with all applicable state and federal air quality regulations.
  - In the event the stripping system is out of service and foul condensate must be discharged to the ASB, New-Indy Catawba must use automated control of addition of a chemical oxidant, hydrogen peroxide, to treat the unstripped foul condensate prior to discharging into the ASB to maintain a rolling 90-minute average oxidation reduction potential (ORP) of the foul condensate above 0 millivolts.
  - New-Indy Catawba must notify SCDHEC at least 48 hours prior to any planned downtime and within 24 hours of unplanned downtime for which the primary stripper will not be operational (and for the existing stripper when it should be operating but will not be).



New-Indy Catawba must submit reports to the Department regarding the implementation of the Consent Order to NewIndyOrderReports@dhec.sc.gov. For twelve consecutive months after execution of this order, the reports shall be submitted monthly on the 1st business day of the month. Thereafter, reports shall only be submitted every three months on the 1st business day of the month until the order terminates.

## 3.3.2 November 16, 2022 EPA Consent Decree

#### Item I(a) of Appendix A

Item I(a) of Appendix A of the Consent Decree contains requirements related to the uptime and monitoring of the foul condensate steam stripper at the Mill.

- New-Indy Catawba will operate their foul condensate treatment system (inclusive of the new and existing steam strippers) during all times that unbleached kraft pulp is being produced and foul condensate is being generated at the Mill.
- During periods the new steam stripper is experiencing downtime the existing steam stripper will be used.
- Periods of downtime in which both strippers are down will not exceed 576 hours for the first year and 460 hours annually thereafter.
- Peroxide will be added to the non-stripped condensate during the transition to the existing steam stripper and will continue to be added throughout the period in which the existing steam stripper is in operation as necessary to maintain a rolling 90-minute average ORP of the foul condensate above 0 millivolts.
- The Mill will notify the necessary authorities forty-eight (48) hours prior to any scheduled downtime and within twenty-four (24) hours of any unscheduled downtime and will operate both steam strippers, as applicable, for compliance with 40 CFR Part 63, Subpart S.

#### Item I(b) of Appendix A of the Consent Decree

Item I(b) of Appendix A of the Consent Decree covers the maintenance, operation, and calibration of the system used to treat the unstripped foul condensate by the Mill. The Mill's foul condensate treatment system (inclusive of the new equipment to be installed with this application) will be capable of continuously measuring the ORP of the foul condensate, automatically controlling the dosage of hydrogen peroxide to maintain a rolling ninety-minute average of the ORP of the foul



condensate above 0 millivolts (mV) before it is discharged to the ASB, and treating the maximum amount of foul condensate produced when both steam strippers are down and when untreated foul condensate is discharged to the Hardpipe.

#### Item I(c) of Appendix A of the Consent Decree

Item I(c) of Appendix A of the Consent Decree contains recordkeeping requirements for data obtained by the ORP monitoring system used by the Mill. The Mill will maintain continuous records of the ORP monitoring system used by the Mill and will provide data to U.S. EPA upon request.

#### Item I(d) of Appendix A of the Consent Decree

Item I(d) of Appendix A of the Consent Decree includes reporting requirements for the ORP monitoring system used by the Mill. When untreated foul condensate is discharged to the Hardpipe, New-Indy Catawba will include the date, time, and value of any instance of a rolling ninety-minute average of the ORP falling below 0 mV in the Mill's semi-annual report for the previous six months.

# APPENDIX A -PERMIT APPLICATION FORMS



#### **SECTION 1 - FACILITY IDENTIFICATION**

SC Air Permit Number (8-digits only) (Leave blank if one has never been assigned) 2440 - 0005 Application Date

March 2023, updated April 2024

Facility Name/Legal Identity (This should be the official legal name under which the facility is owned/operated and should be consistent with the name registered with the S.C. Secretary of State's office, as applicable.)

New-Indy Catawba LLC

Facility Site Name (Optional) (Please provide any alternative or additional identifier of the facility, such as a specific plant identifier (e.g., Columbia plant) or any applicable "doing business as" (DBA) identity. This name will be listed on the permit and used to identify the facility at the physical address listed below.)

Facility Federal Tax Identification Number (Established by the U.S. Internal Revenue Service to identify a business entity) 83-1904423

#### **REQUEST TYPE (Check all that apply)**

Exemption Request: 🗆

Complete Section 1 and attach documentation to support exemption request.

#### Construction Application:

Minor New Source Review Project

□ Synthetic Minor Project

□ Prevention of Significant Deterioration Project

□ 112(g) Project

Expedited Review Request: 🗆

If checked, include <u>Expedited Form D-2212</u> in the construction application package.

Construction Permit Modification:

Provide the construction permit ID (e.g. CA, CB, etc.) for which modification is requested:

#### Application Revision: 🗆

# CONSTRUCTION PERMIT APPLICATION FORMS BEING REVISED (Amended construction permit forms must be filled out completely and attached to this modification request.) Form # Date of Original Submittal Brief Description of Revision D-2566 March 2023 Updated Faciltiy Air Contact, Owner or Operator, Application Narrative and Appendix B D-2573 March 2023 Updated Faciltiy Air Contact

FACILITY PHYSICAL ADDRESS					
Physical Address: 5300 Cureton Ferry Road		County: York			
City: Catawba	State: SC	Zip Code: 29704			
Facility Coordinates (Facility coordinates should be based at the front door or main entrance of the facility) Latitude: 34°50'37"N Longitude: 80°53'25"W					



#### **FACILITY'S PRODUCTS / SERVICES**

Primary Products / Services (List the primary product and/or service)					
Linerboard / Pulp Manufacturing					
Primary <u>SIC Code</u> (Standard Industrial Classification Codes)	Primary <u>NAICS Code</u> (North American Industry Classification System)				
2631 322130					
Other Products / Services (List other products and/or services)					
Other SIC Code(s):	Other NAICS Code(s):				

#### **PROJECT DESCRIPTION**

Project Description (What, why, how, etc.): Installation of a new steam stripper system to treat foul condensate prior to being hard piped to the aeration stabilization basin. The new steam stripper will include a new stripper feed tank, new methanol tank, new hot water tank, and a new methanol rectification condenser. The rectified methanol will be burned in the recovery furnaces with the black liquor. The LVHC gases from the methanol condenser system, stripper feed tank, and methanol tank will be combusted in the No. 3 Recovery Furnace. The hot water tank is not expected to be a source of air emissions. The existing steam stripper will serve as a backup to the new steam stripper.

#### AIR PERMIT FACILITY CONTACT

(Person listed will be in our files as the point of contact for all air permitting related questions and will receive all air permitting notifications.)							
Title/Position: Environmental Manager Salutation: Ms. First Name: Rachel Last Name: Davis							
Mailing Address: P.O. Box 7							
City: Catawba	State: SC	Zip Code: 29704					
E-mail Address: rachel.davis@new-indycb.com	Primary Phone No.: (803) 981-8206	Alternate Phone No.:					

The signed permit will be e-mailed to the designated Air Permit Contact.				
If additional individuals need copies of the permit, please provide their names and e-mail addresses.				
Name E-mail Address				
Steven Moore	smoore@all4inc.com			

#### **CONFIDENTIAL INFORMATION / DATA**

Is <u>confidential information</u> or data being submitted under separate cover? 🛛 No 🗌 Yes\*

\*If yes, submit **ONLY ONE COMPLETE CONFIDENTIAL APPLICATION**, with original signature, along with the public version of the application.

#### **CO-LOCATION DETERMINATION**

Are there other facilities in close proximity that could be considered collocated? oxtimes No oxtimes Yes\*

If yes, list potential collocated facilities, including air permit numbers if applicable:

*\*If yes, please submit <u>collocation applicability determination</u> details in an attachment to this application.* 



## **Bureau of Air Quality Construction Permit Application** Page 3 of 9

The second second	OWNER O	ROPERATOR	a the content of the second	
Title/Position: Mill Manager	Salutation: Mr.	First Name: Chris	Last Name: Loach	
Mailing Address: P.O. Box 7	- Section Stream Provide Stream			
City: Catawba		State: SC	Zip Code: 29704	
E-mail Address: chris.loach@new-indycb.com		Primary Phone No.: 803- 981-8000	Alternate Phone No.:	
	OWNER OR OPE	RATOR SIGNATURE	A second se	
I certify, to the best of my knowled or violated. I certify that any a submitted in this permit applicat reasonable inquiry. Lunderstand	dge and belief, that no a pplication form, supp ion is true, accurate, a l that any statements	applicable standards and/or re- orting documentation, report, nd complete based on informa and/or descriptions, which are	gulations will be contravened or compliance certification ation and belief formed after found to be incorrect may	

result in the immediate revocation of any permit issued for this application.

is stac

Signature of Owner or Operator

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APPLICATION PREPARER (if other than Professional Engineer below)							
Title/Position: Consultant	Senior	Managing	Salutation: Mr.	First Name: Steven	Last Name: Moore		
Mailing Address	: 630 Davis	Drive, Suite	203				
City: Durham	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	1000		State: NC	Zip Code: 27560		
E-mail Address: smoore@all4inc.com		Phone No.: (919) 234-5981	Cell No.: (864) 616-4711				

	PROFESSIONAL ENG	INEER INFORMATION		
Consulting Firm Name: ALL4 L	LC	SC Certificate of Authority Li	cense No.: 6409	
Title/Position: PE Salutation: Ms. First Name: Sheryl Last Name: Watkin:				
Mailing Address: 300 Chastain	Center Blvd, Suite 395			
City: Kennesaw		State: Georgia	Zip Code: 30144	
E-mail Address: swatkins@all4inc.com		Phone No.: (678) 293-9428	Cell No.: (386) 503-0266	
SC License/Registration No.: 34	4347			

#### **PROFESSIONAL ENGINEER SIGNATURE**

I have placed my signature and seal on the engineering documents submitted, signifying that I have reviewed this construction permit application as it pertains to the requirements of South Carolina Regulation 61-62, Air Pollution Control Regulations and Standards.

Thing Watter	THILL CARO	4-26-24
Signature of Professional E	nginegr =Date	
	11111111111111111111111111111111111111	
DHEC 2566 (03/2021)	THE WARKS	This form is su

bject to Retention Schedule 16303.



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EQUIPMENT / PROCESS INFORMATION							
Equipment ID/ Process ID	Action	Equipment / Process Description	Maximum Design Capacity (Units)	Control Device ID(s)	Emission Point ID(s)		
9801	Add Remove Modify Existing	Existing Steam Stripper	850 gallons/minute	9820, 2605, 3705, 2901	2610S2, 2610S1, Fugitive		
9802	Add Remove Modify Existing	Hardpipe	850 gallons/minute	2901	Fugitive		
9803	Add Remove Modify Existing	New Steam Stripper (Methanol Condenser)	6.5 gallons/minute	5260, 5260C, 2605, 3705, 5105	5105S, 2610S2, 2610S1		
9803	Add Remove Modify Existing	New Steam Stripper (Condensed Methanol)	6.5 gallons/minute	2505, 5105	2505S, 5105S		
9803	Add Remove Modify Existing	New Steam Stripper (Stripper Off Gases)	850 gallons/minute	9820, 2605, 3705	2610S2, 2610S1		
9804	Add Remove Modify Existing	New Steam Stripper Feed Tank	80,400 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S		
9805	Add Remove Modify Existing	New Steam Stripper Rectified Liquid Methanol Tank	1,300 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S		



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CONTROL DEVICE INFORMATION											
Control Device ID	Action	Control Device Description	Maximum Design Capacity (Units)	Inherent/ Required/ Voluntary	Pollutants Controlled (Include CAS #)	Capture Efficiency	Destruction/ Removal Efficiency	Emission Point ID(s)			
2505	Add Remove Modify Existing	No. 2 Recovery Furnace	412,140 tons BLS/year	Required	See Ap	2505S					
2605	Add Remove Modify Existing	No. 1 Combination Boiler	405 MMBtu/hr	Required	See Ap	2610S2					
2901	Add Remove Modify Existing	Aerated Biotreatment (Aerated Stabilization Basin)	N/A	Required	See Appendix B/Narrative			Fugitive			
3705	Add Remove Modify Existing	No. 2 Combination Boiler	720 MMBtu/hr	Required	See Appendix B/Narrative			2610S1			
5105	Add Remove Modify Existing	No. 3 Recovery Furnace	744,600 tons BLS/year	Required	See Appendix B/Narrative		arrative	5105S			
9820	Add Remove Modify Existing	Stripper Off Gases Collection System	2,700 ADTP/day	Required	See Appendix B/Narrative			2610S1, 2610S2			
5260	Add Remove Modify Existing	LVHC Collection System	2,700 ADTP/day	Required	See Appendix B/Narrative		arrative	2610S1, 2610S2, 5105S			
5260C	Add Remove Modify Existing	LVHC Collection System Caustic Scrubber	2,700 ADTP/day	Required	See Appendix B/Narrative		2610S1, 2610S2, 5105S				



## Bureau of Air Quality Construction Permit Application Page 6 of 9

Check Box for information addressed	Required Information
	Source identification and emissions:
$\boxtimes$	Name of each source, process, and control device.
$\boxtimes$	<ul> <li>Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application.</li> </ul>
$\boxtimes$	Assign an Emission Point ID for each source.
$\boxtimes$	Assign a Control Device ID for each control device.
$\boxtimes$	List each pollutant the source will emit.
$\boxtimes$	<ul> <li>List the Uncontrolled, Controlled, and PTE emissions for each source or equipment in lb/hr and tons/year.</li> </ul>
$\boxtimes$	• Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.
$\boxtimes$	• Provide the CAS# for each Hazardous Air Pollutant (HAP) and/or Toxic Air Pollutant (TAP).
	Information to support emission rates:
$\boxtimes$	Sample calculations.
$\boxtimes$	• Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.
$\boxtimes$	Explanation of assumptions, bottlenecks, etc.
	<ul> <li>Source test information: A copy of the source test results may be requested. If the test results are not included in the application, the application should cite whether this was a DHEC approved test, and if not, explain where the test was conducted and other identifying information.</li> </ul>
	Manufacturer's data.
	Vendor guarantees that support control device efficiencies.
$\boxtimes$	New Source Review (NSR) analysis.
$\boxtimes$	Other (e.g. example particle size analysis)

	Existing (Permitted) Facilities										
Check Box	Check Box Required Information										
$\boxtimes$	<ul> <li>Facility-wide emissions prior to construction/modification:</li> <li>Include an explanation if these emissions do not match the facility- wide emissions submitted in the last application.</li> </ul>	Appendix B									
	<ul><li>Facility-wide emissions after construction/modification:</li><li>Include net change, if applicable.</li></ul>	Appendix B									
	As applicable for the construction/ modification:										
$\boxtimes$	Name of each source.	See									
		Equipment/Process									
		Information Above									

This form is subject to Retention Schedule 16303.



## Bureau of Air Quality Construction Permit Application Page 7 of 9

Existing (Permitted) Facilities									
Check Box	Required Information	Location in Application							
$\boxtimes$	Assign each source an Equipment ID. The IDs must match the IDs listed	See							
	in Section 2 of this application or on your current construction /	Equipment/Process							
	operating permit.	Information Above							
$\boxtimes$	<ul> <li>Assign a Control Device ID for each control device.</li> </ul>	See							
		Equipment/Process							
		Information Above							
$\boxtimes$	<ul> <li>Assign an Emission Point ID for each source.</li> </ul>	See							
		Equipment/Process							
		Information Above							
$\square$	List each pollutant the source will emit.	Appendix B							
$\boxtimes$	• List the Uncontrolled, Controlled, and PTE (if applicable) emissions for each source or equipment.	Appendix B							
$\boxtimes$	• Emission rates for each pollutant should be totaled and listed in lb/hr	Appendix B							
	and tons/year.	Арреник в							
	Provide the CAS# for each HAP and/or TAP.	Appendix B							
	Information to support facility-wide emission rates:								
$\boxtimes$	Sample calculations.	Appendix B							
	• Emission factors. Include the source, revision date, specific table	Narrative							
$\boxtimes$	and/or chapters. Include source test data if factors were derived from	Appendix B							
$\square$	Explanation of assumptions, bottlenecks, etc.	Narrative							
	• Source test information: A copy of source the test results may be	itaitaatte							
	requested. If the results are not included in the application, the								
$\boxtimes$	application should cite whether this was a DHEC approved test and if	Appendix B							
	not, explain where the test was conducted and other identifying								
	information.								
	Manufacturer's data.								
	<ul> <li>Vendor guarantees that support control device efficiencies.</li> </ul>								
$\square$	NSR analysis.	Narrative							
$\boxtimes$	Other (please explain)	Appendix B							



## Bureau of Air Quality Construction Permit Application Page 8 of 9

Check Box	State and Federal Air Pollution Control Regulations and Standards
$\boxtimes$	S.C. Regulation 61-62.1 Section II.E Synthetic Minor Construction Permits
$\boxtimes$	S.C. Regulation 61-62.5 Air Pollution Control Standards
	Standard No. 1 Emissions from Fuel Combustion
$\boxtimes$	Standard No. 2 Ambient Air Quality
$\boxtimes$	Standard No. 3 Waste Combustion and Reduction (state only)
	<ul> <li>Standard No. 4 Emissions from Process Industries</li> </ul>
$\boxtimes$	(Note: If Section VIII of this Standard applies, include the process weight rate (PWR) in ton per hour for
	each applicable source or process.)
	Standard No. 5 Volatile Organic Compounds
	<ul> <li>Standard No. 5.2 Nitrogen Oxides Lowest Achievable Emission Rate</li> </ul>
$\boxtimes$	<ul> <li>Standard No. 7 Prevention of Significant Deterioration (PSD)</li> </ul>
	Standard No. 7.1 Nonattainment New Source Review (NSR)
$\boxtimes$	Standard No. 8 Toxic Air Pollutants (TAPs) (state only)
	S.C. Regulation 61-62.6 Control of Fugitive Particulate Matter
$\boxtimes$	S.C. Regulation 61-62.60 and 40 CFR Part 60 New Source Performance Standards (NSPS)
$\boxtimes$	S.C. Regulation 61-62.61 and 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP)
$\boxtimes$	S.C. Regulation 61-62.63 and 40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories
$\boxtimes$	40 CFR Part 64 Compliance Assurance Monitoring (CAM)
	S.C. Regulation 61-62.68 and 40 CFR Part 68 Chemical Accident Prevention Provisions
$\boxtimes$	S.C. Regulation 61-62.70 and 40 CFR Part 70 Title V Operating Program
	Other S.C. Air Pollution Control Regulations, as applicable.
	Other Federal Air Pollution Control Regulations, as applicable.
	40 CFR 98 Green House Gas (GHG) emissions
	(Note: Quantify GHG emissions, if S.C. Regulation 61-62.5, Standard No. 7 or S.C. Regulation 61-62.5, Standard
	No. 7.1 is triggered.)



Check Box	Completeness Checklist:							
	Applicability Determination:							
$\boxtimes$	• Is this regulation applicable, reasonably applicable, potentially applicable, or not applicable?							
$\boxtimes$	<ul> <li>Is the basis for the applicability determination explained?</li> </ul>							
	Affected Sources:							
$\boxtimes$	<ul> <li>Is the name and identification of each emission source or process included?</li> </ul>							
Compliance Demonstration:								
$\boxtimes$	How will compliance be demonstrated?							
$\boxtimes$	<ul> <li>Are specific methods or activities to be utilized by the facility to demonstrate compliance with each specific limitation and/or requirement provided?</li> </ul>							
$\boxtimes$	Are control devices and control device requirements included?							
$\boxtimes$	<ul> <li>Are monitoring, recordkeeping, and reporting requirements necessary to demonstrate compliance included?</li> </ul>							
	Regulatory Citations:							
$\boxtimes$	Are the regulatory citations identified?							



## Bureau of Air Quality Emission Point Information Page 1 of 4

A. APPLICATION IDENTIFICATION									
1. Facility Name: New-Indy Catawba LLC									
2. SC Air Permit Number (if known; 8-digits only): 2440 - 0005	3. Application Date: March 2023, updated April 2024								
4. Project Description: New Condensate Stripper Permit Application									
5. Are other facilities collocated for air compliance? 🗌 Yes 🔀 No	6. If Yes, provide permit numbers of collocated facilities:								

B. AIR CONTACT										
Consulting Firm Name (if applicable):										
Title/Position: Environmental Manager Salutation: Ms. First Name: Rachel Last Name: Davis										
Mailing Address: P.O. Box 7										
City: Catawba		State: SC	Zip Code: 29704							
E-mail Address: rachel.davis@new-indycb.com		Phone No.: (803) 981-8206	Cell No.:							

#### **C. EMISSION POINT DISPERSION PARAMETERS**

- Source data requirements are based on the appropriate source classification.
- Each emission point is classified as a point, flare, area, area circular, area polygon, volume, open pit, line, or buoyant line source.
- Contact the Bureau of Air Quality for clarification of data requirements.
- Include sources on a scaled site map. Also, a picture of area or volume sources would be helpful but is not required.
- A user generated document or spreadsheet may be substituted in lieu of this form provided all of the required emission point parameters are submitted in the same order, units, etc. as presented in these tables.

#### Abbreviations / Units of Measure:

•	AGL = Above Ground Level	•	°F = Degrees Fahrenheit	٠	K = Kelvin
•	BTU/hr = British Thermal Unit per hour	•	ft = feet	٠	m = meters
٠	° = Degrees	•	ft/s = feet per second	•	UTM = Universal Transverse Mercator



Bureau of Air Quality Emission Point Information Page 2 of 4

Reminder: For all Emission Points, list the unique Emission Point ID for that source. Use the same emission point ID as shown in the current permit and provided in the last modeling submittal (as applicable). If the emission point ID has been changed from what was previously submitted, please list the current emission point ID with the old emission point ID in parenthesis

	D. POINT SOURCE													
Emission Point ID	Description (Neme	UTM Coo (NA	UTM Coordinates (NAD83)		Exit	Exit	Exit Inside	ide Discharge	ge Rain	Distance To Nearest		Building		
	Description/Name	Easting (m)	Northing (m)	AGL (ft)	Temp. (°F)	(ft/s)	(ft)	tion	(Y/N)	Property Boundary (ft)	Height (ft)	Length (ft)	Width (ft)	
2610S1	No. 2 Combination Boiler Stack	510039.32	3855689.18	228	364	47.2	10.0	Vert.	Ν	3,937	N/A	N/A	N/A	
2610S2	No. 1 Combination Boiler Stack	510020.32	3855678.18	228	405	62.3	10.0	Vert.	Ν	3,937	N/A	N/A	N/A	
2505S	No. 2 Recovery Furnace	510095.85	3855743.58	195	365	99.1	7.0	Vert.	Ν	3,953	N/A	N/A	N/A	
5105S	No. 3 Recovery Furnace	510032.37	3855802.28	225	342	61.7	10.5	Vert.	Ν	4,134	N/A	N/A	N/A	

E. FLARE SOURCE												
Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release	Heat	Exit	Exit	Heatlass	Distance To Nearest	Building		
		Easting (m)	Northing (m)	AGL (ft)	Release Rate (BTU/hr)	Velocity (ft/s)	Temp. (°F)	Fraction	Property Boundary (ft) (ft)	Length (ft)	Width (ft)	

F. AREA SOURCE											
Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height	Easterly Length	Northerly Length	Angle From	Initial Vertical	Distance To Nearest		
	Description/Mame	Easting (m)	Northing (m)	(ft)	(ft)	(ft)	(°)	(ft)	(ft)		



# Bureau of Air Quality Emission Point Information Page 3 of 4

	G. AREA CIRCULAR SOURCE													
Emission Point ID	Description (Name	UTM Coc (NAI	ordinates 083)	Release Height AGL (ft)	Radius of Area	Number of	Initial Vertical	Distance To Nearest						
	Description/Marrie	Easting (m)	Northing (m)		(ft)	Vertices	Dimension $\sigma_z$ (ft)	(ft)						

	H. AREA POLYGON SOURCE													
Emission Point ID	Description (Namo	UTM Cod (NA	ordinates D83)	Release Height	Initial Vertical	Number of	Area	Distance To Nearest						
	Description/Marrie	Easting-1	Northing-1	AGL (ft)	(ft)	Vertices	(ft²)	(ft)						
		(m)	(m)		(10)			(10)						
Fugitive	Aerated Stabilization Basin (Zone 1)	510803.40	3856319.69	20	0	15	547,769	1,969						
Fugitive	Aerated Stabilization Basin (Zone 2)	510964.42	3856054.20	20	0	18	733,653	1,510						
Fugitive	Aerated Stabilization Basin (Zone 3)	511052.13	3855887.21	20	0	10	783,500	1,180						

	I. VOLUME SOURCE													
Emission Point ID	Description (Name	UTM Coordinates (NAD83)		Release Height	Physical	Initial Horizontal	Physical Vertical	Initial Vertical	Distance To Nearest Property					
	Description/Marrie	Easting Northing (m) (m)	(ft)	Dimension (ft)	(ft)	Dimension (ft)	$\sigma_z$ (ft)	Boundary (ft)						

	J. OPEN PIT SOURCE													
Emission Point ID	Description/Name	UTM Coo (NA	ordinates D83)	Release Height	Easterly Length	Northerly Length	Pit Volume	Angle From North						
	Description/Marrie	Easting (m)	Northing (m)	AGL (ft)	(10)	(ft)	(ft³)	(°)						



# Bureau of Air Quality Emission Point Information Page 4 of 4

	K. LINE SOURCE													
Emission Point ID	Description (Name		UTM Coor (NAD	rdinates 83)		Release Height	Line Length	Line Width	Initial Vertical					
	Description/Name	Start Easting	Start Northing	End Easting	End Northing	AGL (ft)	(ft)	(ft)	Dimension O <sub>Z</sub>					
		(m)	(m)	(m)	(m)	(10)			(11)					

	L. BUOYANT LINE SOURCE (must complete Line Source and Buoyant Line Source tables)													
Emission Point ID	Description/Name	Average Building Length (ft)	Average Building Height (ft)	Average Building Width (ft)	Average Line Source Width (ft)	Average Building Separation (ft)	Average Buoyancy Parameter (m⁴/s³)							

	M. EMISSION RATES													
Emission	Pollutant Namo	CAS #	Emission Rate	Same as	Controlled or	Averaging								
Point ID	Follutarit Name	CAS #	(lb/hr)	Permitted? <sup>(1)</sup>	Uncontrolled	Period								
261052,														
2610S1														
2505S		Refer to A	ppendix B											
5105S														
Fugitive														

(1) Any difference between the rates used for permitting and the air compliance demonstration must be explained in the application report.

# APPENDIX B -EMISSIONS CALCULATIONS

#### **NEW-INDY CATAWBA MILL STRIPPER PROJECT**

	Operati	ng Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	4.75%	416.0
No Stripper Online	5.25%	460.0

LVHC Control	Operating Time						
Operating Scenario	%	hrs					
RF3 Available for LVHC	75%	6,570.0					
LVHC to CB1/CB2	25%	2,190.0					

#### Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	со	H2SO4	TRS	VOC	Pb	H₂S	CO <sub>2</sub>
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3.61	12,275
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2.43	16.8	260	2.06E-03	5.59	48,200
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.95	26.8	1.95E-03	1.98	35,925
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

#### SO2 EMISSIONS REFERENCES

	Stripper	Scenario		Operating C	onfiguration		Con	trols				SO2	Sulfur				
	Operat	ing Time		Ti	me		Operati	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>c</sup>	SO2 E	missions		
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy		
						BASELINE AC	TUAL EMISSIC	NS (March 2	021 - Februa	ry 2023)							
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8		
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1.97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6		
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.1		
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6		
SO2 BASELINE ACTUAL EMISSIONS (BAE)											· · · · · · · · · · · · · · · · · · ·						
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor / Preliminary Design Information	99%	0.6	2.4		
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	99%	0.9	2.7		
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	50%	47.2	44.2		
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	31.0		
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	32.7		
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA		
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.87	Project Columbia Projected Emissions Factor <sup>47</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) form 2012 stack test.	99%	6.6	21.7		
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87	Project Columbia Projected Emissions Factor <sup>47</sup> , Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (50%) and estimated bark ash sulfur capture (20%) form 2012 stack test.	50%	330.3	361.7		
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.00	0.0		
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2		
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	202.9	147.2		
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>D,F</sup>	81.6%	339.5	NA	100.0%	339.5	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.02	0.003		
Backup Stripper Steam - No. 6 Oil	4.75%	416.0	No. 6 Oil <sup>D,F</sup>	18.4%	76.5	NA	100.0%	76.5	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	2.1		
SO2 PROJECTED ACTUAL EMISSIONS (PAE	)														645.80		
						N	ET EMISSION	S CHANGE (P/	AE - BAE)								
NET EMISSIONS CHANGE (PAE - BAE)															-91.21		

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - The Backup Stripper operating in Methanol Mode would potentially strip less sulfur, but SOG emissions are conservatively based upon all of the sulfur being captured in the SOG.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

J - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

H - Project Columbia SO2 emissions factor from NCG Combustion applied to October 2021 stack test SO2 emissions distribution between LVHC, HVLC, and SOG.

#### H2SO4 EMISSIONS REFERENCES

	Stripper	Scenario		Operating			Con	trols			H2SO4		Sulfur		
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Production Rate			Emissions Factor	Capture	H2SO4 I	Emissions
Stripper Operating Scenario	%	hrs	Operating Configuration	% hrs Controls		%	hrs	Value	UOM	lb/ADTP	Reference	%	lb/hr	tpy	
	BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)														
LVHC Collection System 100% 8,760.0 NA 100% 8,760.0 LVHC to CB1/					LVHC to CB1/CB2	100.0%	8 760 0	1 365	ADTP/day	4 93F-03	NCASI Technical Bulletin 858,	NΔ	03	12	
Evile concetion system	100%	8,700.0	114	10078	0,700.0	Evric to cb1/cb2	100.078	8,700.0	1,505	Abiryddy	4.552 05	Table 10	na Na	0.5	1.2
2SO4 BASELINE ACTUAL EMISSIONS (BAE)														1.2	
PROJECTED ACTUAL EMISSIONS															
IVHC Collection System	100%	8 760 0	NA	100%	8 760 0	LVHC to BE3	75.0%	6 570 0	2 700	ADTP/day	4 93F-03	NCASI Technical Bulletin 858,	NΔ	0.55	1.87
Evile conceasin system	100%	8,700.0	114	100%	0,700.0	Evile to Ki 5	75.078	0,570.0	2,700	Abir/day	4.552 05	Table 10	ha	0.55	1.02
IVHC Collection System	100%	8 760 0	NA	100%	8 760 0	LVHC to CB1/CB2	25.0%	2 190 0	2 700	ADTP/day	4 93F-03	NCASI Technical Bulletin 858,	NΔ	0.55	0.61
Evile conceasin system	100%	8,700.0	114	100%	0,700.0	24116 18 681/682	25.076	2,150.0	2,700	Abir/day	4.552 05	Table 10	ha	0.55	0.01
H2SO4 PROJECTED ACTUAL EMISSIONS (	PAE)														2.43
						NET EMISSIONS CHANGE (PAE	- BAE)								
NET EMISSIONS CHANGE (PAE - BAE)															1.20

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

#### NOX EMISSIONS REFERENCES

	Stripper Scenario		Operating			Con	trols				NOX	Ammonia			
	Operat	ing Time		Configura	ation Time		Operati	ing Time	Produc	tion Rate		Emissions Factor	Increase <sup>c</sup>	NOX En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value UOM		lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	94.5
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B,E</sup>	97.9%	7,835.7	NA	100%	7,835.7	26.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.3	28.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B,E</sup>	2.1%	168.3	NA	100%	168.3	24.8	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.8	0.7
NOX BASELINE ACTUAL EMISSIONS													123.72		
	PROJECTED ACTUAL EMISSIONS														
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,852	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	2.0%	3.6	13.4
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	316.9	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12.	2.0%	0.4	1.1
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	270.0	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
Backup Stripper Online <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.7
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100%	460.0	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D,F</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D,F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	NA	100%	339.5	26.0	mmBtu/hr	2.80E-01	AP-42 Table 1.4-2.	NA	7.3	1.2
Backup Stripper Steam - No. 6 Oil	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	NA	100%	76.5	24.8	mmBtu/hr	3.13E-01	AP-42 Table 1.3-1.	NA	7.8	0.3
NOX PROJECTED ACTUAL EMISSIONS														-	147.54
						NET E	MISSIONS CH	ANGE (PAE - E	AE)						
PAE - BAE													-		23.82

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >2% with maximum addition of SRL of 2% by volume (representative of ~1% by volume pure methanol.)

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - No change in NO<sub>x</sub> emissions factor between Backup Stripper TRS mode and Methanol mode.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

J - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

#### CO EMISSIONS REFERENCES

	Stripper Scenario		Ope	rating		Cor	itrols				CO	CO			
	Operat	ting Time		Configur	ation Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Control	CO Em	lissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	Ib/UOM Reference		%	lb/hr	tpy
						BASELINE ACTUAL EM	ISSIONS (Mar	ch 2021 - Feb	uary 2023)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.1	16.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	8.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.		0.8	0.1
CO BASELINE ACTUAL EMISSIONS															25.22
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Backup Stripper Online <sup>C</sup>	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.7
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	3.1	2.2
Backup Stripper Steam - Natural Gas <sup>G</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	NA	100.0%	339.5	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	0.4
Backup Stripper Steam - No. 6 Oil <sup>G</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	NA	100.0%	76.5	24.8	mmBtu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.0
CO PROJECTED ACTUAL EMISSIONS															62.81
						NET EMISS	SIONS CHANG	E (PAE - BAE)							
PAE - BAE															37.60

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021. B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - No change in CO emissions factor between Backup Stripper TRS mode and Methanol mode.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

#### VOC EMISSIONS REFERENCES

	Stripper Scenario		Operating			Cor	ntrols				VOC				
	Operati	ing Time		Configura	ation Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Removal <sup>C</sup>	VOC Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS (	March 2021 -	ebruary 2023	)						
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.35	Average daily methanol stripped based on daily Subpart S compliance through 2/28/2023.	98.0%	4.95	19.81
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	8.51E-01	WATER9 Inputs and Outputs Provided.	NA	48.39	211.96
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.77
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>8</sup>	97.9%	7,835.7	NA	100.0%	7,835.7	26.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	24.8	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC BASELINE ACTUAL EMISSIONS															233.11
						PROJECTED ACTU	AL EMISSION	5	r		r				
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G</sup>	100%	7,489.8	2,700	ADTP/day	14.40	Vendor / Preliminary Design Information	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	10.11
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25%	1,872.5	2,700	ADTP/day	1.60	Vendor / Preliminary Design Information	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor / Preliminary Design Information	98%	36.00	7.10
Backup Stripper Online (TRS Mode) H	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	7.20	Vendor / Preliminary Design Information	98%		
Backup Stripper Online (Methanol Mode) H	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	16.00	Assume methanol mode captures all VOC in SOG	98%	36.00	7.49
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9 Inputs and Outputs Provided.	NA	32.85	129.50
ASB - Backup Stripper Online (TRS Mode)	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100%	416.0	2,700	ADTP/day	1.43	WATER9 Inputs and Outputs Provided.	NA		
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	1.54	WATER9 Inputs and Outputs Provided.	NA	173.20	36.03
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	NA	100%	460.0	2,700	ADTP/day	2.20	WATER9 Inputs and Outputs Provided.	NA	247.14	56.84
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	5.50E-03	2.71E-03
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.2	0.1
Backup Stripper Steam - Natural Gas K	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5	NA	100%	339.5	26.0	mmBtu/hr	5.50E-03	AP-42 Table 1.4-2.	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil K	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5	NA	100%	76.5	24.8	mmBtu/hr	1.87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS												· · · · · · · · · · · · · · · · · · ·			259.89
						NET EMISSIONS CHA	ANGE (PAE - B	AE)							
PAE - BAE															26.79

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - The Backup Stripper operating in Methanol Mode result in higher SOG emissions, since more VOC are stripped.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

J - When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in the table, but ASB emissions are based on methanol mode operation.

K - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

#### TRS EMISSIONS REFERENCES

	Stripper Scenario		Operating		Con	trols				TRS	Sulfur				
	Operat	ing Time		Configura	ation Time		Operat	ng Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	TRS Err	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
	BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)														
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.88E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.46	2.00
TRS BASELINE ACTUAL EMISSIONS															12.81
	- 1	r		<b>e</b>	r	PROJECTED ACTU	AL EMISSIONS	r	œ.	r	r		r		
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.33	Vendor / Preliminary Design Information	99.9%	0.04	0.14
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.18
Backup Stripper Online <sup>1</sup>	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	99%	0.91	0.19
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.72	10.74
ASB - Backup Stripper Online (TRS Mode) <sup>1</sup>	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	5.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	5.94	1.24
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	8.19	1.88
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre- control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															16.76
						NET EMISSIONS CHA	NGE (PAE - BA	E)							
PAE - BAE															3.95

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

I - Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.

J - When the Backup Stripper is operating, ASB emissions are higher if the stripper is operating in methanol mode. Both emissions factors are shown in the table, but ASB emissions are based on methanol mode operation.

#### H2S EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Cor	trols				H2S	Sulfur		
	Operati	ing Time		Configura	tion Time		Operat	ing Time	Produc	tion Rate		Emissions Factor	Capture <sup>C</sup>	H2S Em	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
		1				BASELINE ACTUAL EMIS	SIONS (Marc	h 2021 - Febru	ary 2023)	œ.					
Backup Stripper SOG <sup>A</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.13E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.02	0.09
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.03E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS				-											3.61
						PROJECT	ED ACTUAL E	AISSIONS							
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3 <sup>G,H</sup>	100.0%	7,489.8	2,700	ADTP/day	0.24	Vendor / Preliminary Design Information	99.9%	0.03	0.10
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>G</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
Backup Stripper Online	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	99%	0.69	0.14
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.04	4.11
ASB - Backup Stripper Online (TRS Mode)	4.75%	416.0	H2S Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	9.81E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.23
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	9.45E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	9.54E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.07	0.25
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. Pre-control emissions based on LVHC scrubber efficiency (S0%) and estimated 99% combustion efficiency in combination boilers.	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															5.59
						NET EMISSIO	ONS CHANGE	(PAE - BAE)							
PAE - BAE															1.98

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

I - Backup Stripper SOG emissions are conservatively based upon all of the sulfur being captured in the SOG for both TRS mode and Methanol mode.

J - When the Backup Stripper is operating, H2S ASB emissions are higher if the stripper is operating in TRS mode. Both emissions factors are shown in the table, but ASB emissions are based on TRS mode operation.

#### PM EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				PM	PM		
	Operat	ing Time		Configura	tion Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	PM Em	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.3
PM BASELINE ACTUAL EMISSIONS	BASELINE ACTUAL EMISSIONS 1.1														1.1
						PROJECTED A	CTUAL EMISSI	ONS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>I</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8
Backup Stripper Steam - Natural Gas <sup>c</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.2
PM PROJECTED ACTUAL EMISSIONS															13.33
	NET EMISSIONS CHANGE (PAE - BAE)														
PAE - BAE	AE - BAE 12.													12.22	

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.
#### PM10 EMISSIONS REFERENCES

	Stripper	Scenario		Ope	rating		Con	rols				PM10	PM10		
	Operati	ng Time		Configura	ation Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	PM10 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS	(March 2021	- February 20	23)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
PM10 BASELINE ACTUAL EMISSIONS															1.02
						PROJECTED ACT	UAL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
Backup Stripper Steam - Natural Gas <sup>C</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.1
PM10 PROJECTED ACTUAL EMISSIONS															10.34
						NET EMISSIONS CI	HANGE (PAE -	BAE)							
PAE - BAE	BAE 9.32										9.32				

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### PM2.5 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	ating		Con	trols				PM2.5	PM2.5		
	Operati	ng Time		Configura	tion Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Control	PM2.5 E	missions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS (M	March 2021 - I	ebruary 2023	3)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
PM2.5 BASELINE ACTUAL EMISSIONS	PM2.5 BASELINE ACTUAL EMISSIONS								0.96						
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8.1	5.9
Backup Stripper Steam - Natural Gas <sup>C</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.37
						NET EMISSIONS CHA	NGE (PAE - B	AE)							
PAE - BAE	- BAE 7.41														

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### LEAD EMISSIONS REFERENCES

	Stripper Scenario			0			6	hand la							
	Stripper	Scenario		Oper	ating		Con	trois				Lead	Lead		
	Operat	ing Time		Configura	ation Time		Operati	ng Time	Product	tion Rate		Emissions Factor	Control	Lead Er	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
					i	BASELINE ACTUAL EMISSIONS (M	/larch 2021 - F	ebruary 2023	)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	5.00E-07 AP-42 Table 1.4-2.		1.30E-05	5.10E-05
												U.S. EPA document "Estimating Air Toxic Emissions			1
A	04 494	0.004.0		2.40/	100.0		100.00/	460.0	24.0		2 005 05	from Coal and Oil Combustion Sources" [EPA-450/2-		C 055 04	5 055 05
Backup Stripper Steam	91.4%	8,004.0	No. 6 Oil <sup>-</sup>	Z.1%	168.3		100.0%	168.3	24.8	mmBtu/nr	2.80E-05	89-001] for Uncontrolled Residual Oil-fired Utility	NA	6.95E-04	5.85E-05
												Boilers (Table 4-1)			i i
LEAD BASELINE ACTUAL EMISSIONS															1.10E-04
						PROJECTED ACTU	AL EMISSIONS								
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	4.84E-05	1.56E-04
												U.S. EPA document "Estimating Air Toxic Emissions			(
			P							a. //		from Coal and Oil Combustion Sources" [EPA-450/2-			4 975 99
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	89-001] for Uncontrolled Residual Oil-fired Utility	NA	2.58E-03	1.8/E-03
												Boilers (Table 4-1)			í l
Backup Stripper Steam - Natural Gas <sup>C</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	2.21E-06
												U.S. EPA document "Estimating Air Toxic Emissions			
												from Coal and Oil Combustion Sources" [FPA-450/2-			í l
Backup Stripper Steam - No. 6 Oil	4.75%	416.0	No. 6 Oil <sup>b</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	2.80E-05	89-001] for Uncontrolled Residual Oil-fired Utility	NA	6.95E-04	2.66E-05
												Boilers (Table 4.1)			í l
LEAD PROJECTED ACTUAL EMISSIONS		1				1						Doners (Table 4-1)			2 06F-03
															2.002-00
						NET EMISSIONS CHA	NGE (PAE - BA	AE)							
PAE - BAE															1.95E-03

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

#### CO2 EMISSIONS REFERENCES

	Stripper	Scenario		Oper	rating		Cont	rols				CO2	CO2		
	Operati	ng Time		Configura	ation Time		Operati	ng Time	Product	tion Rate		Emissions Factor	Control	CO2 En	nissions
Stripper Operating Scenario	%	hrs	Operating Configuration	%	hrs	Controls	%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
						BASELINE ACTUAL EMISSIONS	6 (March 2021	- February 2	023)						
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	Natural Gas <sup>B</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,044.8	11,929
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>B</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	346
CO2 BASELINE ACTUAL EMISSIONS															12,275
						PROJECTED AC	FUAL EMISSIO	NS							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>D</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas <sup>C</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	3,044.8	517
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	157
CO2 PROJECTED ACTUAL EMISSIONS															48,200
						NET EMISSIONS C	HANGE (PAE -	BAE)							
PAE - BAE	£-BAE 35,925														

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

## SUMMARY OF ASB EMISSIONS FACTORS

		ASB Emissions Factors (lb/ODTP)									
Scenario	H <sub>2</sub> S	DMDS	DMS	MMC	TRS as H <sub>2</sub> S	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>			
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	3.37E-02	0.89	0.95	0.0453			
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	1.99E-02	0.30	0.32	0.0269			
Backup Stripper Scenario - TRS Mode	0.0109	0.0033	0.0147	1.30E-03	2.23E-02	1.53	1.59	0.0302			
Backup Stripper Scenario - Methanol Mode	0.0105	0.0308	0.0169	5.12E-04	4.24E-02	1.62	1.71	0.0587			
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	5.81E-02	2.31	2.44	0.0809			

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

### **BAE Other VOC Emissions Factors**

Date of Subpart S Performance Testing	Acetadehyde, ppm	MEK, ppm	Prop., ppm
7/9/2021	24.3	7.7	1.1
7/10/2021	25.3	5.7	4.0
7/11/2021	25.0	6.5	7.0
10/26/2021	25.0	12.3	0.8
10/27/2021	27.5	13.3	1.0
10/28/2021	10.6	6.6	1.2
10/29/2021	15.0	8.6	0.9
2/14/2022	16.7	7.5	0.7
2/15/2022	17.0	9.5	0.6
2/16/2022	15.7	8.6	1.0
5/4/2022	20.7	7.1	1.0
5/5/2022	16.3	7.3	1.0
5/6/2022	15.0	6.8	1.0
8/9/2022	15.3	5.9	0.7
8/10/2022	25.0	7.2	1.1
8/11/2022	20.3	6.0	1.0
9/27/2022	14.3	5.3	0.7
9/28/2022	15.0	5.2	0.7
9/29/2022	18.0	5.6	0.9
10/18/2022	25.0	5.6	1.0
10/19/2022	23.7	5.5	1.1
10/20/2022	23.0	6.6	0.9
AVG ppm:	19.72	7.28	1.34
Lbs into ASB	55.48	20.49	3.78
Fair estimated from WATER9	0.55	0.38	0.43
properties	0.55	0.50	0.45
Lbs emitted	30.73	7.73	1.61
Average Pulp Production		1716	
during Subpart S testing		1,10	
lb/ODTP	0.018	0.005	0.001

## PAE Other VOC Emissions Factors

			PA	E	
			lb/OI	DTP	
	BAE Ib/ODTP	New Stripper	Backup Stripper TRS Mode	No Stripper	Backup Stripper Methanol Mode
Methanol	0.89	0.30	1.53	2.31	1.62
Acetadehyde	0.018	0.006	0.031	0.046	0.033
MEK	0.005	0.002	0.008	0.012	0.008
Propionaldehyde	0.001	0.000	0.002	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504	0.0308
DMS	0.0185	0.0136	0.0147	0.0192	0.0169
MMC	3.28E-04	1.88E-04	1.30E-03	7.42E-04	5.12E-04
VOC:	0.95	0.32	1.59	2.44	1.71

Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference
	ADTP	ODTP	Ib/ODTP	
Mar-21	42,474	38,226	1.50	
Apr-21	43,075	38,767	1.50	
May-21	46,962	42,266	1.50	
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart
Jul-21	49,371	44,434	1.50	S Performance Tests.
Aug-21	44,614	40,152	1.50	Representative of ASB
Sep-21	40,177	36,159	1.50	operation from March
Oct-21	47,234	42,510	1.50	2021 to February 2022.
Nov-21	39,185	35,266	1.50	
Dec-21	38,734	34,860	1.50	
Jan-22	43,690	39,321	1.50	
Feb-22	37,736	33,962	0.33	
Mar-22	43,944	39,549	0.33	
Apr-22	40,046	36,041	0.33	
May-22	38,896	35,006	0.33	
Jun-22	23,184	20,866	0.33	Average of 2022 Subpart
Jul-22	39,890	35,901	0.33	S Performance Tests.
Aug-22	53,396	48,057	0.33	Representative of ASB
Sep-22	45,044	40,539	0.33	operation from February
Oct-22	47,517	42,765	0.33	2022 to February 2023.
Nov-22	40,133	36,120	0.33	
Dec-22	33,859	30,474	0.33	
Jan-23	35,464	31,918	0.33	
Feb-23	39,276	35,348	0.33	
Baseline Methanol En	missions Factor (Pul	p Weighted Average)	0.89	lb/ODTP

## New Indy Catawba ASB BAE Methanol Emissions Factor

			Con	centration (pp	m)	
		Hydrogen	Methyl	Dimethyl	Dimethyl	
Date	Sample Time	Sulfide	Mercaptan	Sulfide	Disulfide	Total TRS
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 c	or 6/25	146.7	16.0	17.0	15.0	194.7

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

	MW
Hydrogen Sulfide	34.08 g/mol
Methyl Mercaptan	48.11 g/mol
Dimethyl Sulfide	62.13 g/mol
Dimethyl Disulfide	94.20 g/mol
Sulfur	32.07 g/mol
	Hydrogen Sulfide Methyl Mercaptan Dimethyl Sulfide Dimethyl Disulfide Sulfur

Convert compound to equivalent S (ppm)

Hydrogen	Methyl	Dimethyl	Dimethyl
Sulfide	Mercaptan	Sulfide	Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168 Maximum feed to stripper (AH	iL)
Lb S/gallon FC	1.40E-03	
Lb S/hr @850 gpm	71.3	
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.7001	

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

## New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination	Combination		Combination	Combination		
		Boiler No. 1	Boiler No. 2	Total	Boiler No. 1	Boiler No. 2	Total	Total
		Natural Gas	Natural Gas	Natural Gas	No. 6 Fuel Oil			
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252
Total	996,766			3,237,544				69,553
Annual Average	498,383							
				97.9%				2.1%

# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PEROXIDE ADDITION



Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Source: TB949 H2O2 Mill Bench Scale Study

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# 1/27/2022 and 2/8/2022 H202/FC Bench Test Results w/ Corrected Ratios



NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT

# SUMMARY OF INDUSTRY EXPERIENCE WITH ODOR MINIMIZATION AT WASTEWATER TREATMENT PLANTS

TECHNICAL BULLETIN NO. 949 MAY 2008

by Diana Cook NCASI West Coast Regional Center Corvallis, Oregon

#### 5.3 Oxidation

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Several oxidizing agents have been used for destruction of odors resulting from  $H_2S$ . The approach is to oxidize the sulfide into nonvolatile forms such as elemental sulfur, thiosulfate, sulfite, and sulfate. Chemical oxidation reactions are generally slower than biochemical oxidation reactions (ASCE 1989). In the presence of large organic loads, as with industrial wastewaters, the economics of oxidizing agent use can be prohibitive due to competitive reactions with organic materials. Some of the commonly used oxidizing agents are chlorine, chlorine dioxide, hypochlorite, oxygen, and hydrogen peroxide. Industry experience with use of oxidizing agents is summarized herein.

#### 5.3.1 Hydrogen Peroxide

Hydrogen peroxide  $(H_2O_2)$  can be used to chemically oxidize  $H_2S$  into either elemental sulfur or sulfate (the former at pH <8 to 9; the latter at pH >8 to 9), as shown in Equations 5.6 and 5.7. In the range of pH 7 to 9, both reactions may occur. Excess H<sub>2</sub>O<sub>2</sub> can oxidize other wastewater components or decompose to release oxygen and water.

$$H_2O_2 + H_2S \rightarrow S + 2H_2O \qquad (Eq. 5.6)$$

$$4H_2O_2 + S^{2-} \rightarrow SO_4^{2-} + 4H_2O$$
 (Eq. 5.7)

 $H_2O_2$  is a clear, colorless, nonflammable compound that is miscible with water in all proportions and is normally sold as a solution expressed as a percentage of the solution's weight (e.g., a 35% solution contains 35%  $H_2O_2$  and 65% water by weight). Solutions of >8% are classified as oxidizers by the U.S. Department of Transportation.  $H_2O_2$  can be obtained in small drums or tanks equipped with metering pumps and plumbed to the addition point. Storage containers must be properly vented because contamination or excess heat can accelerate decomposition to oxygen and water. Special safety handling is required, including eye protection and protective clothing.

Davies, Christy, and O'Connor (2000) reported on the effectiveness of using  $H_2O_2$  to control odors resulting from release of H<sub>2</sub>S at four locations around the WWTP at a pulp and paper mill in Canada. The specific objectives were to reduce H<sub>2</sub>S concentration in an anaerobic spill basin effluent returned to the effluent clarification and treatment system; treat anaerobic sludge from the spill basin; minimize odors arising from sewering condensates; and treat all foul condensates from the mill during a scheduled shutdown of the steam stripper.

 $H_2O_2$  was found to be effective for odor reduction at all the locations. It was added to the anaerobic spill basin effluent at a location that promoted good mixing prior to introduction into the clarifier. The residence time associated with transfer of effluent from the spill basin to the clarifier was sufficient to oxidize H<sub>2</sub>S and minimize odor. Sludge dewatering equipment consisted of a screen, an agitation tank, a centrifuge, and a belt press. H<sub>2</sub>O<sub>2</sub> was added to the agitation tank. In addition, an odorcontrolling spray (Ecosorb) was applied to the air around the screens to capture any residual odors. H<sub>2</sub>O<sub>2</sub> was also used to reduce odors during occasional sewering of condensates. Dosage levels were selected based on laboratory studies that indicated that  $\sim 200 \text{ mg H}_2\text{O}_2/\text{L}$  of treated condensate was sufficient to remove odors. A solution containing 50%  $H_2O_2$  was also used to reduce odors during steam stripper downtime events when foul condensates were piped directly into the aeration pond.

 $H_2O_2$  and calcium peroxide (CaO<sub>2</sub>) have been used in the presence of peroxidase, an enzyme found in horseradish, to remove odors in swine manure. Swine manure is known to contain large amounts of VFAs, phenolic compounds, and indolic compounds that have been implicated in odor. Peroxidase, in the presence of peroxides, has been found to polymerize phenolic odorants, thereby reducing associated odors (Govere et al. 2007).

 $H_2O_2$  has also been used successfully as one element of a multi-pronged approach to control odor attributed to VFA generation in anaerobic environments (Davis and Smith 2001).  $H_2O_2$  would be particularly beneficial for use in mills with high levels of water reuse (e.g., some recycle mills). Oxygen-limited environments in the process water transport system at those facilities can be ideal for anaerobic bacterial growth. Traditional oxidizers such as sodium hypochlorite, chlorine, and chlorine dioxide increase total chloride and conductivity in the reused effluent, which can disrupt process performance and cause corrosion. The multi-pronged approach used at a 100% recycled corrugating medium mill focused on good operating practices aimed at oxygenation, biocide application to control the amount of aerobic bacteria, and  $H_2O_2$  use to prevent anaerobic environments in the secondary treatment system (Davis and Smith 2001).

NCASI assisted a bleached kraft mill that conducted a trial to investigate the effects of adding  $H_2O_2$  to foul condensates. Foul condensates were piped directly to the first basin of a multi-stage ASB. Samples were collected at two locations (just prior to addition of peroxide and just following the addition point) over a five-day period to assess impacts on sulfide concentrations. Samples were analyzed using direct injection GC/PFPD (NCASI Method RSC-02.02; NCASI 2007).  $H_2O_2$  was added as a 50% solution at a rate of 1.78 gallons per minute (GPM) to the foul condensate stream, which had a flow rate of 3 MGD, resulting in a concentration of approximately 0.51 g  $H_2O_2/L$  of foul condensate. The average reduction in sulfide concentration was over 79%, as illustrated in Figure 5.3.



**Figure 5.3** Sulfide Concentrations after Peroxide Addition (0.51 g/L) to a Foul Condensate [numbers above bars represent percent reductions in total sulfide observed each day]

Dosage and retention time trends were evaluated using a screening technique that involved collecting 25-mL samples in a 500-mL bottle that was closed and agitated for one minute. The cap was removed and a Jerome air monitor was used to measure volatile  $H_2S$  in the headspace. The effect of peroxide dose and retention time are illustrated in Figure 5.4. Reductions of >90% were observed after the first minute, and at some dosage rates they increased modestly with additional retention time. Figure 5.5 illustrates trends for doses of 0.5 and 1.0 GPM of a 50%  $H_2O_2$  solution to the 3 MGD foul condensate at the four sampling locations (drop legs 1 through 4). Although some variability was observed, a significant reduction in sulfide was observed at the first drop leg under both addition rates investigated and increased gradually as the foul condensate progressed through the drop legs.



**Figure 5.4** Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Retention Time on Sulfide Removal Efficiency [headspace measurements]



**Figure 5.5** Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Sample Location on Sulfide Removal Efficiency [headspace measurements]

Another example of  $H_2O_2$  use at a bleached kraft mill is illustrated in Figure 5.6. The mill conducted a bench study prior to an odor reduction trial to determine the dose-response curve for peroxide addition to foul condensates. Foul condensates were treated with the oxidant (50%  $H_2O_2$ ; density 1.2 g/mL) volumes shown in the figure (equivalent to 0.14, 0.29, 0.43, and 0.56 g  $H_2O_2/L$  of foul condensate) at 50°C for 30 minutes in sealed vials. Samples were removed and analyzed by direct aqueous injection GC/sulfur chemiluminescence detectors (SCD) for sulfide, MeSH, DMS, and

DMDS. The data indicate that sulfide and MeSH were readily removed, but that DMS required significantly higher doses to achieve equivalent levels of removal. DMDS was not removed and in fact increased with peroxide dose, presumably due to oxidation of MeSH.

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Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Following the bench studies, a mill trial was conducted over a five day period.  $H_2O_2$  was added to the foul condensate tank (pH 9.0 to 9.3) at a rate of 1 gallon (100%  $H_2O_2$ ) to every 500 gallons of condensate, which is equivalent to 2.8 g  $H_2O_2/L$  of foul condensate. This addition point provided a retention time of ~30 minutes prior to the WWTP. The trial resulted in overall average reductions in sulfide, MeSH, and DMS of 38.8, 64.6, and -3.9%, respectively (Table 5.1). The level of DMDS increased (probably due to oxidation of MeSH to DMDS) during the addition but reportedly did not affect overall odor from the WWTP (NCASI files). The mill continues to feed  $H_2O_2$  to the foul condensate and has reported a reduction in odor at the WWTP.

-			
Day of Study	$H_2S$	MeSH	DMS
1	26.1	67.3	-20.8
2	68.3	74.7	16.5
3	38.1	57.0	1.9
4	36.4	60.0	2.6
5	25.3	63.8	-19.5
Average	38.8	64.6	-3.86

 Table 5.1
 Percent Reduction in Hydrogen Sulfide, Methyl Mercaptan, and Dimethyl Sulfide during a Peroxide Addition Trial Conducted in a Foul Condensate

# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION BASELINE ACTUAL EMISSIONS

## May/July 2022 Baseline Emissions Calculations H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

		Method: GC/SCD Reduced Sulfur Analysis (Average)			erage)
Sample Date	Sample Location	ALS H2S, ppb	ALS DMDS, ppb	ALS DMS, ppb	ALS MMC, ppb
2021/2022	Avg. ASB Influent (2021 and 2022)	252	86.78	199	2.60
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	105,667	6,633	14,667	8,267
5/17/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1,057	14,647	1,467	82.67
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	58,333	5,633	5,400	3,900
7/19/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	583	9,414	540	39.00
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	76,200	6,932	7,140	7,393
7/20/2022	Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	762	14,099	714	73.93
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	62,500	8,967	9,200	6,533
7/21/2022	Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	625	15,300	920	65.33
		ALS H2S, ppm	ALS DMDS, ppm	ALS DMS, ppm	ALS MMC, ppm
	Avg. Foul Condensate Concentration (after peroxide)	0.76	13.36	0.91	0.07
Flow Weight Average	Avg. ASB Inlet Concentration	0.25	0.09	0.20	2.60E-03
Loading Calculation	Avg. Hardpipe Flow, MGD	0.34			
0	Avg. ASB Inlet Flow, MGD	23.96			
	Flow Maight Avg Loading (nnm)	24.50	0 2712	0.2088	0.0035
	Flow Weight. Avg. Loading (ppin)	0.2593	0.2712	0.2088	0.0035
	H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
	ASB Zone 1		0.10	0.15	2.74E-03
Results and Emissions	ASB Zone 2	Multiple	1.43E-03	3.05E-03	4.63E-05
Factors Calculation	ASB Zone 3	H2SSIM runs.	2.57E-05	1.01E-04	1.43E-06
	I otal ASB		0.10	0.16	2.78E-03
	Baseline Emissions Factor 2200 ODTP/day	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
	Baseline Emissions Factor	1.51E-02	1.14E-02	1.85E-02	3.28E-04

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 8 5 Humidity of inlet air (%) 40 9 25 6 Temperature of air (C) 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 .006 14 friction factor gas 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 41 COMPOUND: DIMETHYL DISULFIDE 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 52 9 Impeller diameter (cm) 49.53 53 10 Impeller rotation (RPM) 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

vp= 45.945 mmHg (0.88868 psia) 65 hl= 0.001714 atm-m3/mol 66 95.2 y/x 67 0.068011 g/L gas per g/L liquid 68 Temperature adjustment factor = 1.046 ^(T-25), deg. C 69 dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s k1=0. L/g-hrCompound flow rate from inlet water is 0.26179 g/s. 70 71 Compound flow rate from inlet vent is 0. g/s. 72 Compound flow rate from inlet duct is 0. g/s. 73 Submerged aeration rate from inlet vent is 0. m3/s. 74 Total submerged aeration is 0. m3/s. 75 The residence time in the unit is 31.792 hr. 76 Biomass production 77 The biomass production rate is 0.mg/hr. (0. mg/L) 78 The fraction dissolved solids converted is 0. . 79 The estimated biomass exit concentration is 0. mg/L. 80 \_Quiescent wind shear surface\_\_\_Springer\_ The fetch to depth ratio is 237.766. 81 kl is estimated as 5.971e-06 m/s. 82 kg is estimated as 0.005598 m/s. Model: 2 83 kg is estimated as 0.005598 m/s. Model: 2 84 85 The Schmidt number is 1.70412. 86 The friction velocity is 37.398 m/s 87 kg is estimated as 0.012927 m/s. Model: 3 88 Agitated surface 89 The rotation speed is 125.654 radians per second. 90 The rotation factor NRW is 2.052e+06. 91 The power number NPR is 7.881e-04. 92 The rotation factor NFR is 797.027. 93 kg (agitated) is estimated as 0.11564 m/s. 94 kl (agitated) is estimated as 0.017486 m/s. 95 The specified and growth biomass is 0.3 g/L. 96 The effective KL (surface + diffused air) is 2.753e-04 m/s. 97 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254 hrs.) 98 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 99 The ratio of the mixing to the striping (surface + diffused air) is 0. 100 The mean residence time is 1907.493 min. (31.792 hr.) 101 The ratio of the pump mixing to the residence time is 0. 102 KG aerated (m/s) 0.11781 103 0.017486 KL aerated (m/s) 104 KL OVERALL AERATED (m/s) 0.005609 105 KG quiescent (m/s) 0.005703 106 KL quiescent (m/s) 5.971e-06 107 KL OVERALL QUIESCENT (m/s) 5.883e-06 108 KL OVERALL (m/s) 2.753e-04 109 air stripping time constant (min) 84.752 110 FRACTION SURFACE VOLATILIZED 0.36432 111 FRACTION SUBMERGED VOLATILIZED 0. 112 0.36432 TOTAL FRACTION VOLATILIZED 113 FRACTION BIOLOGICALLY REMOVED 0.61949 114 FRACTION ABSORBED Ο. 115 TOTAL AIR EMISSIONS (g/s) 0.095374 116 3.00772 (Mg/year) 117 EMISSION FACTOR (g/cm2-s) 1.096e-10 118 UNIT EXIT CONCENTRATION (ppmw) 0.003981 119 DETAILED CALCULATIONS at Unit 12 def.system exit st 120 Type: system exit stream 121 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 122 COMPOUND: DIMETHYL DISULFIDE 123 124 Type of unit is system exit stream 125 1 Description of unit 12 def.system exit st 126 127 TOTAL AIR EMISSIONS (g/s) 0.

12.8 (Mg/year) 0. 129 EMISSION FACTOR (g/cm2-s) 1.096e-10 130 UNIT EXIT CONCENTRATION (ppmw) 6.079e-06 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 134 COMPOUND: DIMETHYL DISULFIDE 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 144 8 Subsurface entrance=1 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 Ο 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1064.53 l/s. Weight fraction down is 2.712E-07 156 157 Gas concentration in 0 mol fraction. 158 Gas flow 1064.53 L/s 159 Weight fraction out at base of drop is 2.459166666343852E-07 160 fraction transferred in the drain drop from hub is .093228 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.093228 fraction loss in unit 165 Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 3.134e-19 171 mol fract. headspace vent base 6.978e-06 172 headspace flow out vent (cc/s) -1.065e+06 headspace flow down line (cc/s) 173 1.065e+06 174 KG surface (m/s) 1860.422 175 KL surface (m/s) 6.37e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.2887 178 total component into unit, g/s 0.26179 179 TOTAL AIR EMISSIONS (g/s) 0.026915 180 0.84879 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 1.096e-10 182 UNIT EXIT CONCENTRATION (ppmw) 0.24592 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 186 COMPOUND: DIMETHYL DISULFIDE 187

188Type of unit is aerated biotreatment1891 Description of unit17ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
210
               hl= 0.00141 atm-m3/mol
                                         vp= 37.814 mmHg (0.7314 psia)
211
                   78.352 y/x
212
                    0.056726 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
214
               kl = 0. L/g-hr
                                       dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
215
            Compound flow rate from inlet water is 1.411e-04 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.785 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 5.918e-06 m/s.
228
            kg is estimated as 0.005575 m/s. Model: 2
229
            kg is estimated as 0.005575 m/s. Model: 2
230
            The Schmidt number is 1.74436.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.012742 m/s. Model: 3
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.1143 m/s.
239
            kl (agitated) is estimated as 0.015772 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 5.972e-05 m/s.
242
             The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
             hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 1007.112 min. (16.785 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                         0.11644
               KL aerated (m/s)
248
                                                          0.015772
249
               KL OVERALL AERATED (m/s)
                                                         0.004711
250
               KG quiescent (m/s)
                                                         0.005679
251
               KL quiescent (m/s)
                                                         5.918e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         5.813e-06
253
               KL OVERALL (m/s)
                                                         5.972e-05
254
               air stripping time constant (min)
                                                         253.944
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B-33

255	FRACTION SURFACE VOLATILIZED	0.18189
256	FRACTION SUBMERGED VOLATILIZED	0.
257	TOTAL FRACTION VOLATILIZED	0.18189
258	FRACTION BIOLOGICALLY REMOVED	0.77225
259	FRACTION ABSORBED	0.
260	TOTAL AIR EMISSIONS (g/s)	2.567e-05
261	(Mg/vear)	8 094e-04
262	FMISSION FACTOR (a/cm2-s)	3 631e - 14
262	INIT EVIT CONCENTRATION (DOMMA)	6.0702.06
203	DEMALTED CALCULATION (PPINW)	0.079E-00
204	DETAILED CALCULATIONS at UNIT 18 ASB	zone z
265	Type: aerated blotreatment	
266		
	WWTP\BAE\TRS\	WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08
267	COMPOUND: DIMETHYL DISULFIDE	
268		
269	Type of unit is aerated biotreatment	
270	1 Description of unit	18 ASB Zone 2
271	2 Wastewater temperature (C)	32.08
272	3 length of aeration unit (m)	368
273	4 width of aeration unit (m)	184
274	5 depth of aeration unit (m)	0.97
275	6 Area of agitation (each aerator.m2	) 135
276	7 Total number of agitators in the u	nit. 15
273	8 Power of agitation (each aerator H	D) 75
277	9 Impeller diameter (cm)	10 52
270	10 Impeller retation (DDM)	1200
279	10 Imperier rotation (RPM)	1200
280	11 Agitator mechanical efficiency	0.83
281	12 aerator effectiveness, alpha	0.83
282	13 if there is plug flow, enter 1	0
283	14 Overall biorate (mg/g bio-hr)	19
284	15 Aeration air flow (m3/s)	0
285	16 active biomass, aeration (g/l)	0.3
286	17 If covered, then enter 1	0
287	18 special input	0
288	19 pH (enter 0 for no pH adjustment	) 7.24
289		
290	Properties of DIMETHYL DISULFIDE at	32.1 deg.C (89.7 deg.F)
291	$h_{1} = 0.001558 \text{ atm} - m_3/m_01$ $v_{1} = 0.001558 \text{ atm} - m_3/m_01$	41 785  mmHg (0.80821  psia)
292	86 579 v/x	
202	0.062258  g/L and per g/L light	id
201	Temperature adjustment factor = 1	$10$ $(\pi_2 25)$ dog C
294	$\frac{1}{1-0} = \frac{1}{2} \sqrt{2}$	(1-25), $(1-25)$ , $(1-2$
295	$KI = 0. L/g - IIr \qquad dI = 1.034e$	-05  Cm2/S $av = 0.08/022  Cm2/S$
296	Compound flow rate from inlet water	1s 0.004238 g/s.
297	Compound flow rate from inlet vent is	s U. g/s.
298	Compound flow rate from inlet duct is	s 0. g/s.
299	Submerged aeration rate from inlet ve	ent is O. m3/s.
300	Total submerged aeration is 0. m3/s.	
301	The residence time in the unit is 17	.139 hr.
302	Biomass production	
303	The biomass production rate is 0	.mg/hr. (0. mg/L)
304	The fraction dissolved solids con	nverted is 0
305	The estimated biomass exit concer	ntration is 0. mg/L.
306	Ouiescent wind shear surface	Springer
307	The fetch to depth ratio is 302 703	1 3.1
308	kl is estimated as 5 945e-06 m/s	
309	ka is estimated as 0.005622 m/s.	del: 2
310	ka is patimated as 0.0000000 m/s. Mod	
211	The Cohmidt number is $1 - 20271$	
311 210	The Schuldt number is $1./23/1$ .	
3⊥Z	The friction velocity is 37.398 m/s	1.1. 2
313	kg is estimated as 0.012836 m/s. Mod	del: 3
314	Agitated surface	
315	The rotation speed is 125.654 radian	s per second.
316	The rotation factor NRW is 2.052e+06	
317	The power number NPR is 7.881e-04.	
318	The rotation factor NFR is 797.027.	
	R-34	
	D Off	

319	kg (agitated)is estimated as 0.11498 m/s.			
320	(agitated)is estimated as 0.016622 m/s.			
321	The specified and growth biomass is $0.3 \text{ g/L}$			
322	The effective KL (surface + diffused air)	The effective KL (surface + diffused air) is $1.598e-04 \text{ m/s}$		
323	The effective stripping time (surface + di	ffused air) is 101.198 minutes.		
	(1.68663 hrs.)	,,,,		
324	The pump mixing time is 5 x the pumping re	circulaion time, 0. min.		
325	The ratio of the mixing to the striping (s	urface + diffused air) is 0.		
326	The mean residence time is 1028.32 min. (1	7.139 hr.)		
327	The ratio of the pump mixing to the reside	nce time is 0.		
328	KG aerated (m/s)	0.11714		
329	KL aerated (m/s)	0.016622		
330	KL OVERALL AERATED (m/s)	0.005152		
331	KG quiescent (m/s)	0.005738		
332	KL quiescent (m/s)	5.945e-06		
333	KL OVERALL QUIESCENT (m/s)	5.85e-06		
334	KL OVERALL (m/s)	1.598e-04		
335	air stripping time constant (min)	101.198		
336	FRACTION SURFACE VOLATILIZED	0.33837		
337	FRACTION SUBMERGED VOLATILIZED	0.		
338	TOTAL FRACTION VOLATILIZED	0.33837		
339	FRACTION BIOLOGICALLY REMOVED	0.62833		
340	FRACTION ABSORBED	0.		
341	TOTAL AIR EMISSIONS (g/s)	0.001434		
342	(Mg/year)	0.045218		
343	EMISSION FACTOR (g/cm2-s)	2.118e-12		
344	UNIT EXIT CONCENTRATION (ppmw)	1.326e-04		
345				

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 .006 14 friction factor gas 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 19 design branch line fraction full .4 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 53 11 Agitator mechanical efficiency 0.83 54 55 12 aerator effectiveness, alpha 0.83 56 0 13 if there is plug flow, enter 1 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 0.3 59 16 active biomass, aeration (g/l)17 If covered, then enter 1 60 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

65 hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia) 66 162.463 y/x 67 0.11606 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C 68 69 dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s k1=0. L/q-hrCompound flow rate from inlet water is 0.19189 g/s. 70 71 Compound flow rate from inlet vent is 0. g/s. 72 Compound flow rate from inlet duct is 0. g/s. 73 Submerged aeration rate from inlet vent is 0. m3/s. 74 Total submerged aeration is 0. m3/s. 75 The residence time in the unit is 31.792 hr. 76 Biomass production 77 The biomass production rate is 0.mg/hr. (0. mg/L) 78 The fraction dissolved solids converted is 0. . 79 The estimated biomass exit concentration is 0. mg/L. 80 \_Quiescent wind shear surface\_\_\_Springer\_ The fetch to depth ratio is 237.766. 81 kl is estimated as 7.634e-06 m/s. 82 kg is estimated as 0.007917 m/s. Model: 2 83 kg is estimated as 0.007917 m/s. Model: 2 84 85 The Schmidt number is 1.01591. 86 The friction velocity is 37.398 m/s 87 kg is estimated as 0.017873 m/s. Model: 3 88 Agitated surface 89 The rotation speed is 125.654 radians per second. 90 The rotation factor NRW is 2.052e+06. 91 The power number NPR is 7.881e-04. 92 The rotation factor NFR is 797.027. 93 kg (agitated) is estimated as 0.14978 m/s. 94 kl (agitated) is estimated as 0.021024 m/s. 95 The specified and growth biomass is 0.3 g/L. 96 The effective KL (surface + diffused air) is 4.77e-04 m/s. 97 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526 hrs.) 98 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 99 The ratio of the mixing to the striping (surface + diffused air) is 0. 100 The mean residence time is 1907.493 min. (31.792 hr.) 101 The ratio of the pump mixing to the residence time is 0. 102 KG aerated (m/s) 0.15258 103 0.021024 KL aerated (m/s) 104 KL OVERALL AERATED (m/s) 0.009769 105 KG quiescent (m/s) 0.008066 106 KL quiescent (m/s) 7.634e-06 107 KL OVERALL QUIESCENT (m/s) 7.574e-06 108 KL OVERALL (m/s) 4.77e-04 109 air stripping time constant (min) 48.915 110 FRACTION SURFACE VOLATILIZED 0.80226 111 FRACTION SUBMERGED VOLATILIZED 0. 112 0.80226 TOTAL FRACTION VOLATILIZED 113 FRACTION BIOLOGICALLY REMOVED 0.17717 114 FRACTION ABSORBED Ο. 115 TOTAL AIR EMISSIONS (g/s) 0.15394 116 4.85471 (Mg/year) 117 EMISSION FACTOR (g/cm2-s) 1.769e-10 118 UNIT EXIT CONCENTRATION (ppmw) 0.003708 119 DETAILED CALCULATIONS at Unit 12 def.system exit st 120 Type: system exit stream 121 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 122 COMPOUND: DIMETHYL SULFIDE (DMS) 123 124 Type of unit is system exit stream 125 1 Description of unit 12 def.system exit st 126 127 TOTAL AIR EMISSIONS (g/s) 0.

Ο. 12.8 (Mg/year) 129 EMISSION FACTOR (g/cm2-s) 1.769e-10 130 UNIT EXIT CONCENTRATION (ppmw) 1.362e-05 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 134 COMPOUND: DIMETHYL SULFIDE (DMS) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (l/s) 139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1064.53 l/s. Weight fraction down is 2.088E-07 156 157 Gas concentration in 0 mol fraction. 158 Gas flow 1064.53 L/s 159 Weight fraction out at base of drop is 1.80253671574623E-07 160 fraction transferred in the drain drop from hub is .136716 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.13672 165 fraction loss in unit Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 4.509e-19 171 mol fract. headspace vent base 1.195e-05 172 headspace flow out vent (cc/s) -1.065e+06 headspace flow down line (cc/s) 173 1.065e+06 174 KG surface (m/s) 2626.947 175 KL surface (m/s) 8.245e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.22227 178 total component into unit, g/s 0.19189 179 TOTAL AIR EMISSIONS (g/s) 0.030388 180 0.95833 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 1.769e-10 182 UNIT EXIT CONCENTRATION (ppmw) 0.18025 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) 186 187 188 Type of unit is aerated biotreatment

189 1 Description of unit

17

ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
            13 if there is plug flow, enter 1
201
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
210
               hl= 0.002519 atm-m3/mol
                                           vp= 606.985 mmHg (11.74 psia)
211
                   139.945 y/x
212
                   0.10132 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 (T-25), deg. C
213
214
               kl = 0. L/g-hr
                                       dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
215
            Compound flow rate from inlet water is 1.708e-04 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.785 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                   _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.566e-06 m/s.
228
            kg is estimated as 0.007884 m/s. Model: 2
229
            kg is estimated as 0.007884 m/s. Model: 2
230
            The Schmidt number is 1.03989.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.017611 m/s. Model: 3
232
                   Agitated surface
233
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.14804 m/s.
239
            kl (agitated) is estimated as 0.018962 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.053e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 144.073 minutes.
             (2.40122 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 1007.112 min. (16.785 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                         0.15081
               KL aerated (m/s)
248
                                                          0.018962
249
               KL OVERALL AERATED (m/s)
                                                         0.00854
250
               KG quiescent (m/s)
                                                         0.008032
251
               KL quiescent (m/s)
                                                         7.566e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.497e-06
253
               KL OVERALL (m/s)
                                                         1.053e-04
254
               air stripping time constant (min)
                                                         144.073
```

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255	FRACTION SURFACE VOLATILIZED 0.59355	
256	FRACTION SUBMERGED VOLATILIZED 0.	
257	TOTAL FRACTION VOLATILIZED 0.59355	
258	FRACTION BIOLOGICALLY REMOVED 0.32154	
259	FRACTION ABSORBED 0.	
260	TOTAL AIR EMISSIONS $(q/s)$ 1 014e-04	
261	(Mg/year) 0.003197	
262	$(\operatorname{Hg})_{\mathcal{F}}(\operatorname{and}) = 0.00177$	
202	$\frac{1}{2620} = \frac{1}{2620} = 1$	
203	DEMAILED GALGULANTONG at Unit 10 AGD Rame 2	
264	DETAILED CALCULATIONS at UNIT 18 ASB ZONE Z	
265	Type: aerated blotreatment	
266		
		10.10.10
267	WWIP BAE (IRS WAIER9 ASB VS 3/14/2023 2.1/.21 PM	19.10.12
207	COMPOUND: DIMETHIE SOLFIDE (DMS)	
268		
269	Type of unit is aerated biotreatment	
270	1 Description of unit 18 ASB Zone 2	
271	2 Wastewater temperature (C) 32.08	
272	3 length of aeration unit (m) 368	
273	4 width of aeration unit (m) 184	
274	5 depth of aeration unit (m) 0.97	
275	6 Area of agitation (each aerator,m2) 135	
276	7 Total number of agitators in the unit 15	
277	8 Power of agitation (each aerator, HP) 75	
278	9 Impeller diameter (cm) 49.53	
279	10 Impeller rotation (RPM) 1200	
280	11 Agitator mechanical efficiency 0.83	
200	12 apartor offortiveness alterna 0.83	
201	12 defator effectivelless, alpha 0.05	
202	14 Ourseally bisects (mg/g bis ba)	
283	14 Overall blorate (mg/g blo-nr)	
284	15 Aeration air flow (m3/s) 0	
285	16 active biomass, aeration $(g/1)$ 0.3	
286	17 If covered, then enter 1 0	
287	18 special input 0	
288	19 pH (enter 0 for no pH adjustment) 7.24	
289		
290	Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F)	
291	hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia)	
292	151.062 y/x	
293	0.10863 g/L gas per g/L liquid	
294	Temperature adjustment factor = $1.046 (T-25)$ , deg. C	
295	kl = 0, $L/g-hr$ $dl = 1.495e-05$ cm2/s $dv = 0.14597$ cm2/s	
296	Compound flow rate from inlet water is 0 003948 g/s	
297	Compound flow rate from inlet went is 0 g/s.	
207	Compound flow rate from inlet dust is 0. g/s.	
200	Submarged asystics rate from inlet up t is $0 - m^2/a$	
299	Total submarged acretion is 0 m2/s.	
300	Total submerged defation is 0. $m_2/s$ .	
301	The residence time in the unit is 17.139 hr.	
302	Blomass production	
303	The biomass production rate is 0.mg/hr. (0. mg/L)	
304	The fraction dissolved solids converted is 0	
305	The estimated biomass exit concentration is 0. mg/L.	
306	Quiescent wind shear surfaceSpringer_	
307	The fetch to depth ratio is 302.703.	
308	kl is estimated as 7.6e-06 m/s.	
309	kg is estimated as 0.007966 m/s. Model: 2	
310	kg is estimated as 0.007966 m/s. Model: 2	
311	The Schmidt number is 1.02758.	
312	The friction velocity is 37 398 m/s	
313	kg is estimated as $0.017744 \text{ m/s}$ Model: 3	
314	Agitated gurface	
215	The rotation group is 125 654 radians nor accord	
216	The rotation factor NDW is $2.054$ fautalls per second.	
310 217	The neuron number NDD is $7.991 \times 04$	
J⊥/	The power number NPR is $7.881e-04$ .	
378	The rotation factor NFR is 797.027.	

319 kg (agitated) is estimated as 0.14892 m/s. 320 kl (agitated) is estimated as 0.019984 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 2.809e-04 m/s. 323 The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 1028.32 min. (17.139 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.15171 329 KL aerated (m/s) 0.019984 330 KL OVERALL AERATED (m/s) 0.009148 331 KG quiescent (m/s) 0.008115 332 KL quiescent (m/s) 7.6e-06 333 KL OVERALL QUIESCENT (m/s) 7.537e-06 334 KL OVERALL (m/s) 2.809e-04 335 air stripping time constant (min) 57.552 FRACTION SURFACE VOLATILIZED 336 0.77311 FRACTION SUBMERGED VOLATILIZED 337 Ο. 0.77311 338 TOTAL FRACTION VOLATILIZED 0.18362 339 FRACTION BIOLOGICALLY REMOVED 340 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 0.003052 341 342 0.096247 (Mg/year) 343 EMISSION FACTOR (q/cm2-s) 4.507e-12 344 UNIT EXIT CONCENTRATION (ppmw) 1.605e-04 345

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 8 5 Humidity of inlet air (%) 40 9 25 6 Temperature of air (C) 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 9 Conduit air velocity (ft/min) 12 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 52 9 Impeller diameter (cm) 49.53 53 10 Impeller rotation (RPM) 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ω 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

65 hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia) 66 230.99 y/x 67 0.16502 g/L gas per g/L liquid 68 Temperature adjustment factor = 1.046 ^(T-25), deg. C 69 dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s k1=0. L/q-hrCompound flow rate from inlet water is 0.003078 g/s. 70 71 Compound flow rate from inlet vent is 0. g/s. 72 Compound flow rate from inlet duct is 0. g/s. 73 Submerged aeration rate from inlet vent is 0. m3/s. 74 Total submerged aeration is 0. m3/s. 75 The residence time in the unit is 31.792 hr. 76 Biomass production 77 The biomass production rate is 0.mg/hr. (0. mg/L) 78 The fraction dissolved solids converted is 0. . 79 The estimated biomass exit concentration is 0. mg/L. 80 \_Quiescent wind shear surface\_\_\_Springer\_ The fetch to depth ratio is 237.766. 81 kl is estimated as 7.703e-06 m/s. 82 kg is estimated as 0.010871 m/s. Model: 2 83 kg is estimated as 0.010871 m/s. Model: 2 84 85 The Schmidt number is 0.63285. 86 The friction velocity is 37.398 m/s 87 kg is estimated as 0.024173 m/s. Model: 3 88 Agitated surface 89 The rotation speed is 125.654 radians per second. 90 The rotation factor NRW is 2.052e+06. 91 The power number NPR is 7.881e-04. 92 The rotation factor NFR is 797.027. 93 kg (agitated) is estimated as 0.18977 m/s. 94 kl (agitated) is estimated as 0.021167 m/s. 95 The specified and growth biomass is 0.3 g/L. 96 The effective KL (surface + diffused air) is 6.265e-04 m/s. 97 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071 hrs.) 98 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 99 The ratio of the mixing to the striping (surface + diffused air) is 0. 100 The mean residence time is 1907.493 min. (31.792 hr.) 101 The ratio of the pump mixing to the residence time is 0. 102 KG aerated (m/s) 0.19332 103 0.021167 KL aerated (m/s) 104 KL OVERALL AERATED (m/s) 0.012876 105 KG quiescent (m/s) 0.011075 106 7.703e-06 KL quiescent (m/s) 107 KL OVERALL QUIESCENT (m/s) 7.672e-06 108 KL OVERALL (m/s) 6.265e-04 109 air stripping time constant (min) 37.242 110 FRACTION SURFACE VOLATILIZED 0.88891 111 FRACTION SUBMERGED VOLATILIZED 0. 112 TOTAL FRACTION VOLATILIZED 0.88891 113 FRACTION BIOLOGICALLY REMOVED 0.093739 114 FRACTION ABSORBED Ο. 115 TOTAL AIR EMISSIONS (g/s) 0.002736 116 0.086272 (Mg/year) 117 EMISSION FACTOR (g/cm2-s) 3.144e-12 118 UNIT EXIT CONCENTRATION (ppmw) 5.017e-05 119 DETAILED CALCULATIONS at Unit 12 def.system exit st 120 Type: system exit stream 121 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 122 COMPOUND: METHANETHIOL(methyl mercaptan) 123 124 Type of unit is system exit stream 125 1 Description of unit 12 def.system exit st 126 127 TOTAL AIR EMISSIONS (g/s) 0.

12.8 (Mg/year) 0. 129 EMISSION FACTOR (g/cm2-s) 3.144e-12 130 UNIT EXIT CONCENTRATION (ppmw) 1.458e-07 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 134 COMPOUND: METHANETHIOL(methyl mercaptan) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (l/s) 139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 Ο 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1064.53 l/s. 156 Weight fraction down is 3.5E-09 157 Gas concentration in 0 mol fraction. 158 Gas flow 1064.53 L/s 159 Weight fraction out at base of drop is 2.89099406807993E-09 160 fraction transferred in the drain drop from hub is .174002 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.174 fraction loss in unit 165 Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 9.429e-21 171 mol fract. headspace vent base 3.292e-07 172 headspace flow out vent (cc/s) -1.065e+06 headspace flow down line (cc/s) 173 1.065e+06 174 KG surface (m/s) 3602.086 175 KL surface (m/s) 8.324e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.003726 178 total component into unit, g/s 0.003078 179 TOTAL AIR EMISSIONS (g/s) 6.483e-04 180 0.020445 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 3.144e-12 0.002891 182 UNIT EXIT CONCENTRATION (ppmw) DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 186 COMPOUND: METHANETHIOL(methyl mercaptan) 187

- 188 Type of unit is aerated biotreatment
- 189 1 Description of unit

17

ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
210
               hl= 0.003687 atm-m3/mol
                                          vp= 2014.774 mmHg (38.97 psia)
211
                   204.826 y/x
212
                   0.14829 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deq. C
214
               kl = 0. L/g-hr
                                       dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
215
            Compound flow rate from inlet water is 1.957e-06 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.785 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                   _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.635e-06 m/s.
228
            kg is estimated as 0.010826 m/s. Model: 2
229
            kg is estimated as 0.010826 m/s. Model: 2
230
            The Schmidt number is 0.64779.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.023814 m/s. Model: 3
232
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.18756 m/s.
239
            kl (agitated) is estimated as 0.019092 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.391e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 109.038 minutes.
             (1.81731 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 1007.112 min. (16.785 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                         0.19108
               KL aerated (m/s)
248
                                                          0.019092
249
               KL OVERALL AERATED (m/s)
                                                         0.011483
250
               KG quiescent (m/s)
                                                         0.011029
251
               KL quiescent (m/s)
                                                         7.635e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.6e-06
253
               KL OVERALL (m/s)
                                                         1.391e-04
254
               air stripping time constant (min)
                                                         109.038
```

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255	FRACTION SURFACE VOLATILIZED 0.7324	
256	FRACTION SUBMERGED VOLATILIZED 0.	
257	TOTAL FRACTION VOLATILIZED 0.7324	
258	FRACTION BIOLOGICALLY REMOVED 0.1883	
259	FRACTION ABSORBED 0.	
260	TOTAL AIR EMISSIONS (q/s) 1.433e	-06
261	(Mg/year) 4.52e-	05
262	EMISSION FACTOR (g/cm2-s) 2.028e	-15
263	$\frac{1}{458e}$	-07
264	DETAILED CALCULATIONS at Unit 18 ASB Zone 2	
265	Type: aerated biotreatment	
266		
200		
	WWTP\BAE\TRS\WATER9\ASB_V5	3/14/2023 2:17:21 PM 19:18:53
267	COMPOIND: METHANETHIOL(methyl mercaptan)	0, 11, 2020 2 2, 22 111 2, 20 00
268		
269	Type of unit is aerated biotreatment	
270	1 Description of unit 18 A	SB Zone 2
271	2 Wastewater temperature (C)	2 08
271	3 length of peration unit (m)	68
272	4 width of coration unit (m) 1	0.0
273	4 width of aeration unit $(m)$	07
274	6 Average of a mitation (mark a subtraction m2)	. <i>91</i>
275	6 Area of agitation (each aerator, m2)	35
276	/ Total number of agitators in the unit	5
2.7.7	8 Power of agitation (each aerator, HP) 7	5
278	9 Impeller diameter (cm) 4	9.53
279	10 Impeller rotation (RPM) 1	200
280	11 Agitator mechanical efficiency 0	.83
281	12 aerator effectiveness, alpha 0	.83
282	13 if there is plug flow, enter 1 0	
283	14 Overall biorate (mg/g bio-hr) 1	9
284	15 Aeration air flow (m3/s) 0	
285	16 active biomass, aeration (g/l) 0	.3
286	17 If covered, then enter 1 0	
287	18 special input 0	
288	19 pH (enter 0 for no pH adjustment) 7	.24
289		
290	Properties of METHANETHIOL(methyl mercaptan) at 32	.1 deg.C (89.7 deg.F)
291	hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg	(41.446 psia)
292	217.838 v/x	· • • ·
293	0.15664 g/L gas per g/L liquid	
294	Temperature adjustment factor = $1.046 (T-25)$ .	deg. C
295	$k_{1} = 0$ $L/a - hr$ $d_{1} = 1$ 515e-05 cm2/s $dy = 1$	$0.23433 \text{ cm}^2/\text{s}$
296	Compound flow rate from inlet water is 5 341e-05 g	
290	Compound flow rate from inlet water is 0. g/g	/5.
207	Compound flow rate from inlet dust is 0. g/s.	
200	Submorged coration rate from inlet went is 0 m <sup>2</sup> /g	
299	Submerged aeracion rate from fintet vent is 0. $m_2/a$	•
201	The regidence time in the unit is 17 120 hr	
301 202	Diemona muchanien	
302	BIOMASS production	
303	The blomass production rate is U.mg/hr. (U. mg	·/ L )
304	The fraction dissolved solids converted is 0.	•
305	The estimated biomass exit concentration is 0.	mg/L.
306	Quiescent wind shear surfaceSpringer_	
307	The fetch to depth ratio is 302.703.	
308	kl is estimated as 7.67e-06 m/s.	
309	kg is estimated as 0.010938 m/s. Model: 2	
310	kg is estimated as 0.010938 m/s. Model: 2	
311	The Schmidt number is 0.64013.	
312	The friction velocity is 37.398 m/s	
313	kg is estimated as 0.023996 m/s. Model: 3	
314	Agitated surface	
315	The rotation speed is 125.654 radians per second.	
316	The rotation factor NRW is 2.052e+06.	
317	The power number NPR is 7.881e-04.	
318	The rotation factor NFR is 797.027.	
319 kg (agitated) is estimated as 0.18868 m/s. 320 kl (agitated) is estimated as 0.020121 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 3.715e-04 m/s. 323 The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 1028.32 min. (17.139 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.19222 329 KL aerated (m/s) 0.020121 0.012174 330 KL OVERALL AERATED (m/s) 331 KG quiescent (m/s) 0.011143 332 KL quiescent (m/s) 7.67e-06 333 KL OVERALL QUIESCENT (m/s) 7.637e-06 334 KL OVERALL (m/s) 3.715e-04 335 air stripping time constant (min) 43.518 FRACTION SURFACE VOLATILIZED 336 0.86584 FRACTION SUBMERGED VOLATILIZED 337 Ο. 0.86584 338 TOTAL FRACTION VOLATILIZED 0.097514 339 FRACTION BIOLOGICALLY REMOVED 340 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 4.625e-05 341 342 0.001458 (Mg/year) 343 EMISSION FACTOR (q/cm2-s) 6.83e-14 344 UNIT EXIT CONCENTRATION (ppmw) 1.838e-06 345

#### BAE H2S Factor Summary of H2SSIM Inputs and Outputs

		H2SSI	M Inputs		Windspee	d: 3.55	mph		H2SSIM Outputs	6	
5/17/202	2										
	50	Zone 1	Zone 2	Zone 3			Line de la constitución		Zone 1 Zon	e 2 Zone 3	Total ASB
	DO	1.5	4.63	3 4.66 80.10	Flow	Main Inlet	Hardpipe Units	H2S g/s	0.07 0	0.02 0.02	0.111 g/s
	remp	67.52	2 03.91	00.19	FIUW Total Sulfida	25.11	0.35 MGD				
	p <b>∺</b> Longth	0.71	7.18	<i>1 1 1 1 1 1 1 1 1 1</i>	Total Sullide	0.060	1.06 mg/L				0.012 ID/ODTP
	Length	900			Sullate	390	390 mg/L				
	Aoratore	300	D 004								
	Total UD	5 2221	I IC 5 1126	5 450							
7/10/202	101a1 HF	2323		430							
1/19/202	2	Zone 1	Zone 2	Zone 3					Zone 1 Zon	a 2 7 7 n n a 3	Total ASB
	DO	1.57	7 463	3 4 66		Main Inlet	Hardnine Units	H2S d/s			0 144 g/s
	Temp	96.27	7 93.37	7 89.26	Flow	25.32	0.42 MGD	1120 g/0	0.00	0.02	1900 ODTP
	ρΗ	7.17	7 7.37	7.48	Total Sulfide	0.921	0.583 mg/L				0.014 lb/ODTP
	Length	968	3 1208	3 1235	Sulfate	390	390 mg/L				
	Width	968	3 604	617							
	Aerators	31	1 15	5 6							
7/20/202	2										
		Zone 1	Zone 2	Zone 3					Zone 1 Zon	e 2 Zone 3	Total ASB
	DO	1.57	7 4.63	3 4.66		Main Inlet	Hardpipe Units	H2S g/s	0.06 (	0.03 0.02	0.111 g/s
	lemp	94.80	) 91.27	87.57	Flow	25.48	0.39 MGD				1900 ODTP
	рН	7.10	) 7.22	2 7.39	Total Sulfide	0.053	0.762 mg/L				0.011 Ib/ODTP
	Length	968	3 1208	3 1235	Suitate	390	390 mg/L				0.04
	vviath	968	3 604	+ 617							0.01
	Aerators	3	1 15	0							
7/21/202	2										
17217202	-	Zone 1	Zone 2	Zone 3					Zone 1 Zon	e 2 Zone 3	Total ASB
	DO	1.57	7 4.63	3 4.66		Main Inlet	Hardpipe Units	H2S a/s	0.06	0.03 0.02	0.111 a/s
	Temp	94.76	6 90.42	2 87.08	Flow	19.93	0.19 MGD				940 ODTP
	рН	7.10	7.19	7.35	Total Sulfide	0.094	0.625 mg/L				0.022 lb/ODTP
	Length	968	3 1208	3 1235	Sulfate	390	390 mg/L				
	Width	968	3 604	<b>617</b>			0				
	Aerators	31	1 15	5 6							
			*DO are b	ased on avera	age of all DO readings fro	m 2021 and 2	2022 Subpart S pe	erformance testing.	AVC	<b>:</b>	0.015 lb/ODTP

#### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification Data Type 5. Zone Physical and Chemical Conditions **Company Name** Zone 2 Zone 3 Zone 4 Units **Model Controls** New-Indy Zone Condition Zone 1 Facility Name **Dissolved Oxygen** 1.571780303 4.6275 4.659734848 mg/L Catawba SC Basin Name 87.52 Temperature 83.91 80.19 F Ŧ ASB Run H2SSIM 6.77 7.19 7.44 pН s.u. Data Type 2. Model Zone Information Number of Zones 3 -**Redox Condition** Aerobic 💻 Aerobic -Aerobic 🔻 Aerobic 🔻 View Zone Location of Parameters 1 feet Length 968 1208 1235 Ŧ Hardpipe ASB feet 968 604 617 Type of Basin -Width 1 Clear Input Sheet -Depth feet **Data Type 3. Load Characteristics** 4.5 3.2 3 Loading Main Moderat 🔻 Moderat -Moderat 🖛 Mixing Characteristics Influent Hardpipe Units MGD 🔻 Flow Number of Aerators 25.11 31 15 6 0.35 Total Sulfide 0.06 mg/L 🔫 Total Horsepower 2325 1125 450 HP 1.057 mg/L 🔫 feet Sulfate 390 Impellor Size 1.625 1.625 1.625 390 Impellor RPM 1200 1200 1200 RPM Data Type 4. Atmospheric Conditions mph 🔫 cms Ŧ Windspeed 3.55 Diffused Air Flow 0 0 0 Ambient F feet Ŧ 79 Ŧ Weir Height 0 0 0

Temperature

### **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7726.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.02	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4978.9	1486.3	1261.7		lbs/yr
Emission Flux (H <sub>2</sub> S)	25.9	9.9	8.1		gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	34.400	6.200	5.200		lbs/yr

Current Parameters				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	272.2			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

Percent Inlet Sulfide Removed -35.4%

### 5/17/2022

#### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification Data Type 5. Zone Physical and Chemical Conditions **Company Name** Zone 2 Zone 3 Zone 4 Units **Model Controls** New-Indy Zone Condition Zone 1 Facility Name **Dissolved Oxygen** 1.571780303 4.6275 4.659734848 mg/L Catawba SC Basin Name 96.27 Ŧ Temperature 93.37 89.26 F ASB Run H2SSIM 7.17 7.37 7.48 pН s.u. Data Type 2. Model Zone Information Number of Zones 3 -**Redox Condition** Aerobic 💻 Aerobic -Aerobic 🔻 Aerobic 🔻 View Zone Location of Parameters 1 feet Length 968 1208 1235 Ŧ Hardpipe ASB feet 968 604 617 Type of Basin -Width Ŧ Clear Input Sheet -Depth feet **Data Type 3. Load Characteristics** 4.5 3.2 3 Loading Main Moderat 🔻 Moderat -Moderat 🖛 Mixing Characteristics Influent Hardpipe Units MGD 🔻 Number of Aerators Flow 25.32 31 15 6 0.42 Total Sulfide 0.921 mg/L 🔫 Total Horsepower 2325 1125 450 HP 0.583 mg/L 🔫 feet Sulfate 390 Impellor Size 1.625 1.625 1.625 390 Impellor RPM 1200 1200 1200 RPM Data Type 4. Atmospheric Conditions mph 🔫 cms Ŧ Windspeed 3.55 Diffused Air Flow 0 0 0 Ambient F feet Ŧ 79 Ŧ Weir Height 0 0 0 Temperature

### **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.145	gms/s
Total Emissions (H <sub>2</sub> S)	10050.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	5.0	tons/yr
Total Emissions (H <sub>2</sub> S)	4.6	tonnes/yr
Emission Flux (H <sub>2</sub> S)	20.2	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.09	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	6430.8	1936.5	1683.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	33.5	13.0	10.8		gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.005	0.000	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	60.200	6.100	5.400		lbs/yr

Current Parameters					
kgen	0.25				
ThetaGen	1.06				
KDO	0.05				
KSO4	10				
kanox	0.006				
ThetaOx	1.05				
m	1				
n	0.2				
MLVSS	272.2				
O <sub>2</sub> Transfer Coeff.	2				
alpha 1	0.83				
alpha 2	0.6				

Percent Inlet Sulfide Removed 86.0%

### 7/19/2022

#### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification Data Type 5. Zone Physical and Chemical Conditions **Company Name** Zone 2 Zone 3 Zone 4 Units **Model Controls** New-Indy Zone Condition Zone 1 Facility Name **Dissolved Oxygen** 1.571780303 4.6275 4.659734848 mg/L Catawba SC Basin Name 94.8 91.27 -Run H2SSIM Temperature 87.57 F ASB 7.1 7.22 7.39 pН s.u. Data Type 2. Model Zone Information Number of Zones 3 -**Redox Condition** Aerobic 💌 Aerobic -Aerobic 🔻 Aerobic 🔻 View Zone Location of Parameters 1 feet Length 968 1208 1235 Ŧ Hardpipe ASB feet 968 604 617 Type of Basin -Width 1 Clear Input Sheet -Depth feet **Data Type 3. Load Characteristics** 4.5 3.2 3 Loading Main Moderat 🔻 Moderat -Moderat 🖛 Mixing Characteristics Influent Hardpipe Units MGD 🔻 Number of Aerators Flow 25.48 31 15 6 0.39 Total Sulfide 0.053 mg/L 🔫 Total Horsepower 2325 1125 450 HP 0.762 mg/L 🔫 feet Sulfate 390 Impellor Size 1.625 1.625 1.625 390 Impellor RPM 1200 1200 1200 RPM Data Type 4. Atmospheric Conditions mph 🔫 cms Ŧ Windspeed 3.55 Diffused Air Flow 0 0 0 Ambient F feet Ŧ 79 Ŧ Weir Height 0 0 0 Temperature

#### 7/20/2022

### **H2SSIM Results**

D . E		
Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7721.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4266.3	1852.9	1602.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	22.2	12.4	10.3		gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	26.800	6.300	5.600		lbs/yr

Current Parameters				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	272.2			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

Percent Inlet Sulfide Removed -54.1%

### 7/20/2022

#### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification Data Type 5. Zone Physical and Chemical Conditions **Company Name** Zone 2 Zone 3 Zone 4 Units **Model Controls** New-Indy Zone Condition Zone 1 Facility Name **Dissolved Oxygen** 1.571780303 4.6275 4.659734848 mg/L Catawba SC Basin Name 94.76 Temperature 90.42 87.08 F Ŧ ASB Run H2SSIM 7.1 7.19 7.35 pН s.u. Data Type 2. Model Zone Information Number of Zones 3 -**Redox Condition** Aerobic 💻 Aerobic -Aerobic 🔻 Aerobic 🔻 View Zone Location of Parameters 1 feet Length 968 1208 1235 Ŧ Hardpipe ASB feet 968 604 617 Type of Basin -Width Ŧ Clear Input Sheet -Depth feet **Data Type 3. Load Characteristics** 4.5 3.2 3 Loading Main Moderat 🔻 Moderat -Moderat 🖛 Mixing Characteristics Influent Hardpipe Units MGD 🔻 Number of Aerators Flow 19.93 31 15 6 0.19 Total Sulfide 0.094 mg/L 🔫 Total Horsepower 2325 1125 450 HP 0.625 mg/L 🔫 feet Sulfate 390 Impellor Size 1.625 1.625 1.625 390 Impellor RPM 1200 1200 1200 RPM Data Type 4. Atmospheric Conditions mph 🔫 cms Ŧ Windspeed 3.55 Diffused Air Flow 0 0 0 Ambient F feet Ŧ 79 Ŧ Weir Height 0 0 0 Temperature

#### 7/21/2022

### **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7700.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4305.7	1814.2	1580.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	22.4	12.1	10.1		gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	21.300	5.000	4.400		lbs/yr

Current Parameters		
kgen	0.25	
ThetaGen	1.06	
KDO	0.05	
KSO4	10	
kanox	0.006	
ThetaOx	1.05	
m	1	
n	0.2	
MLVSS	272.2	
O <sub>2</sub> Transfer Coeff.	2	
alpha 1	0.83	
alpha 2	0.6	

Percent Inlet Sulfide Removed -27.1%

### 7/21/2022

# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PROJECTED ACTUAL EMISSIONS

## New Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
No Hardpipe flow (foul or stripped)	N/A	N/A	N/A	N/A
ASB Influent (Wastewater)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.25	0.09	0.20	2.60E-03
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.03	0.15	2.13E-03
ASB Zone 2	0.03	5.03E-04	3.19E-03	3.77E-05
ASB Zone 3	0.02	9.42E-06	1.11E-04	1.22E-06
Total ASB	0.12	0.03	0.16	2.17E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, lb/ODTP
Total ASB	1.03E-02	2.81E-03	1.36E-02	1.88E-04

Hardpipe Flow (Foul or Stripped Condensate)	0	MGD
Post-Project ASB Influent Flow:	25.48	MGD
Total ASB Flow:	25.48	MGD
Total ASB Flow:	1116.47	L/s
Pulp Production	2200	ODTP/day
		N/1\A/

H2S	34
DMDS	94
DMS	62
MMC	48

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 8 40 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 .006 14 friction factor gas 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 41 COMPOUND: DIMETHYL DISULFIDE 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 53 1200 0.83 54 11 Agitator mechanical efficiency 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.001714 atm-m3/mol
                                            vp= 45.945 mmHg (0.88868 psia)
 66
                   95.2 y/x
 67
                   0.068011 g/L gas per g/L liquid
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.087838 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 30.325 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface____Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 5.971e-06 m/s.
 82
            kg is estimated as 0.005598 m/s. Model: 2
 83
            kg is estimated as 0.005598 m/s. Model: 2
 84
 85
            The Schmidt number is 1.70412.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.012927 m/s. Model: 3
 88
                   Agitated surface
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.11564 m/s.
 94
            kl (agitated) is estimated as 0.017486 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 2.753e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1819.519 min. (30.325 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.11781
103
                                                         0.017486
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.005609
105
               KG quiescent (m/s)
                                                         0.005703
106
               KL quiescent (m/s)
                                                         5.971e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         5.883e-06
108
               KL OVERALL (m/s)
                                                         2.753e-04
109
               air stripping time constant (min)
                                                         84.752
110
               FRACTION SURFACE VOLATILIZED
                                                         0.36393
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.36393
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.61912
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.031967
116
                                                         1.00811
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         3.673e-11
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.001334
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\New
              Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50
122
            COMPOUND: DIMETHYL DISULFIDE
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                               def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
                                              B-60
```

Ο. 12.8 (Mg/year) 129 EMISSION FACTOR (g/cm2-s) 3.673e-11 130 UNIT EXIT CONCENTRATION (ppmw) 2.231e-06 DETAILED CALCULATIONS at Unit 13 default open hub d 131 132 Type: open hub drain 133 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 134 COMPOUND: DIMETHYL DISULFIDE 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 143 7 Open surface=1 1 144 8 Subsurface entrance=1 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 17 municipal waste in conduit =1 0 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1116 l/s. 156 Weight fraction down is 8.680001E-08 157 Gas concentration in 0 mol fraction. 158 Gas flow 1116 L/s 159 Weight fraction out at base of drop is 7.87078550837274E-08 160 fraction transferred in the drain drop from hub is .093228 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.093228 165 fraction loss in unit 0. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 9.876e-20 171 mol fract. headspace vent base 2.233e-06 172 headspace flow out vent (cc/s) -1.116e+06 headspace flow down line (cc/s) 173 1.116e+06 174 KG surface (m/s) 1932.406 175 KL surface (m/s) 6.575e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.096869 178 total component into unit, g/s 0.087838 179 TOTAL AIR EMISSIONS (g/s) 0.009031 180 0.2848 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 3.673e-11 182 UNIT EXIT CONCENTRATION (ppmw) 0.078708 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 186 COMPOUND: DIMETHYL DISULFIDE 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
210
               hl= 0.00141 atm-m3/mol
                                         vp= 37.814 mmHg (0.7314 psia)
211
                   78.352 y/x
212
                    0.056726 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
213
214
               kl = 0. L/g-hr
                                       dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
215
            Compound flow rate from inlet water is 5.19e-05 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.011 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. \text{ mg/L}.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 5.918e-06 m/s.
228
            kg is estimated as 0.005575 m/s. Model: 2
229
            kg is estimated as 0.005575 m/s. Model: 2
230
            The Schmidt number is 1.74436.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.012742 m/s. Model: 3
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.1143 m/s.
239
            kl (agitated) is estimated as 0.015772 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 5.972e-05 m/s.
242
             The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
             hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 960.664 min. (16.011 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.11644
               KL aerated (m/s)
248
                                                          0.015772
249
               KL OVERALL AERATED (m/s)
                                                          0.004711
               KG quiescent (m/s)
250
                                                          0.005679
251
               KL quiescent (m/s)
                                                          5.918e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                          5.813e-06
253
               KL OVERALL (m/s)
                                                          5.972e-05
254
               air stripping time constant (min)
                                                          253.944
```

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FRACTION SURFACE VOLATILIZED 255 0.18149 256 FRACTION SUBMERGED VOLATILIZED 0. 257 TOTAL FRACTION VOLATILIZED 0.18149 258 FRACTION BIOLOGICALLY REMOVED 0.77054 259 FRACTION ABSORBED Ο. 260 TOTAL AIR EMISSIONS (g/s) 9.419e-06 2.97e-04 261 (Mg/year) 262 1.332e-14 EMISSION FACTOR (g/cm2-s) 263 UNIT EXIT CONCENTRATION (ppmw) 2.231e-06 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 267 COMPOUND: DIMETHYL DISULFIDE 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 279 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ο 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of DIMETHYL DISULFIDE at 32.1 deq.C (89.7 deq.F) 291 hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 292 86.579 y/x 293 0.062258 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.034e-05 cm2/s dv= 0.087022 cm2/s 296 Compound flow rate from inlet water is 0.001489 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 16.348 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) 304 The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_Springer\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 5.945e-06 m/s. 308 309 kg is estimated as 0.005633 m/s. Model: 2 310 kg is estimated as 0.005633 m/s. Model: 2 311 The Schmidt number is 1.72371. 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.012836 m/s. Model: 3 314 Agitated surface The rotation speed is 125.654 radians per second. 315 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318

319 kg (agitated) is estimated as 0.11498 m/s. 320 kl (agitated) is estimated as 0.016622 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 1.598e-04 m/s. 323 The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 980.894 min. (16.348 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.11714 329 KL aerated (m/s) 0.016622 0.005152 330 KL OVERALL AERATED (m/s) 331 KG quiescent (m/s) 0.005738 332 KL quiescent (m/s) 5.945e-06 333 KL OVERALL QUIESCENT (m/s) 5.85e-06 334 KL OVERALL (m/s) 1.598e-04 335 air stripping time constant (min) 101.198 FRACTION SURFACE VOLATILIZED 336 0.33782 FRACTION SUBMERGED VOLATILIZED 337 Ο. 338 TOTAL FRACTION VOLATILIZED 0.33782 339 FRACTION BIOLOGICALLY REMOVED 0.62732 340 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 5.03e-04 341 342 0.015863 (Mg/year) 343 EMISSION FACTOR (q/cm2-s) 7.429e-13 344 UNIT EXIT CONCENTRATION (ppmw) 4.65e-05 345

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 19 design branch line fraction full .4 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 34 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 53 11 Agitator mechanical efficiency 0.83 54 55 12 aerator effectiveness, alpha 0.83 56 0 13 if there is plug flow, enter 1 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 0.3 59 16 active biomass, aeration (g/l)17 If covered, then enter 1 60 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.002924 atm-m3/mol
                                            vp= 704.653 mmHg (13.629 psia)
 66
                   162.463 y/x
 67
                   0.11606 g/L gas per g/L liquid
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.19163 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 30.325 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface____Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 7.634e-06 m/s.
 82
            kg is estimated as 0.007917 m/s. Model: 2
 83
            kg is estimated as 0.007917 m/s. Model: 2
 84
 85
            The Schmidt number is 1.01591.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.017873 m/s. Model: 3
 88
                   Agitated surface
            The rotation speed is 125.654 radians per second.
 89
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.14978 m/s.
 94
            kl (agitated) is estimated as 0.021024 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 4.77e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1819.519 min. (30.325 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.15258
103
                                                         0.021024
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.009769
105
               KG quiescent (m/s)
                                                         0.008066
106
               KL quiescent (m/s)
                                                         7.634e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.574e-06
108
               KL OVERALL (m/s)
                                                         4.77e-04
109
               air stripping time constant (min)
                                                         48.915
110
               FRACTION SURFACE VOLATILIZED
                                                         0.80146
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.80146
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.17699
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.15358
116
                                                         4.84331
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         1.765e-10
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.0037
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\New
              Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26
122
            COMPOUND: DIMETHYL SULFIDE
                                        (DMS)
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                               def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
                                              B-66
```

Ο. 12.8 (Mg/year) EMISSION FACTOR (g/cm2-s) 129 1.765e-10 130 UNIT EXIT CONCENTRATION (ppmw) 1.485e-05 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 134 COMPOUND: DIMETHYL SULFIDE (DMS) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 143 7 Open surface=1 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1116 l/s. 156 Weight fraction down is 1.989E-07 157 Gas concentration in 0 mol fraction. 158 Gas flow 1116 L/s 159 Weight fraction out at base of drop is 1.71707119336225E-07 160 fraction transferred in the drain drop from hub is .136716 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.13672 165 fraction loss in unit 0. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 4.229e-19 171 mol fract. headspace vent base 1.138e-05 172 headspace flow out vent (cc/s) -1.116e+06 headspace flow down line (cc/s) 173 1.116e+06 174 KG surface (m/s) 2728.591 175 KL surface (m/s) 8.51e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.22197 178 total component into unit, g/s 0.19163 179 TOTAL AIR EMISSIONS (g/s) 0.030347 180 0.95703 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 1.765e-10 182 UNIT EXIT CONCENTRATION (ppmw) 0.17171 183 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 184 Type: aerated biotreatment 185 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS) 186 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3 B-67

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
            13 if there is plug flow, enter 1
201
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
210
               hl= 0.002519 atm-m3/mol
                                           vp= 606.985 mmHg (11.74 psia)
211
                   139.945 y/x
212
                    0.10132 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 (T-25), deg. C
213
214
               kl = 0. L/g-hr
                                       dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
215
            Compound flow rate from inlet water is 1.869e-04 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.011 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. \text{ mg/L}.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.566e-06 m/s.
228
            kg is estimated as 0.007884 m/s. Model: 2
229
            kg is estimated as 0.007884 m/s. Model: 2
230
            The Schmidt number is 1.03989.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.017611 m/s. Model: 3
232
                   Agitated surface
233
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.14804 m/s.
239
            kl (agitated) is estimated as 0.018962 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.053e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 144.073 minutes.
             (2.40122 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 960.664 min. (16.011 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.15081
               KL aerated (m/s)
248
                                                          0.018962
249
               KL OVERALL AERATED (m/s)
                                                          0.00854
250
               KG quiescent (m/s)
                                                          0.008032
251
               KL quiescent (m/s)
                                                          7.566e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.497e-06
253
               KL OVERALL (m/s)
                                                          1.053e-04
254
               air stripping time constant (min)
                                                          144.073
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FRACTION SURFACE VOLATILIZED 255 0.59112 256 FRACTION SUBMERGED VOLATILIZED Ο. 257 TOTAL FRACTION VOLATILIZED 0.59112 258 FRACTION BIOLOGICALLY REMOVED 0.32022 259 FRACTION ABSORBED Ο. 260 TOTAL AIR EMISSIONS (g/s) 1.105e-04 261 0.003484 (Mg/year) 262 EMISSION FACTOR (g/cm2-s) 1.563e-13 263 UNIT EXIT CONCENTRATION (ppmw) 1.485e-05 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 267 COMPOUND: DIMETHYL SULFIDE (DMS) 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 279 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ο 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deq.C (89.7 deq.F) 291 hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 292 151.062 y/x 293 0.10863 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.495e-05 cm2/s dv= 0.14597 cm2/s 296 Compound flow rate from inlet water is 0.004129 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 16.348 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . 304 The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_Springer\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 7.6e-06 m/s. 308 309 kg is estimated as 0.007966 m/s. Model: 2 310 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. 311 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.017744 m/s. Model: 3 314 Agitated surface 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318

319 kg (agitated) is estimated as 0.14892 m/s. 320 kl (agitated) is estimated as 0.019984 m/s. 321 The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 2.809e-04 m/s. 322 323 The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 980.894 min. (16.348 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.15171 329 KL aerated (m/s) 0.019984 330 KL OVERALL AERATED (m/s) 0.009148 331 KG quiescent (m/s) 0.008115 332 KL quiescent (m/s) 7.6e-06 333 KL OVERALL QUIESCENT (m/s) 7.537e-06 334 KL OVERALL (m/s) 2.809e-04 335 air stripping time constant (min) 57.552 FRACTION SURFACE VOLATILIZED 336 0.7715 FRACTION SUBMERGED VOLATILIZED 337 Ο. TOTAL FRACTION VOLATILIZED 0.7715 338 0.18324 339 FRACTION BIOLOGICALLY REMOVED 340 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 0.003185 341 342 0.10045 (Mg/year) 343 EMISSION FACTOR (q/cm2-s) 4.704e-12 344 UNIT EXIT CONCENTRATION (ppmw) 1.675e-04 345

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 8 40 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 53 1200 0.83 54 11 Agitator mechanical efficiency 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.004158 atm-m3/mol
                                           vp= 2272.142 mmHg (43.948 psia)
 66
                   230.99 y/x
                   0.16502 g/L gas per g/L liquid
 67
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.002397 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 30.325 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface___Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 7.703e-06 m/s.
 82
            kg is estimated as 0.010871 m/s. Model: 2
 83
            kg is estimated as 0.010871 m/s. Model: 2
 84
 85
            The Schmidt number is 0.63285.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.024173 m/s. Model: 3
 88
                   Agitated surface
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.18977 m/s.
 94
            kl (agitated) is estimated as 0.021167 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 6.265e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1819.519 min. (30.325 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.19332
103
                                                         0.021167
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.012876
105
               KG quiescent (m/s)
                                                         0.011075
106
               KL quiescent (m/s)
                                                         7.703e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.672e-06
108
               KL OVERALL (m/s)
                                                         6.265e-04
109
               air stripping time constant (min)
                                                         37.242
110
               FRACTION SURFACE VOLATILIZED
                                                         0.88816
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.88816
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.09366
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.002129
116
                                                         0.06713
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         2.446e-12
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         3.904e-05
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\New
              Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58
122
            COMPOUND: METHANETHIOL(methyl mercaptan)
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                              def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
```

Ο. 12.8 (Mg/year) 129 EMISSION FACTOR (g/cm2-s) 2.446e-12 130 UNIT EXIT CONCENTRATION (ppmw) 1.24e-07 DETAILED CALCULATIONS at Unit 13 default open hub d 131 132 Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker 133 Poe Privileged and Confidential/New Stripper Permitting/Emissions/WWTP/PAE/New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 134 COMPOUND: METHANETHIOL(methyl mercaptan) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (l/s) 139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 17 municipal waste in conduit =1 0 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1116 l/s. 156 Weight fraction down is 2.6E-09 157 Gas concentration in 0 mol fraction. 158 Gas flow 1116 L/s 159 Weight fraction out at base of drop is 2.14759568570224E-09 160 fraction transferred in the drain drop from hub is .174002 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.174 165 fraction loss in unit Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 6.896e-21 171 mol fract. headspace vent base 2.445e-07 172 headspace flow out vent (cc/s) -1.116e+06 headspace flow down line (cc/s) 173 1.116e+06 174 KG surface (m/s) 3741.46 175 KL surface (m/s) 8.591e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.002902 178 total component into unit, g/s 0.002397 179 TOTAL AIR EMISSIONS (g/s) 5.049e-04 180 0.015922 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 2.446e-12 182 UNIT EXIT CONCENTRATION (ppmw) 0.002148 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 186 COMPOUND: METHANETHIOL(methyl mercaptan) 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
210
               hl= 0.003687 atm-m3/mol
                                          vp= 2014.774 mmHg (38.97 psia)
211
                   204.826 y/x
212
                   0.14829 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deq. C
214
               kl = 0. L/g-hr
                                       dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
215
            Compound flow rate from inlet water is 1.671e-06 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 16.011 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                   _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.635e-06 m/s.
228
            kg is estimated as 0.010826 m/s. Model: 2
229
            kg is estimated as 0.010826 m/s. Model: 2
230
            The Schmidt number is 0.64779.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.023814 m/s. Model: 3
232
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.18756 m/s.
239
            kl (agitated) is estimated as 0.019092 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.391e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 109.038 minutes.
             (1.81731 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 960.664 min. (16.011 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                         0.19108
               KL aerated (m/s)
248
                                                          0.019092
249
               KL OVERALL AERATED (m/s)
                                                         0.011483
250
               KG quiescent (m/s)
                                                         0.011029
251
               KL quiescent (m/s)
                                                         7.635e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.6e-06
253
               KL OVERALL (m/s)
                                                         1.391e-04
254
               air stripping time constant (min)
                                                         109.038
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FRACTION SURFACE VOLATILIZED 255 0.7296 256 FRACTION SUBMERGED VOLATILIZED Ο. 257 TOTAL FRACTION VOLATILIZED 0.7296 0.18759 258 FRACTION BIOLOGICALLY REMOVED 259 FRACTION ABSORBED Ο. 260 TOTAL AIR EMISSIONS (g/s) 1.219e-06 261 3.844e-05 (Mg/year) 262 1.724e-15 EMISSION FACTOR (g/cm2-s) 263 UNIT EXIT CONCENTRATION (ppmw) 1.24e-07 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 267 COMPOUND: METHANETHIOL(methyl mercaptan) 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 279 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ο 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) 291 hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 292 217.838 y/x 293 0.15664 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.515e-05 cm2/s dv= 0.23433 cm2/s 296 Compound flow rate from inlet water is 4.357e-05 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 16.348 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) 304 The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_Springer\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 7.67e-06 m/s. 308 309 kg is estimated as 0.010938 m/s. Model: 2 310 kg is estimated as 0.010938 m/s. Model: 2 311 The Schmidt number is 0.64013. 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.023996 m/s. Model: 3 314 Agitated surface 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318

319 kg (agitated) is estimated as 0.18868 m/s. 320 kl (agitated) is estimated as 0.020121 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 3.715e-04 m/s. 323 The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 980.894 min. (16.348 hr.) The ratio of the pump mixing to the residence time is 0. 327 328 KG aerated (m/s) 0.19222 329 KL aerated (m/s) 0.020121 0.012174 330 KL OVERALL AERATED (m/s) 331 KG quiescent (m/s) 0.011143 332 KL quiescent (m/s) 7.67e-06 333 KL OVERALL QUIESCENT (m/s) 7.637e-06 334 KL OVERALL (m/s) 3.715e-04 335 air stripping time constant (min) 43.518 FRACTION SURFACE VOLATILIZED 336 0.86431 FRACTION SUBMERGED VOLATILIZED 337 Ο. 0.86431 338 TOTAL FRACTION VOLATILIZED 0.097342 339 FRACTION BIOLOGICALLY REMOVED 340 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 3.766e-05 341 342 0.001188 (Mg/year) 5.562e-14 343 EMISSION FACTOR (q/cm2-s) 344 UNIT EXIT CONCENTRATION (ppmw) 1.497e-06 345

## Backup Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings to Backup				
Stripper	147	15.00	17.00	16.00
Backup Stripper TRS Removal Efficiency	0.98	0.98	0.98	0.98
Stripped Condensate to Hardpipe	2.93	0.30	0.34	0.32
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.38	0.10	0.21	0.02
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.04	0.17	0.01
ASB Zone 2	0.03	6.14E-04	3.60E-03	2.73E-04
ASB Zone 3	0.02	1.20E-05	1.31E-04	9.23E-06
Total ASB	0.13	0.04	0.17	0.02
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, lb/ODTP
Total ASB	1.09E-02	3.28E-03	1.47E-02	1.30E-03

Post-Project Stripped Condensate Flow:		850	gpm
Post-Project Stripped Condensate Flow:		1.22	MGD
Post-Project ASB Influent Flow:		25.48	MGD
Total ASB Flow:		26.71	MGD
Total ASB Flow:		1170	L/s
Pulp Production		2200	ODTP/day
			MW
	H2S		34
	DMDS		94
	DMS		62
	MMC		48

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 8 40 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 41 COMPOUND: DIMETHYL DISULFIDE 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 53 10 Impeller rotation (RPM) 1200 0.83 54 11 Agitator mechanical efficiency 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.001714 atm-m3/mol
                                            vp= 45.945 mmHg (0.88868 psia)
 66
                   95.2 y/x
 67
                   0.068011 g/L gas per g/L liquid
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.10249 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 28.926 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface___Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 5.971e-06 m/s.
 82
            kg is estimated as 0.005598 m/s. Model: 2
 83
            kg is estimated as 0.005598 m/s. Model: 2
 84
 85
            The Schmidt number is 1.70412.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.012927 m/s. Model: 3
 88
                   Agitated surface
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.11564 m/s.
 94
            kl (agitated) is estimated as 0.017486 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 2.753e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.11781
103
                                                         0.017486
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.005609
105
               KG quiescent (m/s)
                                                         0.005703
106
               KL quiescent (m/s)
                                                         5.971e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         5.883e-06
108
               KL OVERALL (m/s)
                                                         2.753e-04
109
               air stripping time constant (min)
                                                         84.752
110
               FRACTION SURFACE VOLATILIZED
                                                         0.36364
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.36364
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.6186
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.037268
116
                                                         1.17529
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         4.282e-11
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.001555
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\Old
              Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37
122
            COMPOUND: DIMETHYL DISULFIDE
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                               def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
                                              B-79
```

Ο. 12.8 (Mg/year) EMISSION FACTOR (g/cm2-s) 129 4.282e-11 130 UNIT EXIT CONCENTRATION (ppmw) 2.847e-06 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 134 COMPOUND: DIMETHYL DISULFIDE 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 143 7 Open surface=1 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 17 municipal waste in conduit =1 0 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1170 l/s. Weight fraction down is 9.66E-08 156 157 Gas concentration in 0 mol fraction. 158 Gas flow 1170 L/s 159 Weight fraction out at base of drop is 8.7594214355091E-08 160 fraction transferred in the drain drop from hub is .093228 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 164 0.093228 165 fraction loss in unit 0. 166 fraction loss in line run -7.27e-08 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) 0. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 1.082e-19 171 mol fract. headspace vent base 2.486e-06 172 headspace flow out vent (cc/s) -1.17e+06 173 headspace flow down line (cc/s) 1.17e+06 174 KG surface (m/s) 2007.233 175 KL surface (m/s) 6.787e-09 176 flow of waste down hub (l/s) 0. 177 component flow in waste into unit (g/s) 0.11302 178 total component into unit, g/s 0.10249 179 TOTAL AIR EMISSIONS (g/s) 0.010537 180 0.33229 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 4.282e-11 182 UNIT EXIT CONCENTRATION (ppmw) 0.087594 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE 186 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
210
               hl= 0.00141 atm-m3/mol
                                         vp= 37.814 mmHg (0.7314 psia)
211
                   78.352 y/x
212
                    0.056726 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
214
               kl = 0. L/g-hr
                                       dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
215
            Compound flow rate from inlet water is 6.639e-05 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 5.918e-06 m/s.
228
            kg is estimated as 0.005575 m/s. Model: 2
229
            kg is estimated as 0.005575 m/s. Model: 2
230
            The Schmidt number is 1.74436.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.012742 m/s. Model: 3
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.1143 m/s.
239
            kl (agitated) is estimated as 0.015772 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 5.972e-05 m/s.
242
             The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
             hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                         0.11644
               KL aerated (m/s)
248
                                                         0.015772
249
               KL OVERALL AERATED (m/s)
                                                         0.004711
               KG quiescent (m/s)
250
                                                         0.005679
251
               KL quiescent (m/s)
                                                         5.918e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         5.813e-06
253
               KL OVERALL (m/s)
                                                         5.972e-05
254
               air stripping time constant (min)
                                                         253.944
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FRACTION SURFACE VOLATILIZED 255 0.18107 256 FRACTION SUBMERGED VOLATILIZED 0. 257 TOTAL FRACTION VOLATILIZED 0.18107 0.76875 258 FRACTION BIOLOGICALLY REMOVED 259 FRACTION ABSORBED Ο. 260 TOTAL AIR EMISSIONS (g/s) 1.202e-05 3.791e-04 261 (Mg/year) 262 1.7e-14 EMISSION FACTOR (g/cm2-s) 2.847e-06 263 UNIT EXIT CONCENTRATION (ppmw) 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 267 COMPOUND: DIMETHYL DISULFIDE 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 279 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ο 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of DIMETHYL DISULFIDE at 32.1 deq.C (89.7 deq.F) 291 hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 292 86.579 y/x 293 0.062258 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.034e-05 cm2/s dv= 0.087022 cm2/s 296 Compound flow rate from inlet water is 0.00182 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 15.594 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) 304 The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_Springer\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 5.945e-06 m/s. 308 309 kg is estimated as 0.005633 m/s. Model: 2 310 kg is estimated as 0.005633 m/s. Model: 2 311 The Schmidt number is 1.72371. 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.012836 m/s. Model: 3 314 Agitated surface The rotation speed is 125.654 radians per second. 315 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318
319 kg (agitated) is estimated as 0.11498 m/s. 320 kl (agitated) is estimated as 0.016622 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 1.598e-04 m/s. 323 The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.11714 329 KL aerated (m/s) 0.016622 330 KL OVERALL AERATED (m/s) 0.005152 331 KG quiescent (m/s) 0.005738 332 KL quiescent (m/s) 5.945e-06 333 KL OVERALL QUIESCENT (m/s) 5.85e-06 334 KL OVERALL (m/s) 1.598e-04 335 air stripping time constant (min) 101.198 FRACTION SURFACE VOLATILIZED 336 0.33725 FRACTION SUBMERGED VOLATILIZED 337 Ο. 338 TOTAL FRACTION VOLATILIZED 0.33725 339 FRACTION BIOLOGICALLY REMOVED 0.62627 340 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 6.138e-04 341 342 0.019356 (Mg/year) 9.065e-13 343 EMISSION FACTOR (q/cm2-s) 344 UNIT EXIT CONCENTRATION (ppmw) 5.674e-05 345

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 4 Drop length to conduit (cm) 61 5 Humidity of inlet air (%) 40 8 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 .006 14 friction factor gas 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 53 11 Agitator mechanical efficiency 0.83 54 55 12 aerator effectiveness, alpha 0.83 56 0 13 if there is plug flow, enter 1 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 17 If covered, then enter 1 60 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.002924 atm-m3/mol
                                           vp= 704.653 mmHg (13.629 psia)
 66
                   162.463 y/x
 67
                   0.11606 g/L gas per g/L liquid
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.20746 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 28.926 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface___Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 7.634e-06 m/s.
 82
            kg is estimated as 0.007917 m/s. Model: 2
 83
            kg is estimated as 0.007917 m/s. Model: 2
 84
 85
            The Schmidt number is 1.01591.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.017873 m/s. Model: 3
 88
                   Agitated surface
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.14978 m/s.
 94
            kl (agitated) is estimated as 0.021024 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 4.77e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.15258
103
                                                         0.021024
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.009769
105
               KG quiescent (m/s)
                                                         0.008066
106
               KL quiescent (m/s)
                                                         7.634e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.574e-06
108
               KL OVERALL (m/s)
                                                         4.77e-04
109
               air stripping time constant (min)
                                                         48.915
110
               FRACTION SURFACE VOLATILIZED
                                                         0.80063
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.80063
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.17681
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.1661
116
                                                         5.23815
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         1.909e-10
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.004001
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\Old
              Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18
122
            COMPOUND: DIMETHYL SULFIDE
                                        (DMS)
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                               def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
                                              B-85
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Ο. 12.8 (Mg/year) 129 EMISSION FACTOR (g/cm2-s) 1.909e-10 130 UNIT EXIT CONCENTRATION (ppmw) 1.753e-05 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 134 COMPOUND: DIMETHYL SULFIDE (DMS) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (1/s)139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1170 l/s. Weight fraction down is 2.054E-07 156 157 Gas concentration in 0 mol fraction. 158 Gas flow 1170 L/s 159 Weight fraction out at base of drop is 1.77318497496617E-07 160 fraction transferred in the drain drop from hub is .136716 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.13672 165 fraction loss in unit Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 4.299e-19 171 mol fract. headspace vent base 1.175e-05 172 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) 1.17e+06 173 174 KG surface (m/s) 2834.248 175 KL surface (m/s) 8.784e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.24032 178 total component into unit, g/s 0.20746 179 TOTAL AIR EMISSIONS (g/s) 0.032855 180 1.03613 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 1.909e-10 182 UNIT EXIT CONCENTRATION (ppmw) 0.17732 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 183 184 Type: aerated biotreatment 185 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 186 COMPOUND: DIMETHYL SULFIDE (DMS) 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
            13 if there is plug flow, enter 1
201
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
210
               hl= 0.002519 atm-m3/mol
                                           vp= 606.985 mmHg (11.74 psia)
211
                   139.945 y/x
212
                    0.10132 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 (T-25), deg. C
213
214
               kl = 0. L/g-hr
                                       dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
215
            Compound flow rate from inlet water is 2.217e-04 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. \text{ mg/L}.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.566e-06 m/s.
228
            kg is estimated as 0.007884 m/s. Model: 2
229
            kg is estimated as 0.007884 m/s. Model: 2
230
            The Schmidt number is 1.03989.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.017611 m/s. Model: 3
232
                   Agitated surface
233
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.14804 m/s.
239
            kl (agitated) is estimated as 0.018962 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.053e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 144.073 minutes.
             (2.40122 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.15081
               KL aerated (m/s)
248
                                                          0.018962
249
               KL OVERALL AERATED (m/s)
                                                          0.00854
250
               KG quiescent (m/s)
                                                          0.008032
251
               KL quiescent (m/s)
                                                          7.566e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.497e-06
253
               KL OVERALL (m/s)
                                                          1.053e-04
254
               air stripping time constant (min)
                                                          144.073
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FRACTION SURFACE VOLATILIZED 255 0.5886 256 FRACTION SUBMERGED VOLATILIZED Ο. 257 TOTAL FRACTION VOLATILIZED 0.5886 258 FRACTION BIOLOGICALLY REMOVED 0.31886 259 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 1.305e-04 260 261 0.004115 (Mg/year) 262 EMISSION FACTOR (g/cm2-s) 1.846e-13 263 UNIT EXIT CONCENTRATION (ppmw) 1.753e-05 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 267 COMPOUND: DIMETHYL SULFIDE (DMS) 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 279 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ω 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deq.C (89.7 deq.F) 291 hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 292 151.062 y/x 293 0.10863 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.495e-05 cm2/s dv= 0.14597 cm2/s 296 Compound flow rate from inlet water is 0.004681 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 15.594 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . 304 The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_\_Springer\_\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 7.6e-06 m/s. 308 309 kg is estimated as 0.007966 m/s. Model: 2 310 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. 311 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.017744 m/s. Model: 3 314 Agitated surface 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318

319 kg (agitated) is estimated as 0.14892 m/s. 320 kl (agitated) is estimated as 0.019984 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 2.809e-04 m/s. 323 The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. 327 328 KG aerated (m/s) 0.15171 329 KL aerated (m/s) 0.019984 330 KL OVERALL AERATED (m/s) 0.009148 331 KG quiescent (m/s) 0.008115 332 KL quiescent (m/s) 7.6e-06 333 KL OVERALL QUIESCENT (m/s) 7.537e-06 334 KL OVERALL (m/s) 2.809e-04 335 air stripping time constant (min) 57.552 FRACTION SURFACE VOLATILIZED 336 0.76981 FRACTION SUBMERGED VOLATILIZED 337 Ο. 338 TOTAL FRACTION VOLATILIZED 0.76981 339 FRACTION BIOLOGICALLY REMOVED 0.18284 340 FRACTION ABSORBED Ο. TOTAL AIR EMISSIONS (g/s) 0.003604 341 342 0.11365 (Mg/year) 5.322e-12 343 EMISSION FACTOR (q/cm2-s) 344 UNIT EXIT CONCENTRATION (ppmw) 1.895e-04 345

1 2 3 Type of unit is 4 1 Total water added at the unit (1/s) 50 0 5 2 Area of openings at unit (cm2) 50 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 8 40 9 6 Temperature of air (C) 25 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature (C) 34.08 46 3 length of aeration unit (m) 295 4 width of aeration unit (m) 295 47 48 5 depth of aeration unit (m) 1.4 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 49.53 52 9 Impeller diameter (cm) 53 10 Impeller rotation (RPM) 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 19 57 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l)0.3 60 17 If covered, then enter 1 0 61 18 special input Ο 62 19 pH (enter 0 for no pH adjustment) 7.04 63 64 Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
65
               hl= 0.004158 atm-m3/mol
                                           vp= 2272.142 mmHg (43.948 psia)
 66
                   230.99 y/x
                   0.16502 g/L gas per g/L liquid
 67
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                       dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
               k1=0. L/q-hr
            Compound flow rate from inlet water is 0.016622 g/s.
 70
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 28.926 hr.
 76
                Biomass production
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   __Quiescent wind shear surface___Springer_
            The fetch to depth ratio is 237.766.
 81
            kl is estimated as 7.703e-06 m/s.
 82
            kg is estimated as 0.010871 m/s. Model: 2
 83
            kg is estimated as 0.010871 m/s. Model: 2
 84
 85
            The Schmidt number is 0.63285.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.024173 m/s. Model: 3
 88
                   Agitated surface
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.18977 m/s.
 94
            kl (agitated) is estimated as 0.021167 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 6.265e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.19332
103
                                                         0.021167
               KL aerated (m/s)
104
               KL OVERALL AERATED (m/s)
                                                         0.012876
105
               KG quiescent (m/s)
                                                         0.011075
106
               KL quiescent (m/s)
                                                         7.703e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.672e-06
108
               KL OVERALL (m/s)
                                                         6.265e-04
109
               air stripping time constant (min)
                                                         37.242
110
               FRACTION SURFACE VOLATILIZED
                                                         0.88738
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.88738
113
                                                         0.093577
               FRACTION BIOLOGICALLY REMOVED
114
               FRACTION ABSORBED
                                                         Ο.
115
               TOTAL AIR EMISSIONS (g/s)
                                                         0.01475
116
                                                         0.46517
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         1.695e-11
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         2.705e-04
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                                                                  WWTP\PAE\Old
              Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00
122
            COMPOUND: METHANETHIOL(methyl mercaptan)
123
124
            Type of unit is system exit stream
125
            1 Description of unit
                                                        12
                                                              def.system exit st
126
127
               TOTAL AIR EMISSIONS (g/s)
                                                         0.
                                              B-91
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Ο. 12.8 (Mg/year) 129 EMISSION FACTOR (g/cm2-s) 1.695e-11 130 UNIT EXIT CONCENTRATION (ppmw) 9.387e-07 131 DETAILED CALCULATIONS at Unit 13 default open hub d 132 Type: open hub drain 133 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 134 COMPOUND: METHANETHIOL(methyl mercaptan) 135 136 Type of unit is open hub drain 137 1 Description of unit 13 default open hub d 138 2 Underflow T (C) 43.89 3 Total water added at the unit (l/s) 139 0 140 4 Area of openings at unit (cm2) 50 141 5 Radius of drop pipe (cm) 5 142 61 6 Drop length to conduit (cm) 7 Open surface=1 143 1 8 Subsurface entrance=1 144 Ο 9 subsurface exit =1 145 0 10 radius of underflow conduit (cm) 146 12 11 distance to next unit (cm) 147 500 148 12 slope of underflow conduit 0.015 149 16 velocity air at drain opening (ft/min) 84 150 0 17 municipal waste in conduit =1 151 18 Assume equilibrium in unit, =1 0 152 19 pH (enter 0 for no pH adjustment) 8.9 153 154 Equilibrium partitioning in drain drop hub is assumed. 155 Total drain flow is 1170 l/s. 156 Weight fraction down is 1.72E-08 157 Gas concentration in 0 mol fraction. 158 Gas flow 1170 L/s 159 Weight fraction out at base of drop is 1.42071711698917E-08 160 fraction transferred in the drain drop from hub is .174002 161 fraction loss in wastel drop to hub 0. 162 fraction loss in waste2 drop to hub 0. 163 fraction loss in waste3 drop to hub 0. 164 fraction loss in collection hub drop 0.174 165 fraction loss in unit Ο. 166 fraction loss in line run 0. 167 component upstream of unit, g/s 0. 168 mol fract. headspace upstream (y) Ο. headspace at conduit discharge, y 169 0. 170 headspace end of conduit (y) 4.491e-20 171 mol fract. headspace vent base 1.618e-06 172 headspace flow out vent (cc/s) -1.17e+06 headspace flow down line (cc/s) 1.17e+06 173 174 KG surface (m/s) 3886.338 175 KL surface (m/s) 8.868e-09 176 flow of waste down hub (l/s) Ο. 177 component flow in waste into unit (g/s) 0.020124 178 total component into unit, g/s 0.016622 179 TOTAL AIR EMISSIONS (g/s) 0.003502 180 0.11043 (Mg/year) EMISSION FACTOR (g/cm2-s) 181 1.695e-11 182 UNIT EXIT CONCENTRATION (ppmw) 0.014207 183 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 184 Type: aerated biotreatment 185 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan) 186 187 188 Type of unit is aerated biotreatment 189 1 Description of unit 17 ASB Zone 3

```
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
            5 depth of aeration unit (m)
193
                                                               0.91
194
            6 Area of agitation (each aerator,m2)
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
                                                               75
196
            8 Power of agitation (each aerator, HP)
197
                                                               49.53
            9 Impeller diameter (cm)
            10 Impeller rotation (RPM)
198
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               0
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
210
               hl= 0.003687 atm-m3/mol
                                          vp= 2014.774 mmHg (38.97 psia)
211
                   204.826 y/x
212
                    0.14829 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deq. C
214
               kl = 0. L/g-hr
                                       dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
215
            Compound flow rate from inlet water is 1.27e-05 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. \text{ mg/L}.
225
                    _Quiescent wind shear surface___Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.635e-06 m/s.
228
            kg is estimated as 0.010826 m/s. Model: 2
229
            kg is estimated as 0.010826 m/s. Model: 2
230
            The Schmidt number is 0.64779.
231
            The friction velocity is 37.398 m/s
            kg is estimated as 0.023814 m/s. Model: 3
232
233
                   Agitated surface
            The rotation speed is 125.654 radians per second.
234
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
237
            The rotation factor NFR is 797.027.
238
            kg (agitated) is estimated as 0.18756 m/s.
239
            kl (agitated) is estimated as 0.019092 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
241
             The effective KL (surface + diffused air) is 1.391e-04 m/s.
242
             The effective stripping time (surface + diffused air) is 109.038 minutes.
             (1.81731 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
             The ratio of the mixing to the striping (surface + diffused air) is 0.
2.4.4
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.19108
               KL aerated (m/s)
248
                                                          0.019092
249
               KL OVERALL AERATED (m/s)
                                                          0.011483
250
               KG quiescent (m/s)
                                                          0.011029
251
               KL quiescent (m/s)
                                                          7.635e-06
252
               KL OVERALL QUIESCENT (m/s)
                                                         7.6e-06
253
               KL OVERALL (m/s)
                                                          1.391e-04
254
               air stripping time constant (min)
                                                          109.038
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FRACTION SURFACE VOLATILIZED 255 0.72669 256 FRACTION SUBMERGED VOLATILIZED Ο. 257 TOTAL FRACTION VOLATILIZED 0.72669 258 FRACTION BIOLOGICALLY REMOVED 0.18684 259 FRACTION ABSORBED Ο. 260 TOTAL AIR EMISSIONS (g/s) 9.23e-06 261 2.911e-04 (Mg/year) 262 EMISSION FACTOR (g/cm2-s) 1.306e-14 263 UNIT EXIT CONCENTRATION (ppmw) 9.387e-07 264 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 265 Type: aerated biotreatment 266 WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 267 COMPOUND: METHANETHIOL(methyl mercaptan) 268 269 Type of unit is aerated biotreatment 18 270 1 Description of unit ASB Zone 2 271 2 Wastewater temperature (C) 32.08 3 length of aeration unit (m) 272 368 4 width of aeration unit (m) 273 184 274 5 depth of aeration unit (m) 0.97 275 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 276 15 277 8 Power of agitation (each aerator, HP) 75 278 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 279 1200 11 Agitator mechanical efficiency 280 0.83 281 12 aerator effectiveness, alpha 0.83 282 13 if there is plug flow, enter 1 0 283 14 Overall biorate (mg/g bio-hr) 19 284 15 Aeration air flow (m3/s) 0 285 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 Ω 286 287 18 special input 0 288 19 pH (enter 0 for no pH adjustment) 7.24 289 290 Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) 291 hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 292 217.838 y/x 293 0.15664 g/L gas per g/L liquid 294 Temperature adjustment factor = 1.046 ^(T-25), deg. C 295 kl= 0. L/g-hrdl= 1.515e-05 cm2/s dv= 0.23433 cm2/s 296 Compound flow rate from inlet water is 3.165e-04 g/s. 297 Compound flow rate from inlet vent is 0. g/s. 298 Compound flow rate from inlet duct is 0. g/s. 299 Submerged aeration rate from inlet vent is 0. m3/s. 300 Total submerged aeration is 0. m3/s. 301 The residence time in the unit is 15.594 hr. 302 Biomass production 303 The biomass production rate is 0.mg/hr. (0. mg/L) 304 The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. 305 \_Quiescent wind shear surface\_\_\_Springer\_ 306 The fetch to depth ratio is 302.703. 307 kl is estimated as 7.67e-06 m/s. 308 309 kg is estimated as 0.010938 m/s. Model: 2 310 kg is estimated as 0.010938 m/s. Model: 2 311 The Schmidt number is 0.64013. 312 The friction velocity is 37.398 m/s 313 kg is estimated as 0.023996 m/s. Model: 3 314 Agitated surface 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 The rotation factor NFR is 797.027. 318

319 kg (agitated) is estimated as 0.18868 m/s. 320 kl (agitated) is estimated as 0.020121 m/s. 321 The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 3.715e-04 m/s. 322 323 The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. 327 328 KG aerated (m/s) 0.19222 329 KL aerated (m/s) 0.020121 0.012174 330 KL OVERALL AERATED (m/s) 331 KG quiescent (m/s) 0.011143 332 KL quiescent (m/s) 7.67e-06 333 KL OVERALL QUIESCENT (m/s) 7.637e-06 334 KL OVERALL (m/s) 3.715e-04 335 air stripping time constant (min) 43.518 FRACTION SURFACE VOLATILIZED 336 0.86271 FRACTION SUBMERGED VOLATILIZED 337 Ο. 338 TOTAL FRACTION VOLATILIZED 0.86271 0.097161 339 FRACTION BIOLOGICALLY REMOVED 340 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 2.731e-04 341 342 0.008611 (Mg/year) 343 EMISSION FACTOR (q/cm2-s) 4.033e-13 344 UNIT EXIT CONCENTRATION (ppmw) 1.086e-05 345

## No Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings				
(prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.31	1.48	0.27	9.82E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.57	0.22	8.40E-03
ASB Zone 2	0.03	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	0.02	1.85E-04	1.70E-04	5.26E-06
Total ASB	0.12	0.58	0.22	8.56E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, lb/ODTP	MMC, lb/ODTP
Total ASB	1.06E-02	5.04E-02	1.92E-02	7.42E-04

Post-Project Foul Condensate Flow: Post-Project Foul Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: Pulp Production 850 gpm 1.22 MGD 25.48 MGD 26.71 MGD 1170 L/s 2200 ODTP/day MW 34

H2S	34
DMDS	94
DMS	62
MMC	48

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 8 5 Humidity of inlet air (%) 40 9 25 6 Temperature of air (C) 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 41 COMPOUND: DIMETHYL DISULFIDE 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature 34.08 (C) 3 length of aeration unit (m) 295 46 295 47 4 width of aeration unit (m) 5 depth of aeration unit (m) 1.4 48 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 52 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 53 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l) 0.3 60 17 If covered, then enter 1 Ο 61 18 special input 0 62 19 pH (enter 0 for no pH adjustment) 7.04

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63

```
Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)
 64
 65
               hl= 0.001714 atm-m3/mol vp= 45.945 mmHg (0.88868 psia)
 66
                   95.2 y/x
 67
                   0.068011 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 68
 69
                                       dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
               k1=0. L/g-hr
 70
            Compound flow rate from inlet water is 1.57133 g/s.
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
            The residence time in the unit is 28.926 hr.
 75
 76
               __Biomass production__
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                    _Quiescent wind shear surface___Springer_
 81
            The fetch to depth ratio is 237.766.
            kl is estimated as 5.971e-06 m/s.
 82
            kg is estimated as 0.005598 m/s. Model: 2
 83
            kg is estimated as 0.005598 m/s. Model: 2
 84
 85
            The Schmidt number is 1.70412.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.012927 m/s. Model: 3
 88
                    _Agitated surface_
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.11564 m/s.
 94
            kl (agitated) is estimated as 0.017486 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 2.753e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.11781
103
               KL aerated (m/s)
                                                         0.017486
104
               KL OVERALL AERATED (m/s)
                                                         0.005609
105
                                                         0.005703
               KG quiescent (m/s)
106
               KL quiescent (m/s)
                                                         5.971e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         5.883e-06
108
               KL OVERALL (m/s)
                                                         2.753e-04
109
               air stripping time constant (min)
                                                         84.752
110
               FRACTION SURFACE VOLATILIZED
                                                         0.36452
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
                                                         0.36452
               TOTAL FRACTION VOLATILIZED
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.61768
114
               FRACTION ABSORBED
                                                         Ο.
               TOTAL AIR EMISSIONS (g/s)
115
                                                         0.57278
116
                                                         18.063
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         6.582e-10
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.023907
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                    WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
              3/16/2023 1:47:24 PM 19:20:20
            COMPOUND: DIMETHYL DISULFIDE
122
123
124
            Type of unit is system exit stream
```

125 1 Description of unit

126			
127	TOTAL AIR EMISSIONS (g/s)	Ο.	
128	(Mq/year)	Ο.	
129	EMISSION FACTOR (g/cm2-s)	6.582	e-10
130	UNIT EXIT CONCENTRATION (ppmw)	4.376	e-05
131	DETAILED CALCULATIONS at Unit 13 default op	en hub	d
132	Type: open hub drain		
133			
100			
	WWTP\PAE\Hardpipe Sc	enario	ASB Hardpipe Scenario V7
	3/16/2023 1:47:24 PM 19:20:20	011012.20	
134	COMPOUND: DIMETHYL DISULFIDE		
135			
136	Type of unit is open hub drain		
137	1 Description of unit	13	default open hub d
138	2 Underflow T (C)		43.89
139	3 Total water added at the unit $(1/s)$		0
140	4 Area of openings at unit (cm2)		50
141	5 Radius of drop pipe (cm)		5
142	6 Drop length to conduit (cm)		61
143	7 Open surface=1		1
144	8 Subsurface entrance=1		0
145	9 subsurface exit =1		0
146	10 radius of underflow conduit (cm)		12
147	11 distance to next unit (cm)		500
148	12 slope of underflow conduit		0 015
149	16 velocity air at drain opening (ft/min)		84
150	17 municipal waste in conduit =1		0
151	18 Assume equilibrium in unit. =1		0
152	19 pH (enter 0 for no pH adjustment)		8 9
153			0.2
154	Equilibrium partitioning in drain drop hub	is as	sumed
155	Total drain flow is 1170 l/s.	10 0.0	
156	Weight fraction down is 1.4811E-06		
157	Gas concentration in 0 mol fraction.		
158	Gas flow 1170 L/s		
159	Weight fraction out at base of drop is	1.3430	203399053E-06
160	fraction transferred in the drain drop f	rom hu	b is .093228
161	fraction loss in wastel drop to hub	0.	
162	fraction loss in waste2 drop to hub	0.	
163	fraction loss in waste3 drop to hub	0.	
164	fraction loss in collection hub drop	0.093	228
165	fraction loss in unit	0.	
166	fraction loss in line run	0.	
167	component upstream of unit, q/s	0.	
168	mol fract. headspace upstream (y)	0.	
169	headspace at conduit discharge, y	0.	
170	headspace end of conduit (y)	1.659	e-18
171	mol fract. headspace vent base	3.811	e-05
172	headspace flow out vent $(cc/s)$	-1.17	e+06
173	headspace flow down line (cc/s)	1.17e	+06
174	KG surface (m/s)	2007.	233
175	$KI_{L}$ surface $(m/s)$	6 787	e=09
176	flow of waste down hub $(1/s)$	0.	
177	component flow in waste into unit $(\alpha/s)$	1.732	89
178	total component into unit a/s	1.571	33
179	TOTAL AIR EMISSIONS (g/g)	0 161	55
180	(Mg/vear)	5 094	74
181	EMISSION FACTOR $(\alpha/cm^2-s)$	6 582	e-10
182	UNIT EXIT CONCENTRATION (DOMM)	1 242	02
183	DETAILED CALCULATIONS at Unit 17 ASR Zone 3	±•010	~ 2
184	Type: aerated biotreatment		
185			

```
186
            COMPOUND: DIMETHYL DISULFIDE
187
188
            Type of unit is aerated biotreatment
                                                               ASB Zone 3
189
            1 Description of unit
                                                         17
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
193
            5 depth of aeration unit (m)
                                                               0.91
            6 Area of agitation (each aerator,m2)
194
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
196
            8 Power of agitation (each aerator, HP)
                                                               75
            9 Impeller diameter (cm)
197
                                                               49.53
198
            10 Impeller rotation (RPM)
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               Ω
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
209
            Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
               hl= 0.00141 atm-m3/mol
210
                                            vp= 37.814 mmHg (0.7314 psia)
211
                   78.352 y/x
212
                    0.056726 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deg. C
214
               k1=0. L/g-hr
                                       dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
215
            Compound flow rate from inlet water is 0.00102 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                    _Quiescent wind shear surface____Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 5.918e-06 m/s.
228
            kg is estimated as 0.005575 m/s. Model: 2
            kg is estimated as 0.005575 m/s. Model: 2
229
230
            The Schmidt number is 1.74436.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.012742 m/s. Model: 3
233
                   __Agitated surface_
234
            The rotation speed is 125.654 radians per second.
            The rotation factor NRW is 2.052e+06.
235
236
            The power number NPR is 7.881e-04.
            The rotation factor NFR is 797.027.
237
238
            kg (agitated) is estimated as 0.1143 m/s.
239
            kl (agitated) is estimated as 0.015772 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
             The effective KL (surface + diffused air) is 5.972e-05 m/s.
241
242
             The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
             hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
244
             The ratio of the mixing to the striping (surface + diffused air) is 0.
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.11644
248
               KL aerated (m/s)
                                                          0.015772
249
               KL OVERALL AERATED (m/s)
                                                          0.004711
250
               KG quiescent (m/s)
                                                          0.005679
```

251	KL quiescent (m/s)	5.9	18e-06	
252	KL OVERALL OUIESCENT (m/s)	5.8	13e-06	
253	KI, OVERALL (m/s)	59	72e-05	
254	air stripping time constant (min)	253	944	
255	FRACTION SUPPACE VOLATILIZED	0 1	8107	
255	FRACTION SURFACE VOLATILIZED	0.1	8107	
200	TRACTION SUBMERGED VOLATILIZED	0.	0107	
207	IDIAL FRACTION VOLATILIZED	0.1	C075	
258	FRACTION BIOLOGICALLY REMOVED	0.7	0875	
259	FRACTION ABSORBED	0.		
260	TOTAL AIR EMISSIONS (g/s)	1.8	48e-04	
261	(Mg/year)	0.0	05827	
262	EMISSION FACTOR (g/cm2-s)	2.6	14e-13	
263	UNIT EXIT CONCENTRATION (ppmw)	4.3	76e-05	
264	DETAILED CALCULATIONS at Unit 18 ASB Zone	e 2		
265	Type: aerated biotreatment			
266				
	WWTP\PAE\Hardpipe	Scenar	io\ASB Hardpipe Scenario	v 7
	3/16/2023 1:47:24 PM 19:20:20			
267	COMPOUND: DIMETHYL DISULFIDE			
268				
269	Type of unit is aerated biotreatment			
270	1 Description of unit	18	ASB Zone 2	
271	2 Wastewater temperature (C)	20	32 08	
272	3 length of aeration unit (m)		368	
272	4 width of aeration unit (m)		184	
275	F dopth of coration unit $(m)$		0 07	
274	5  depth of aeration unit (m)		125	
275	6 Area of agitation (each aerator, m2)		135	
276	/ Total number of agitators in the unit		15	
277	8 Power of agitation (each aerator, HP)		75	
278	9 Impeller diameter (cm)		49.53	
279	10 Impeller rotation (RPM)		1200	
280	11 Agitator mechanical efficiency		0.83	
281	12 aerator effectiveness, alpha		0.83	
282	13 if there is plug flow, enter 1		0	
283	14 Overall biorate (mg/g bio-hr)		19	
284	15 Aeration air flow (m3/s)		0	
285	16 active biomass, aeration (g/l)		0.3	
286	17 If covered, then enter 1		0	
287	18 special input		0	
288	19 pH (enter 0 for no pH adjustment)		7.24	
289				
290	Properties of DIMETHYL DISULFIDE at 32.1	deg.C	(89.7 deg.F)	
291	$h_{1} = 0.001558 \text{ atm} - m_{3}/m_{0}$ vp= 41.78	35 mmHa	(0.80821  psia)	
292	86 579 v/x	,, , , , , , , , , , , , , , , , , , ,	(0.00011 pb14)	
293	0.062258  g/L gas per g/L liquid			
293	Temperature adjustment factor = 1 046	^/m_25	) peb (	
205	$k_1 = 0$ $I/a$ br $d_1 = 1.0240$ 05 c	(1 2)	$f_{1}$ , $deg. c$	
295	Compound flow mate from inlet water is 0			
290	Compound flow rate from inlet water is 0.	.02/9/1	g/s.	
297	compound flow rate from filet vent is 0.	g/s.		
298	Compound flow rate from inlet duct is U.	g/s.		
299	Submerged aeration rate from inlet vent i	ls 0. m	3/s.	
300	Total submerged aeration is 0. m3/s.			
301	The residence time in the unit is 15.594	hr.		
302	Biomass production			
303	The biomass production rate is 0.mg/h	nr. (0.	mg/L)	
304	The fraction dissolved solids convert	ed is	0	
305	The estimated biomass exit concentrat	ion is	0. mg/L.	
306	Quiescent wind shear surface Sr	oringer	_	
307	The fetch to depth ratio is 302.703.	<u> </u>		
308	kl is estimated as 5.945e-06 m/s.			
309	kg is estimated as 0.005633 m/s. Model:	2		
310	kg is estimated as 0 005633 m/s. Model:	2		
311	The Schmidt number is 1 72371	-		
312	The friction velocity is 27 202 m/s			
212 212	ka ja ostimatod os 0 012026 m/s Model.	2		
CTC	NY IS ESUIMALEU AS V.VIZOSO MIS. MOUELO	J		

314 \_Agitated surface\_ 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. 317 318 The rotation factor NFR is 797.027. 319 kg (agitated) is estimated as 0.11498 m/s. 320 kl (agitated) is estimated as 0.016622 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 1.598e-04 m/s. 323 The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. 327 328 KG aerated (m/s) 0.11714 329 KL aerated (m/s) 0.016622 330 KL OVERALL AERATED (m/s) 0.005152 331 KG quiescent (m/s) 0.005738 332 KL quiescent (m/s) 5.945e-06 333 KL OVERALL QUIESCENT (m/s) 5.85e-06 334 KL OVERALL (m/s) 1.598e-04 335 air stripping time constant (min) 101.198 336 FRACTION SURFACE VOLATILIZED 0.33728 337 FRACTION SUBMERGED VOLATILIZED Ο. 338 TOTAL FRACTION VOLATILIZED 0.33728 339 FRACTION BIOLOGICALLY REMOVED 0.62623 340 FRACTION ABSORBED Ο. 341 TOTAL AIR EMISSIONS (g/s) 0.009434 342 (Mg/year) 0.29751 343 EMISSION FACTOR (g/cm2-s) 1.393e-11 344 UNIT EXIT CONCENTRATION (ppmw) 8.721e-04 345

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 8 5 Humidity of inlet air (%) 40 9 25 6 Temperature of air (C) 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 41 COMPOUND: DIMETHYL SULFIDE (DMS) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature 34.08 (C) 295 46 3 length of aeration unit (m) 295 47 4 width of aeration unit (m) 5 depth of aeration unit (m) 1.4 48 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 52 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 53 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 60 Ο 61 18 special input 0 62 19 pH (enter 0 for no pH adjustment) 7.04

B-103

63

```
64
            Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)
 65
               hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia)
 66
                   162.463 y/x
 67
                   0.11606 g/L gas per g/L liquid
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 68
 69
                                       dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
               k1=0. L/q-hr
 70
            Compound flow rate from inlet water is 0.27039 g/s.
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
 74
            Total submerged aeration is 0. m3/s.
 75
            The residence time in the unit is 28.926 hr.
 76
               __Biomass production__
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                    _Quiescent wind shear surface___Springer_
 81
            The fetch to depth ratio is 237.766.
            kl is estimated as 7.634e-06 m/s.
 82
            kg is estimated as 0.007917 m/s. Model: 2
 83
            kg is estimated as 0.007917 m/s. Model: 2
 84
 85
            The Schmidt number is 1.01591.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.017873 m/s. Model: 3
 88
                    _Agitated surface_
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.14978 m/s.
 94
            kl (agitated) is estimated as 0.021024 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 4.77e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
             The ratio of the pump mixing to the residence time is 0.
101
102
               KG aerated (m/s)
                                                         0.15258
103
               KL aerated (m/s)
                                                         0.021024
104
               KL OVERALL AERATED (m/s)
                                                         0.009769
105
               KG quiescent (m/s)
                                                         0.008066
106
               KL quiescent (m/s)
                                                         7.634e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.574e-06
108
               KL OVERALL (m/s)
                                                         4.77e-04
109
               air stripping time constant (min)
                                                         48.915
110
               FRACTION SURFACE VOLATILIZED
                                                         0.80064
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
               TOTAL FRACTION VOLATILIZED
                                                         0.80064
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.1768
114
               FRACTION ABSORBED
                                                         Ο.
               TOTAL AIR EMISSIONS (g/s)
115
                                                         0.21648
116
                                                         6.82699
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         2.488e-10
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         0.005215
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                    WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
              3/16/2023 1:47:24 PM 19:21:06
122
            COMPOUND: DIMETHYL SULFIDE (DMS)
123
124
            Type of unit is system exit stream
```

125 1 Description of unit

126		
127	TOTAL AIR EMISSIONS (g/s)	0.
128	(Mq/year)	0.
129	EMISSION FACTOR (g/cm2-s)	2.488e-10
130	UNIT EXIT CONCENTRATION (ppmw)	2.285e-05
131	DETAILED CALCULATIONS at Unit 13 default op	en hub d
132	Type: open hub drain	
133		
	WWTP\PAE\Hardpipe Sc	enario\ASB Hardpipe Scenario V7
	3/16/2023 1:47:24 PM 19:21:06	, L L
134	COMPOUND: DIMETHYL SULFIDE (DMS)	
135		
136	Type of unit is open hub drain	
137	1 Description of unit	13 default open hub d
138	2 Underflow T (C)	43.89
139	3 Total water added at the unit $(1/s)$	0
140	4 Area of openings at unit (cm2)	50
141	5 Radius of drop pipe (cm)	5
142	6 Drop length to conduit (cm)	61
143	7 Open surface=1	1
144	8 Subsurface entrance=1	0
145	9 subsurface exit =1	0
146	10 radius of underflow conduit (cm)	12
147	11 distance to next unit (cm)	500
148	12 slope of underflow conduit	0.015
149	16 velocity air at drain opening (ft/min)	84
150	17 municipal waste in conduit =1	0
151	18 Assume equilibrium in unit, =1	0
152	19 pH (enter 0 for no pH adjustment)	8.9
153		
154	Equilibrium partitioning in drain drop hub	is assumed.
155	Total drain flow is 1170 l/s.	
156	Weight fraction down is 2.677E-07	
157	Gas concentration in 0 mol fraction.	
158	Gas flow 1170 L/s	
159	Weight fraction out at base of drop is	2.31101058606837E-07
160	fraction transferred in the drain drop f	rom hub is .136716
161	fraction loss in wastel drop to hub	0.
162	fraction loss in waste2 drop to hub	0.
163	fraction loss in waste3 drop to hub	0.
164	fraction loss in collection hub drop	0.13672
165	fraction loss in unit	0.
166	fraction loss in line run	0.
167	component upstream of unit, g/s	0.
168	mol iract. neadspace upstream (y)	0.
109	headspace at conduit discharge, y	U.
171	meladspace end of conduit (y)	5.6030-19
	mol fract. neadspace vent base	1.5320-05
	headspace flow out vent (cc/s)	-1.1/0+06
$\perp / 3$	KC gurfage (m/g)	1.170+00
	KG SUFLACE (m/s)	2834.248
176	KL SUFLACE $(M/S)$	8.7840-09
177	$\begin{array}{c} \text{IIOW OI waste uowii into (1/S)} \\ \text{appropriate flow in waste into whit (z/z)} \end{array}$	0. 21221
179	total component into unit (g/s)	0.31341
170	TOTAL ALD EMISSIONS (~/~)	0.27039
エ / フ 1 0 0	IUIAL AIK EMISSIUNS (9/S)	U.U42021 1 2604
10U	(MG/yedr)	2.4886-10
101 100	LINIT EVIT CONCENTRATION ()	2.400E-1U 0.2211
183	DETAILED CALCULATIONS at Unit 17 ACD 7000 2	0.2311
184	Type: aerated histratuent	
185	TARC. GETALEN DIOLICALIIEIIL	

```
186
            COMPOUND: DIMETHYL SULFIDE
                                        (DMS)
187
188
            Type of unit is aerated biotreatment
            1 Description of unit
189
                                                         17
                                                               ASB Zone 3
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
193
            5 depth of aeration unit (m)
                                                               0.91
            6 Area of agitation (each aerator,m2)
194
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
196
            8 Power of agitation (each aerator, HP)
                                                               75
            9 Impeller diameter (cm)
197
                                                               49.53
198
            10 Impeller rotation (RPM)
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               Ο
202
            14 Overall biorate (mg/g bio-hr)
                                                               19
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
            Properties of DIMETHYL SULFIDE (DMS) at 30. deq.C (86. deq.F)
209
               hl= 0.002519 atm-m3/mol
210
                                             vp= 606.985 mmHg (11.74 psia)
211
                   139.945 y/x
212
                    0.10132 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deg. C
214
               k1=0. L/g-hr
                                       dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
215
            Compound flow rate from inlet water is 2.889e-04 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                    _Quiescent wind shear surface____Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.566e-06 m/s.
228
            kg is estimated as 0.007884 m/s. Model: 2
            kg is estimated as 0.007884 m/s. Model: 2
229
230
            The Schmidt number is 1.03989.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.017611 m/s. Model: 3
233
                   __Agitated surface_
234
            The rotation speed is 125.654 radians per second.
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
            The rotation factor NFR is 797.027.
237
238
            kg (agitated) is estimated as 0.14804 m/s.
239
            kl (agitated) is estimated as 0.018962 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
             The effective KL (surface + diffused air) is 1.053e-04 m/s.
241
242
             The effective stripping time (surface + diffused air) is 144.073 minutes.
             (2.40122 hrs.)
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
243
244
             The ratio of the mixing to the striping (surface + diffused air) is 0.
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.15081
248
               KL aerated (m/s)
                                                          0.018962
249
               KL OVERALL AERATED (m/s)
                                                          0.00854
250
               KG quiescent (m/s)
                                                          0.008032
```

251	KL quiescent (m/s)	7.566e-06
252	KL OVERALL OUTESCENT (m/s)	7.497e-06
253	KI. OVERALI. $(m/s)$	1 053e - 04
254	air stripping time constant (min)	144 073
255	FRACTION SURFACE VOLATILIZED	0 5886
256	FRACTION SUBMERGED VOLATILIZED	0.
257	TOTAL FRACTION VOLATILIZED	0 5886
258	FRACTION BIOLOGICALLY REMOVED	0 31886
259	FRACTION ABSORBED	0
260	TOTAL AIR EMISSIONS (a/a)	1, 701 = -04
261	(Ma/year)	0.005363
262	$(\mathbf{M}_{\mathbf{G}}) = (\mathbf{M}_{\mathbf{G}})$ $\mathbf{FM}_{\mathbf{G}} = \mathbf{M}_{\mathbf{G}} = \mathbf{M}_{G$	2 406e - 13
263	INTT FXIT CONCENTRATION (DDmw)	2 2850-05
264	DETAILED CALCULATIONS at Unit 18 ASB Zone	2.205C 05
265	Type: aerated biotreatment	. 4
266		
200		
	WWTD\ DAF\ Hardnine	Scenario\ASB Hardnine Scenario V7
	3/16/2023 1.47.24 DM 19.21.06	Scenario (ASB nardpipe Scenario V/
267	COMPOUND · DIMETHVI, SULFIDE (DMS)	
207	COMPOUND: DIMETHIE SOUPIDE (DMS)	
200	Type of unit is serated histrestment	
209	1 Degarintion of unit	19 ACR 7000 2
270	2 Westerreter temperature (C)	
271	2 wastewater temperature (C)	32.00
272	3 length of aeration unit (m)	308
2/3	4 width of aeration unit (m)	
2/4	5 depth of aeration unit (m)	0.97
275	6 Area of agitation (each aerator,m2)	135
276	/ Total number of agitators in the unit	15
277	8 Power of agitation (each aerator, HP)	75
278	9 Impeller diameter (cm)	49.53
279	10 Impeller rotation (RPM)	1200
280	11 Agitator mechanical efficiency	0.83
281	12 aerator effectiveness, alpha	0.83
282	13 if there is plug flow, enter 1	0
283	14 Overall biorate (mg/g bio-hr)	19
284	15 Aeration air flow (m3/s)	0
285	16 active biomass, aeration (g/l)	0.3
286	17 If covered, then enter 1	0
287	18 special input	0
288	19 pH (enter 0 for no pH adjustment)	7.24
289		
290	Properties of DIMETHYL SULFIDE (DMS) at	32.1 deg.C (89.7 deg.F)
291	hl= 0.002719 atm-m3/mol vp= 655.2	201 mmHg (12.673 psia)
292	151.062 y/x	
293	0.10863 g/L gas per g/L liquid	
294	Temperature adjustment factor = 1.046	^(T-25), deg. C
295	kl = 0. L/g-hr $dl = 1.495e-05 c$	cm2/s dv= 0.14597 cm2/s
296	Compound flow rate from inlet water is 0.	006101 g/s.
297	Compound flow rate from inlet vent is 0.	g/s.
298	Compound flow rate from inlet duct is 0.	g/s.
299	Submerged aeration rate from inlet vent i	.s 0. m3/s.
300	Total submerged aeration is 0. m3/s.	
301	The residence time in the unit is 15.594	hr.
302	Biomass production	
303	The biomass production rate is 0.mg/h	nr. (0. mg/L)
304	The fraction dissolved solids convert	ted is 0
305	The estimated biomass exit concentrat	tion is 0. mg/L.
306	Quiescent wind shear surfaceSp	pringer_
307	The fetch to depth ratio is 302.703.	
308	kl is estimated as 7.6e-06 m/s.	
309	kg is estimated as 0.007966 m/s. Model:	2
310	kg is estimated as 0.007966 m/s. Model:	2
311	The Schmidt number is 1.02758.	
312	The friction velocity is 37.398 m/s	
313	kg is estimated as 0.017744 m/s. Model:	3

314 \_Agitated surface\_ 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. 317 The power number NPR is 7.881e-04. 318 The rotation factor NFR is 797.027. 319 kg (agitated) is estimated as 0.14892 m/s. 320 kl (agitated) is estimated as 0.019984 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 2.809e-04 m/s. 323 The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. 327 328 KG aerated (m/s) 0.15171 329 KL aerated (m/s) 0.019984 330 KL OVERALL AERATED (m/s) 0.009148 331 KG quiescent (m/s) 0.008115 332 KL quiescent (m/s) 7.6e-06 333 KL OVERALL QUIESCENT (m/s) 7.537e-06 334 KL OVERALL (m/s) 2.809e-04 335 air stripping time constant (min) 57.552 336 FRACTION SURFACE VOLATILIZED 0.76981 337 FRACTION SUBMERGED VOLATILIZED Ο. 338 TOTAL FRACTION VOLATILIZED 0.76981 339 FRACTION BIOLOGICALLY REMOVED 0.18284 340 FRACTION ABSORBED Ο. 341 TOTAL AIR EMISSIONS (g/s) 0.004697 342 (Mg/year) 0.14812 343 EMISSION FACTOR (g/cm2-s) 6.937e-12 344 UNIT EXIT CONCENTRATION (ppmw) 2.469e-04 345

1 2 3 Type of unit is 4 1 Total water added at the unit (l/s) 50 0 5 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 5 6 7 61 4 Drop length to conduit (cm) 8 5 Humidity of inlet air (%) 40 9 25 6 Temperature of air (C) 84 10 7 Drain air velocity (ft/min) 11 8 manhole air velocity (ft/min) 128 12 9 Conduit air velocity (ft/min) 66 13 10 Wind speed (cm/s at 10 m) 447 14 11 distance to next unit (cm) 500 15 12 slope of underflow conduit .015 .016 16 13 friction factor liquid 17 14 friction factor gas .006 18 15 radius of underflow conduit (cm) 12 16 Underflow T (C) 25 19 20 17 oscillation cycle time (min) 5 2 21 18 design collection velocities (ft/s) 22 .4 19 design branch line fraction full 23 24 Type of unit is 25 0 8 HL partition flag=1, adjust for sorption 26 9 unit recycle convergence number 200 27 10 oil molecular weight 0 0 28 11 oil density (g/cc) 29 12 NaUT 1=municipal 2=industrial 3=turb. 0 30 13 NaUT 1=mass tr. 2=equil 0 31 14 parts biomass per 1000 parts COD 32 15 oil water partition method 0=owpc 33 16 use UNIFAC aqueous data base =1 34 17 specify mass transfer for unit, =1 35 18 Use biomass for unit option, =1 36 19 biogrowth Monod half concentration ppm 37 38 DETAILED CALCULATIONS at Unit 11 ASB Zone 1 39 Type: aerated biotreatment 40 WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 41 COMPOUND: METHANETHIOL(methyl mercaptan) 42 43 Type of unit is aerated biotreatment 44 1 Description of unit 11 ASB Zone 1 45 2 Wastewater temperature 34.08 (C) 295 46 3 length of aeration unit (m) 295 47 4 width of aeration unit (m) 5 depth of aeration unit (m) 1.4 48 49 6 Area of agitation (each aerator,m2) 135 50 7 Total number of agitators in the unit 31 51 8 Power of agitation (each aerator, HP) 75 52 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 53 1200 54 11 Agitator mechanical efficiency 0.83 55 12 aerator effectiveness, alpha 0.83 56 13 if there is plug flow, enter 1 0 57 19 14 Overall biorate (mg/g bio-hr) 58 15 Aeration air flow (m3/s) 0 59 16 active biomass, aeration (g/l) 0.3 60 17 If covered, then enter 1 Ο 61 18 special input 0 62 19 pH (enter 0 for no pH adjustment) 7.04

63

```
64
            Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)
 65
               hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia)
 66
                   230.99 y/x
 67
                   0.16502 g/L gas per g/L liquid
 68
               Temperature adjustment factor = 1.046 ^(T-25), deg. C
 69
                                      dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
               k1=0. L/q-hr
 70
            Compound flow rate from inlet water is 0.009471 g/s.
 71
            Compound flow rate from inlet vent is 0. g/s.
 72
            Compound flow rate from inlet duct is 0. g/s.
 73
            Submerged aeration rate from inlet vent is 0. m3/s.
            Total submerged aeration is 0. m3/s.
 74
            The residence time in the unit is 28.926 hr.
 75
 76
               __Biomass production__
 77
                The biomass production rate is 0.mg/hr. (0. mg/L)
 78
                The fraction dissolved solids converted is 0. .
 79
                The estimated biomass exit concentration is 0. mg/L.
 80
                   _Quiescent wind shear surface___Springer_
 81
            The fetch to depth ratio is 237.766.
            kl is estimated as 7.703e-06 m/s.
 82
            kg is estimated as 0.010871 m/s. Model: 2
 83
            kg is estimated as 0.010871 m/s. Model: 2
 84
 85
            The Schmidt number is 0.63285.
 86
            The friction velocity is 37.398 m/s
 87
            kg is estimated as 0.024173 m/s. Model: 3
 88
                    _Agitated surface_
 89
            The rotation speed is 125.654 radians per second.
 90
            The rotation factor NRW is 2.052e+06.
 91
            The power number NPR is 7.881e-04.
 92
            The rotation factor NFR is 797.027.
 93
            kg (agitated) is estimated as 0.18977 m/s.
 94
            kl (agitated) is estimated as 0.021167 m/s.
 95
                The specified and growth biomass is 0.3 \text{ g/L}.
 96
             The effective KL (surface + diffused air) is 6.265e-04 m/s.
 97
             The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
             hrs.)
 98
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 99
             The ratio of the mixing to the striping (surface + diffused air) is 0.
100
             The mean residence time is 1735.541 min. (28.926 hr.)
101
             The ratio of the pump mixing to the residence time is 0.
102
               KG aerated (m/s)
                                                         0.19332
103
               KL aerated (m/s)
                                                         0.021167
104
               KL OVERALL AERATED (m/s)
                                                         0.012876
105
               KG quiescent (m/s)
                                                         0.011075
106
               KL quiescent (m/s)
                                                         7.703e-06
107
               KL OVERALL QUIESCENT (m/s)
                                                         7.672e-06
108
               KL OVERALL (m/s)
                                                         6.265e-04
109
               air stripping time constant (min)
                                                         37.242
110
               FRACTION SURFACE VOLATILIZED
                                                         0.88738
111
               FRACTION SUBMERGED VOLATILIZED
                                                         0.
112
                                                         0.88738
               TOTAL FRACTION VOLATILIZED
113
               FRACTION BIOLOGICALLY REMOVED
                                                         0.093578
114
               FRACTION ABSORBED
                                                         Ο.
               TOTAL AIR EMISSIONS (g/s)
115
                                                         0.008404
116
                                                         0.26504
                                 (Mg/year)
117
               EMISSION FACTOR (g/cm2-s)
                                                         9.657e-12
118
               UNIT EXIT CONCENTRATION (ppmw)
                                                         1.541e-04
119
            DETAILED CALCULATIONS at Unit 12 def.system exit st
120
            Type: system exit stream
121
                                    WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
              3/16/2023 1:47:24 PM 19:21:41
122
            COMPOUND: METHANETHIOL(methyl mercaptan)
123
124
            Type of unit is system exit stream
```

125 1 Description of unit

126		
127	TOTAL AIR EMISSIONS (g/s)	0.
128	(Mq/year)	0.
129	EMISSION FACTOR (g/cm2-s)	9.657e-12
130	UNIT EXIT CONCENTRATION (ppmw)	5.348e-07
131	DETAILED CALCULATIONS at Unit 13 default op	en hub d
132	Type: open hub drain	
133		
	WWTP\PAE\Hardpipe Sc	enario\ASB Hardpipe Scenario V7
	3/16/2023 1:47:24 PM 19:21:41	
134	COMPOUND: METHANETHIOL(methyl mercaptan)	
135		
136	Type of unit is open hub drain	
137	1 Description of unit	13 default open hub d
138	2 Underflow T (C)	43.89
139	3 Total water added at the unit $(l/s)$	0
140	4 Area of openings at unit (cm2)	50
141	5 Radius of drop pipe (cm)	5
142	6 Drop length to conduit (cm)	61
143	7 Open surface=1	1
144	8 Subsurface entrance=1	0
145	9 subsurface exit =1	0
146	10 radius of underflow conduit (cm)	12
147	11 distance to next unit (cm)	500
148	12 slope of underflow conduit	0.015
149	16 velocity air at drain opening (ft/min)	84
150	17 municipal waste in conduit =1	0
151	18 Assume equilibrium in unit, =1	0
152	19 pH (enter 0 for no pH adjustment)	8.9
153		
154	Equilibrium partitioning in drain drop hub	is assumed.
155	Total drain flow is 1170 l/s.	
156	Weight fraction down is 9.8E-09	
157	Gas concentration in 0 mol fraction.	
158	Gas flow 1170 L/s	
159	Weight fraction out at base of drop is	8.09478308097639E-09
160	fraction transferred in the drain drop f	rom hub is .174002
161	fraction loss in wastel drop to hub	0.
162	fraction loss in waste2 drop to hub	0.
163	fraction loss in waste3 drop to hub	0.
164	fraction loss in collection hub drop	0.174
165	fraction loss in unit	0.
166	fraction loss in line run	0.
167	component upstream of unit, g/s	0.
168	mol iract. neadspace upstream (y)	0.
109	headspace at conduit discharge, y	0.
171	meladspace end of conduit (y)	2.559e-20
$\perp / \perp$	mor fract. Headspace vent base	9.21/0-07
⊥/Z 172	headspace flow down line (cc/s)	-1.1/e+06
171	RC gurfage (m/g)	
175	KG Suiface ( $m/s$ )	
176	flow of waste down hub $(1/a)$	0
± / 0 1 7 7	$\begin{array}{c} \text{IIII} \text{ or } \text{waste uowil IIII} (1/S) \\ \text{component flow in waste into whit } (a/a) \\ \end{array}$	0.011466
± / / 1 7 8	total component into unit $\alpha/\alpha$	0 009471
179	TOTAL AID EMISSIONS (~/~)	0.009474
180	(YCS) (Ma (YCS)	0.062918
181	(rig/year) FMISSION FACTOR (a/am2-a)	9 6570-12
182	$\frac{1}{10000000000000000000000000000000000$	0 008095
183	DETAILED CALCULATIONS at Unit 17 AGE 7000 2	0.00095
184	Type: aerated histratment	
185	TYPE, actated protectiment	

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41

```
186
            COMPOUND: METHANETHIOL(methyl mercaptan)
187
188
            Type of unit is aerated biotreatment
189
            1 Description of unit
                                                         17
                                                               ASB Zone 3
190
            2 Wastewater temperature
                                                               30.01
                                        (C)
191
            3 length of aeration unit (m)
                                                               376
            4 width of aeration unit (m)
192
                                                               188
193
            5 depth of aeration unit (m)
                                                               0.91
            6 Area of agitation (each aerator,m2)
194
                                                               135
195
            7 Total number of agitators in the unit
                                                               6
196
            8 Power of agitation (each aerator, HP)
                                                               75
            9 Impeller diameter (cm)
197
                                                               49.53
198
            10 Impeller rotation (RPM)
                                                               1200
199
            11 Agitator mechanical efficiency
                                                               0.83
200
            12 aerator effectiveness, alpha
                                                               0.83
201
            13 if there is plug flow, enter 1
                                                               Ο
202
                                                               19
            14 Overall biorate (mg/g bio-hr)
203
            15 Aeration air flow (m3/s)
                                                               0
204
            16 active biomass, aeration (g/l)
                                                               0.3
205
            17 If covered, then enter 1
                                                               0
206
            18 special input
                                                               0
207
            19 pH (enter 0 for no pH adjustment)
                                                               7.42
208
            Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
209
               hl= 0.003687 atm-m3/mol
210
                                            vp= 2014.774 mmHg (38.97 psia)
211
                    204.826 y/x
212
                    0.14829 g/L gas per g/L liquid
213
               Temperature adjustment factor = 1.046 (T-25), deg. C
214
               k1=0. L/g-hr
                                       dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
215
            Compound flow rate from inlet water is 7.237e-06 g/s.
216
            Compound flow rate from inlet vent is 0. g/s.
217
            Compound flow rate from inlet duct is 0. g/s.
218
            Submerged aeration rate from inlet vent is 0. m3/s.
219
            Total submerged aeration is 0. m3/s.
220
            The residence time in the unit is 15.272 hr.
221
                Biomass production_
222
                The biomass production rate is 0.mg/hr. (0. mg/L)
223
                The fraction dissolved solids converted is 0. .
224
                The estimated biomass exit concentration is 0. mg/L.
225
                    _Quiescent wind shear surface____Springer_
226
            The fetch to depth ratio is 329.675.
227
            kl is estimated as 7.635e-06 m/s.
228
            kg is estimated as 0.010826 m/s. Model: 2
            kg is estimated as 0.010826 m/s. Model: 2
229
230
            The Schmidt number is 0.64779.
231
            The friction velocity is 37.398 m/s
232
            kg is estimated as 0.023814 m/s. Model: 3
233
                   _Agitated surface_
234
            The rotation speed is 125.654 radians per second.
235
            The rotation factor NRW is 2.052e+06.
236
            The power number NPR is 7.881e-04.
            The rotation factor NFR is 797.027.
237
238
            kg (agitated) is estimated as 0.18756 m/s.
239
            kl (agitated) is estimated as 0.019092 m/s.
240
                The specified and growth biomass is 0.3 \text{ g/L}.
             The effective KL (surface + diffused air) is 1.391e-04 m/s.
241
242
             The effective stripping time (surface + diffused air) is 109.038 minutes.
             (1.81731 hrs.)
243
             The pump mixing time is 5 x the pumping recirculaion time, 0. min.
244
             The ratio of the mixing to the striping (surface + diffused air) is 0.
245
             The mean residence time is 916.326 min. (15.272 hr.)
246
             The ratio of the pump mixing to the residence time is 0.
247
               KG aerated (m/s)
                                                          0.19108
248
               KL aerated (m/s)
                                                          0.019092
249
               KL OVERALL AERATED (m/s)
                                                          0.011483
250
               KG quiescent (m/s)
                                                          0.011029
```

251	KL quiescent (m/s)	7.635e-06
252	KL OVERALL QUIESCENT (m/s)	7.6e-06
253	KL OVERALL (m/s)	1.391e-04
254	air stripping time constant (min)	109.038
255	FRACTION SURFACE VOLATILIZED	0.72669
256	FRACTION SUBMERGED VOLATILIZED	0.
257	TOTAL FRACTION VOLATILIZED	0.72669
258	FRACTION BIOLOGICALLY REMOVED	0.18684
259	FRACTION ABSORBED	0.
260	TOTAL AIR EMISSIONS (q/s)	5.259e-06
261	(Mg/year)	1.658e-04
262	EMISSION FACTOR $(q/cm^2-s)$	7 439e-15
263	$\frac{1}{1}$	5.348e - 07
264	DETAILED CALCULATIONS at Unit 18 ASB 7 or	2
265	Type: aerated biotreatment	
205	Type: aeraced Diotreatment	
200		
	WWTD\ DAF\ Hardnine	Scenario ASB Hardning Scenario V7
	WWIF (PAL (Halupipe 3/16/2023 1·47·24 DM 10·21·41	Scenario (ASB naropipe Scenario V/
267	COMPOIND: METUANETUIOI (motby] morgaptan)	
207	COMPOUND: METHANEIHIOL(Methyl Mercaptan)	
268	There is a subject of the second set of the second	
269	Type of unit is aerated blotreatment	
270	1 Description of unit	18 ASB Zone 2
271	2 Wastewater temperature (C)	32.08
272	3 length of aeration unit (m)	368
273	4 width of aeration unit (m)	184
274	5 depth of aeration unit (m)	0.97
275	6 Area of agitation (each aerator,m2)	135
276	7 Total number of agitators in the unit	15
277	8 Power of agitation (each aerator,HP)	75
278	9 Impeller diameter (cm)	49.53
279	10 Impeller rotation (RPM)	1200
280	11 Agitator mechanical efficiency	0.83
281	12 aerator effectiveness, alpha	0.83
282	13 if there is plug flow, enter 1	0
2.83	14 Overall biorate (mg/g bio-br)	19
284	15 Aeration air flow $(m_3/s)$	0
285	16 active biomass aeration $(\alpha/1)$	03
286	17 If covered then enter 1	0
287	18 special input	Ũ
207	10 special input	0 24
200	19 ph (encer o for no ph adjustment)	1.21
209	Droportion of METHANETHIAL (mother] moreor	(20, 7, 1)
290	bl 0.002001 stm m2/msl	(11) at $32.1$ deg.c $(39.7  deg.r)$
291	MI = 0.003921 atm - m3/m01 Vp = 2142	2.//1 mmHg (41.446 psia)
292	217.838 Y/X	
293	U.15664 g/L gas per g/L liquid	
294	Temperature adjustment factor = 1.046	6 (1-25), deg. C
295	kl = 0. L/g-hr $dl = 1.515e-05$	cm2/s dv= 0.23433 cm2/s
296	Compound flow rate from inlet water is 1	803e-04 g/s.
297	Compound flow rate from inlet vent is 0.	g/s.
298	Compound flow rate from inlet duct is 0.	g/s.
299	Submerged aeration rate from inlet vent	is 0. m3/s.
300	Total submerged aeration is 0. m3/s.	
301	The residence time in the unit is 15.594	hr.
302	Biomass production	
303	The biomass production rate is 0.mg/	'hr. (0. mg/L)
304	The fraction dissolved solids conver	ted is 0
305	The estimated biomass exit concentra	ation is 0. mg/L.
306	Quiescent wind shear surface	Springer
307	The fetch to depth ratio is 302 703	L J
308	k] is estimated as 7 $67e-06 \text{ m/s}$	
309	kg is estimated as 0 010938 m/s Model.	2
310	ka is estimated as 0.010000 m/s. Model.	2
311	The Schmidt number is 0 6/012	-
312	The friction velocity is 27 200 m/s	
313	the is estimated as 0 022006 m/s Madal.	2
CIC	MUDEL.	

314 \_Agitated surface\_ 315 The rotation speed is 125.654 radians per second. 316 The rotation factor NRW is 2.052e+06. 317 The power number NPR is 7.881e-04. 318 The rotation factor NFR is 797.027. 319 kg (agitated) is estimated as 0.18868 m/s. 320 kl (agitated) is estimated as 0.020121 m/s. 321 The specified and growth biomass is 0.3 g/L. 322 The effective KL (surface + diffused air) is 3.715e-04 m/s. 323 The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) 324 The pump mixing time is 5 x the pumping recirculaion time, 0. min. 325 The ratio of the mixing to the striping (surface + diffused air) is 0. 326 The mean residence time is 935.622 min. (15.594 hr.) 327 The ratio of the pump mixing to the residence time is 0. 328 KG aerated (m/s) 0.19222 329 KL aerated (m/s) 0.020121 330 KL OVERALL AERATED (m/s) 0.012174 331 0.011143 KG quiescent (m/s) 332 KL quiescent (m/s) 7.67e-06 333 KL OVERALL QUIESCENT (m/s) 7.637e-06 334 KL OVERALL (m/s) 3.715e-04 335 air stripping time constant (min) 43.518 336 FRACTION SURFACE VOLATILIZED 0.86271 337 FRACTION SUBMERGED VOLATILIZED Ο. 338 TOTAL FRACTION VOLATILIZED 0.86271 339 FRACTION BIOLOGICALLY REMOVED 0.097161 340 FRACTION ABSORBED Ο. 341 TOTAL AIR EMISSIONS (g/s) 1.556e-04 342 (Mg/year) 0.004907 343 EMISSION FACTOR (g/cm2-s) 2.298e-13 344 UNIT EXIT CONCENTRATION (ppmw) 6.185e-06 345

#### PAE H2S Factor Summary of H2SSIM Inputs and Outputs

								7	7 0	7 0	TILLAOD
PAE - No Stripper Scenar DO Temp pH Leng Widtł	rio Zone 1 1.57 p 93.34 7.04 th 968 h 968	Zone 2 7 4.63 4 89.74 4 7.24 3 1208 3 604	Zone 3 4.66 86.02 7.42 1235 617	Flow Total Sulfide Sulfate	Main Inlet H 25.48 0.252 390	ardpipe Units 1.22 MGD 1.47 mg/L 390 mg/L	H2S g/s	Zone 1 0.08	Zone 2 0.03	Zone 3 0.02	Total ASB 0.122 g/s 2200 ODTP/day 1.06E-02 lb/ODTP
Aerat	tors 3 <sup>-</sup>	1 15	6								
PAE - Backup Stripper DO Temp pH Leng Width Aerat	Zone 1 1.5; p 93.34 7.04 th 968 h 968 tors 3	Zone 2 7 4.63 4 89.74 4 7.24 3 1208 3 604 1 15	Zone 3 4.66 86.02 7.42 1235 617 6	Flow Total Sulfide Sulfate	Main Inlet H 25.48 0.252 390	ardpipe Units 1.22 MGD 2.93 mg/L 390 mg/L	H2S g/s	Zone 1 0.08	Zone 2 0.03	Zone 3 0.02	Total ASB <b>0.126</b> g/s 2200 ODTP/day <b>1.09E-02</b> lb/ODTP
								Zone 1	Zone 2	Zone 3	Total ASB
PAE - New Stripper	Zone 1	Zone 2	Zone 3	Flow	Main Inlet H	ardpipe Units	H2S g/s	0.07	0.03	0.02	0.119
Temr	n 93.34	4.03	86.02	Total Sulfide	0 252	0.00 mg/l					1 03E-02 lb/ODTP
Ha	7.04	4 7.24	7.42	Sulfate	390	390 mg/L					
Leng	th 968	3 1208	1235			<u>-</u>					
Width	h 968	3 604	617								
Aerat	tors 3 <sup>r</sup>	1 15	6								

\*DO are based on average of all DO readings from 2021 and 2022 Subpart S performance testing.

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3 –
Zone Location of Hardpipe	1
Type of Basin	ASB 🚽

#### Data Type 3. Load Characteristics

Loading	Main		
Characteristics	Influent	Hardpipe	Units
Flow	25.48		MGD
Total Sulfide	0.252		mg/L 🔽
Sulfate	390	390	mg/L -

#### Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph 🚽
Ambient Temperature	79	F 🛨

Data Type 5. Zone Physical and Chemical Conditions					
Zone Condition	Zone I	Zone Z	Zone 3	Zone 4	Units
Dissolved Oxygen	1.57	4.63	4.66		mg/L
Temperature	93.34	89.74	86.02		F 🔻
рН	7.04	7.24	7.42		s.u.
Redox Condition	Aerobic 🗖	Aerobic 🗖	Aerobic 🗾	Aerobic 🚽	
Length	968	1208	1235		feet 🚽
Width	968	604	617		feet 🚽
Depth	4.5	3.2	3		feet 🚽
Mixing	Moderat -	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet 🚽
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms 🔽
Weir Height	0	0	0		feet -



## New Stripper Scenario

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions $(H_2S)$	0.119	gms/s
Total Emissions (H <sub>2</sub> S)	8271.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.1	tons/yr
Total Emissions (H <sub>2</sub> S)	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.6	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4987.3	1762.5	1522.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	26.0	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	36.300	6.200	5.400		lbs/yr

New Stripper Scenario

Current Parameters			
kgen	0.25		
ThetaGen	1.06		
KDO	0.05		
KSO4	10		
kanox	0.006		
ThetaOx	1.05		
m	1		
n	0.2		
MLVSS	272.2		
O <sub>2</sub> Transfer Coeff.	2		
alpha 1	0.83		
alpha 2	0.6		

Percent Inlet Sulfide Removed 57.7%

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3 –
Zone Location of Hardpipe	1
Type of Basin	ASB 🚽

#### Data Type 3. Load Characteristics

Loading	Main		
Characteristics	Influent	Hardpipe	Units
Flow	25.48	1.22	MGD -
Total Sulfide	0.252	2.93	mg/L 🚽
Sulfate	390	390	mg/L 🚽

#### Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph 🚽
Ambient Temperature	79	F 🚽

Data Type 5. Zone Physical and Chemical Conditions						
Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	
Dissolved Oxygen	1.57	4.63	4.66	4.66		
Temperature	93.34	89.74	86.02		F 🗾	
рН	7.04	7.24	7.42		s.u.	
Redox Condition	Aerobic 🗾	Aerobic 🔽	Aerobic 🗖	Aerobic 🔫		
Length	968	1208	1235		feet 🚽	
Width	968	604	617		feet 🚽	
Depth	4.5	3.2	3		feet 🗾	
Mixing	Moderat -	Moderat	Moderat			
Number of Aerators	31	15	6			
Total Horsepower	2325	1125	450		HP	
Impellor Size	1.625	1.625	1.625		feet 🚽	
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms 🚽	
Weir Height	0	0	0		feet -	


## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions $(H_2S)$	0.126	gms/s
Total Emissions (H <sub>2</sub> S)	8765.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.4	tons/yr
Total Emissions (H <sub>2</sub> S)	4.0	tonnes/yr
Emission Flux (H <sub>2</sub> S)	17.6	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5479.5	1763.8	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	28.6	11.8	9.8		gms/m² yı
Liquid Conc. (Total Sulfide)	0.004	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	45.000	6.500	5.700		lbs/yr

Backup Stripper Scenario			
Current Parameters			
kgen	0.25		
ThetaGen	1.06		
KDO	0.05		
KSO4	10		
kanox	0.006		
ThetaOx	1.05		
m	1		
n	0.2		
MLVSS	272.2		
O <sub>2</sub> Transfer Coeff.	2		
alpha 1	0.83		
alpha 2	0.6		

Percent Inlet Sulfide Removed 71.2%

## NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

## Data Type 2. Model Zone Information

Number of Zones	3 –
Zone Location of Hardpipe	1
Type of Basin	ASB 🚽

## Data Type 3. Load Characteristics

Loading	Main		
Characteristics	Influent	Hardpipe	Units
Flow	25.48	1.22	MGD -
Total Sulfide	0.252	1.47	mg/L 🚽
Sulfate	390	390	mg/L -

## Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph 🚽
Ambient Temperature	79	F 🚽

Data Type 5. Zone Physical and Chemical Conditions						
Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	
Dissolved Oxygen	1.57	4.63	4.66		mg/L	
Temperature	93.34	89.74	86.02		F	
рН	7.04	7.24	7.42		s.u.	
Redox Condition	Aerobic 🗾	Aerobic 🔽	Aerobic 🗖	Aerobic 🔫		
Length	968	1208	1235		feet 🚽	
Width	968	604	617		feet 🚽	
Depth	4.5	3.2	3		feet 🚽	
Mixing	Moderat -	Moderat	Moderat			
Number of Aerators	31	15	6			
Total Horsepower	2325	1125	450		HP	
Impellor Size	1.625	1.625	1.625		feet 🗖	
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms -	
Weir Height	0	0	0		feet -	





## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions $(H_2S)$	0.123	gms/s
Total Emissions $(H_2S)$	8518.1	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.3	tons/yr
Total Emissions (H <sub>2</sub> S)	3.9	tonnes/yr
Emission Flux (H <sub>2</sub> S)	17.1	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5232.9	1763.2	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	27.3	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	41.500	6.500	5.700		lbs/yr

No Stripper Scenario

Current Parameters				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	272.2			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

Percent Inlet Sulfide Removed 65.9%

#### **Methanol PAE Emissions Factors**

Methanol PAE Scenarios	Hardpipe ppm	Hardpipe Flow, MGD	Air Stripping g/s	Pulp Production	Methanol Emissions Factor lb/ODTP
New Stripper	N/A	N/A	3.47	2200	0.30
Backup Stripper	2095	1.22	17.63	2200	1.53
No Stripper	3809	1.22	26.69	2200	2.31

Design MeOH: lb/hr 1620 16

lb/ODT

 Data Date:
 PAE - New Stripper Scenario

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT	ΓΙΟΝ			
-	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	С	35.4	33.5	31.3
Length	ft	968	1,208	1,235
Width	ft	968	604	617
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - total flows		III. HAP DA	III. HAP DATA									
	Flow	Flow	MeOH	Methanol	Methanol			Average Zone Concentration				
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3	_	Limit	
Influent Concentration		25.5	60.0	Conc.	mg/L	60.0	7.4	5.4	3.2		0.5	
				Temp.	F		95.7	92.3	88.3			
Effluent Concentration			5.10									
Wind Speed	mph		3.8									

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	86.3
Fraction air emissions	5.2
Fraction remaining in unit effluent	8.5

12%9%5%Expected zone concentration reductions similar to 2022 data.No Hardpipe Stream

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - New Stripper Scenario

		Equil. Ratio (Hc)											
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn						
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С					
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13					
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8					
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27					

General
---------

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	VW
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT KL Params

		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 <b>AND</b> U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	DIFFUSED			

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - New Stripper Scenario

	Surface Aeration														
Turbulent Area Quiescient Area															
								kL, m/s							
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall			
	Н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s			
Zone1						_									
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06			
Zone 2															
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06			
Zone 3															
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06			

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - New Stripper Scenario

NAME OF THE FACILITY COMPOUND for site specific biorate determination Number of zones in the biological treatment unit VOLUME of full-scale system (cubic meters) Average DEPTH of the full-scale system (meters) FLOW RATE of wastewater to the unit (m3/s) FLOW RATE of condensate to the unit (m3/s) <b>Total wastewater flowrate - (including condensates) (m3/s)</b> ESTIMATE OF KL (m/s) Concentration in the wastewater treated in the unit (mg/L) Concentration in the condensates (mg/L) <b>Concentration in wastewater (total - inc. cond) in (mg/L)</b> Concentration in the effluent (mg/L) TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A) TOTAL RESIDENCE TIME (s) line 2 divided by line 10. TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	Met           1           2         25           3         1.0           4         5           5-A         6           6         se           7         8           8-A         9           10         11           12         12	thanol 50372.98 0878333 1.116 0.000 1.116 60 0 60 0 0 0 0 0 0 0 0 0 0 0 0 0	2.60 days
Lines 13 through 15 Not Used Zone Concentration for zone, Area of the in the zone Number Ci (mg/L) zone, A (m2) (m/s) 1 7.38608521 87091.1501 3.54365E-06 2 5.393164807 67793.7816 2.39719E-06 3 3.166816433 70821.6825 1.37942E-06 4	AIR STR KL A Ci	RIPPING (g/s) 2.2795 0.8765 0.309	0.308621 0.162515 0.097693
6 TOTALS - sum for each zone. 15 225706.614 Removal by air stripping (g/s). Line 16. Loading in effluent (g/s). Line 9 times line 10. Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}. Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18)	16 17 18 19 20	3.47 3.47 5.69 67.0 57.8	
Fraction biodegraded: Divide line 20 by line 19. Fraction air emissions: Divide line 17 by line 19. Fraction remaining in unit effluent. Divide line 18 by 19.	20 21 22 23	0.863 0.052 0.085	

 Data Date:
 PAE - Old Stripper Scenario

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT	I. BIOTREATMENT UNIT DESCRIPTION							vs		
-	Units	Zone 1	Zone 2	Zone 3			Flow MGD	MeOH mg/L		
Number of 75 HP Aerators	#	31	15	6						
Number of 100 HP Aerators	#	0	0	0						
Total Horsepower	HP	2325	1125	450		Inlet Stream **	25.48	59.5		
Temperature	С	35.4	33.5	31.3		Condensate Stream	1.2	2,095		
Length	ft	968	1,208	1,235		Outlet	26.7	5.1		
Width	ft	968	604	617		** except conde	ensate flow			
Average Depth	ft	4.5	3.2	3						
Aerator Rotation	rpm	1200	1200	1200						
Agitation Area per 75 HP aerator	ft2	1452	1452	1452						
Agitation Area per 100 HP aerator	ft2	2206	2206	2206						
Impellor Diameter	in	19.5	19.5	19.5		NA - individual flow/conc data not available				

II. OVERALL PARAMS - total flows		III. HAP DA	III. HAP DATA								
	Flow	Flow	MeOH	Methanol	Average Zone Concentration					Detect	
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3		Limit
Influent Concentration		26.7	152.8	Conc.	mg/L	152.8	41.9	24.2	7.6		0.5
				Temp.	F		95.7	92.3	88.3		
Effluent Concentration			5.10								
Wind Speed	mph		3.8								

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	9.9
Fraction remaining in unit effluent	3.3

**27% 16% 5%**Avg. 2021/2022 Zone Reductions

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - Old Stripper Scenario

	Equil. Ratio (Hc)											
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn					
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С				
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13				
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8				
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27				

Genera	al
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	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	VW
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

## TURBULENT

	NL Falallis			
		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 <b>AND</b> U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	DIEELIGED			

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - Old Stripper Scenario

	Surface Aeration													
				Quiescient Area	a									
								kL, m/s						
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall		
	Н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s		
Zone1						-								
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06		
Zone 2														
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06		
Zone 3														
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06		

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - Old Stripper Scenario

NAME OF THE FACILITY COMPOUND for site specific biorate determination Number of zones in the biological treatment unit VOLUME of full-scale system (cubic meters) Average DEPTH of the full-scale system (meters) FLOW RATE of wastewater to the unit (m3/s) FLOW RATE of condensate to the unit (m3/s) <b>Total wastewater flowrate - (including condensates) (m3/s)</b> ESTIMATE OF KL (m/s) Concentration in the wastewater treated in the unit (mg/L) Concentration in the condensates (mg/L) <b>Concentration in wastewater (total - inc. cond) in (mg/L)</b> Concentration in the effluent (mg/L) TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A) TOTAL RESIDENCE TIME (s) line 2 divided by line 10. TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	Methanol           1           2         250372.98           3         1.0878333           4         1.116           5         0.054           5-A         1.170           6         see table           7         59.511413           8         2094.7948           8-A         152.79058           9         5.0982378           10         1.170           11         214000           12         230157	2.48 days
Lines 13 through 15 Not Used Zone Concentration for zone, Area of the in the zone Number Ci (mg/L) zone, A (m2) (m/s) 1 41.94854003 87091.1501 3.54365E-06 2 24.242506 67793.7816 2.39719E-06 3 7.579459633 70821.6825 1.37942E-06 4 5 6	AIR STRIPPING KL A Ci (g/s) 12.9462 3.9398 0.740	0.308621 0.162515 0.097693
Removal by air stripping (g/s). Line 16. Loading in effluent (g/s). Line 9 times line 10. Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}. Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18). Fraction biodegraded: Divide line 20 by line 19. Fraction air emissions: Divide line 17 by line 19. Fraction remaining in unit effluent. Divide line 18 by 19.	10       17.63         17       17.63         18       5.96         19       178.8         20       155.2         21       0.868         22       0.099         23       0.033	

Data Date:

PAE - No Stripper

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT	ION	II. OVERALL PARAMS	- individual	flows						
_	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L			
Number of 75 HP Aerators	#	31	15	6						
Number of 100 HP Aerators	#	0	0	0						
Total Horsepower	HP	2325	1125	450	Inlet Stream **	25.48	59.5			
Temperature	С	35.4	33.5	31.3	Condensate Stream	1.2	3,809			
Length	ft	968	1,208	1,235	Outlet	26.7	5.1			
Width	ft	968	604	617	** except cond	ensate flow				
Average Depth	ft	4.5	3.2	3						
Aerator Rotation	rpm	1200	1200	1200						
Agitation Area per 75 HP aerator	ft2	1452	1452	1452						
Agitation Area per 100 HP aerator	ft2	2206	2206	2206						
Impellor Diameter	in	19.5	19.5	19.5	NA - individual flow/conc	NA - individual flow/conc data not available				

II. OVERALL PARAMS - total flow	ws			III. HAP DA	TA						
	Flow	Flow	MeOH	Methanol		Average Zone Concentration					Detect
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3		Limit
Influent Concentration		26.7	231.3	Conc.	mg/L	231.3	63.5	36.7	11.5		0.5
				Temp.	F		95.7	92.3	88.3		
Effluent Concentration			5.09824								
Wind Speed	mph		3.8								

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	87.9
Fraction air emissions	9.9
Fraction remaining in unit effluent	2.2

**27% 16% 5%**Avg. 2021/2022 Zone Reductions

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - No Stripper

	Equil. Ratio (Hc)										
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn				
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С			
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13			
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8			
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27			

General
---------

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	VW
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

## TURBULENT

	NL Falallis			
		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 <b>AND</b> U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	DIFFUSED			

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - No Stripper

Surface Aeration												
		Т	urbulent Area					Quiescient Area	a			
								kL, m/s				
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	Н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s
Zone1						-						
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - No Stripper

NAME OF THE FACILITY COMPOUND for site specific biorate determination Number of zones in the biological treatment unit VOLUME of full-scale system (cubic meters) Average DEPTH of the full-scale system (meters) FLOW RATE of wastewater to the unit (m3/s) FLOW RATE of condensate to the unit (m3/s) <b>Total wastewater flowrate - (including condensates) (m3/s)</b> ESTIMATE OF KL (m/s) Concentration in the wastewater treated in the unit (mg/L) Concentration in the condensates (mg/L) <b>Concentration in wastewater (total - inc. cond) in (mg/L)</b> Concentration in the effluent (mg/L) TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A) TOTAL RESIDENCE TIME (s) line 2 divided by line 10. TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	Methanol           1           2         250372.98           3         1.0878333           4         1.116           5         0.054           5-A         1.170           6         see table           7         59.511413           8         3808.7177           8-A         231.34146           9         5.0982378           10         1.170           11         214000           12         230157	2.48 days
Lines 13 through 15 Not Used Zone Concentration for zone, Area of the in the zone Number Ci (mg/L) zone, A (m2) (m/s) 1 63.5146271 87091.1501 3.54365E-06 2 36.70577636 67793.7816 2.39719E-06 3 11.47612174 70821.6825 1.37942E-06 4 5 6	AIR STRIPPING KL A Ci (g/s) 19.6019 5.9652 1.121	0.308621 0.162515 0.097693
TOTALS - sum for each zone. 15 225706.614 Removal by air stripping (g/s). Line 16. Loading in effluent (g/s). Line 9 times line 10. Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}. Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18). Fraction biodegraded: Divide line 20 by line 19. Fraction air emissions: Divide line 17 by line 19. Fraction remaining in unit effluent. Divide line 18 by 19.	16         26.69           17         26.69           18         5.96           19         270.7           20         238.0           21         0.879           22         0.099           23         0.022	

## APPENDIX C -AIR DISPERSION MODELING DOCUMENTATION

## Background:

New-Indy Catawba initially submitted an updated ambient air dispersion modeling analysis in support of the New Condensate Stripper Construction Permit Application (application) in March 2023. Facility-wide modeling of hydrogen sulfide (H<sub>2</sub>S), methyl mercaptan (MMC), and total reduced sulfur (TRS) compounds was conducted using the source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK) that were included in the March 8, 2023 modeling submitted to SCDHEC.

For WWTP sources, New-Indy Catawba used the maximum actual emissions rates as submitted in the October 2021 analysis (for H<sub>2</sub>S, and TRS) and corresponding MMC emissions rates, with the exception of the ASB. Based on U.S. EPA's direction, the October 2021 modeling analysis was performed using WWTP emissions rates derived from the RSK-175 method results, rather than the ALS GC method results.

Refined emissions rates reflecting the new steam stripper operation and foul condensate flow for the ASB were developed in support of the application based on ALS GC method results. Due to the ASB being the only WWTP source impacted by the new condensate steam stripper, New-Indy Catawba initially submitted the ambient air dispersion modeling analysis with the updated ASB emissions rates (ALS GC method), but did not change the emissions rates of the other WWTP sources from the October 2021 modeling analysis (RSK-175 method).

The emissions rates used in the original application's modeling analysis were most recently provided to SCDHEC in New-Indy Catawba's July 6, 2023 response.

In discussions and communications after submittal of the original application, SCDHEC has directed New-Indy Catawba to update the air dispersion modeling analysis with emissions rates for all of the WWTP sources based on the ALS GC method results, specifically in the August 25, 2023 email from Katharine Buckner (SCDHEC). This updated air dispersion modeling analysis was submitted in October 2023.

## Discussion of Updated WWTP Emissions Rates:

The average ALS GC results from the July 2021 sampling were used to estimate actual emissions rates, which was then scaled up to a maximum emissions rate using the ratio of the July 2021 actual pulp production to a max of 2700 ADTP/day. The modeling analysis is based on these maximum emissions rates. There are no changes to the Post Aeration Basin, Holding Pond (H<sub>2</sub>S only), and Sludge Pond emissions rates, as they were not dependent upon July 2021 liquid sulfur sampling results.

## Air Dispersion Modeling Results:

The air dispersion modeling analysis was conducted using the updated ALS emissions rates for WWTP sources as discussed above, with the same source parameters and emissions rates for non-WWTP sources and the Post-Aeration Basin as the original modeling analysis for the application. Results of the air dispersion modeling analysis demonstrate that ambient concentrations are below the relevant standards for H<sub>2</sub>S, MM, and TRS for each averaging period.

## New-Indy Catawba, LLC 2023 New Steam Stripper Application

		Averaging	Modeled	UTM	UTM		Standard <sup>(a)(c)(d)</sup>
Pollutant	Pollutant Standard <sup>(a)</sup>		Concentration	Easting	Northing	Rank <sup>(a)</sup>	Stanuaru
		Period	(µg/m³)	(m)	(m)		(µg/m³)
H.S	MAAC	24-hour	20.20	511,397.27	3,856,649.76	1st High	140
1125	EPA Action Level	30-minute	100.80	511,249.70	3,856,644.83	1-hour 1st High	837
MMC	MAAC	24-hour	9.46	510,115.55	3,856,041.31	1st High	10
IVIIVIC	EPA Action Level	30-minute	48.00	510,209.41	3,856,039.95	1-hour 1st High	57,000
TDC	MAAC	24-hour	77.25	511,249.70	3,856,644.83	1st High	140
TRS	EPA Action Level	30-minute	385.32	510,143.86	3,855,999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ\_SC%20Modeling%20Guidelines\_10.15.18\_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to  $H_2S$ .

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.

## APPENDIX D -BACKUP STRIPPER METHANOL MODE ADDENDUM

#### Background

The construction permit application for the New Condensate Steam Stripper project (Project) was originally submitted in March 2023. The application was updated in April 2024 to reflect the final project description and project emissions calculations at the request of SCDHEC.

The Mill currently utilizes a dual-treatment approach for compliance with the pulping condensate standards of 40 CFR Part 63, Subpart S. The Mill currently operates the existing steam stripper in "methanol mode", which prioritizes operation of the existing condensate steam stripper to remove or "strip" both total reduced sulfur (TRS) compounds and methanol while being fed ~350 gallons per minute (gpm) of foul condensates. Any excess foul condensate flow is treated with hydrogen peroxide to chemically oxidize the hydrogen sulfide into either elemental sulfur or sulfate, then sent via hardpipe to the aerated stabilization basin (ASB) for biological treatment of methanol. When operating in methanol mode, stripped condensates are recycled to the Brownstock Washers, as needed, or discharged to the ASB via the sewer.

Upon installation of the new steam stripper, the existing steam stripper will operate as a backup steam stripper during periods of downtime on the new steam stripper. As part of the Project, the Mill is proposing to operate the backup steam stripper in "TRS mode," which entails feeding all of the foul condensates collected at the mill to the backup steam stripper (nominally 850 gpm). No foul condensates would be sent directly down the hardpipe when the backup steam stripper is in TRS mode.

In TRS mode, the backup steam stripper is expected to still be capable of stripping all of the TRS compounds from the foul condensates (nominal >98% removal). However, due to the higher feed rate of foul condensates to the backup stripper, it is not expected to still be capable of stripping all of the methanol (nominal 45% removal expected). Consequently, the stripped condensate would need to be sent via existing hardpipe to the ASB for further biological treatment of methanol, consistent with the PAE calculations. Emissions calculations for the backup stripper in TRS mode were presented in the original construction permit application submitted in March 2023.

The Mill has been required to operate the existing steam stripper in methanol mode. As such, the Mill is unable to gather meaningful trial data for confirmation of the expected performance of the existing steam stripper operating in TRS mode. After further discussions with SCDHEC concerning the potential technical limitations of gathering data on TRS mode, the Mill provided SCDHEC an update to the PSD applicability calculations to include the alternate operating scenario of the backup stripper operating in methanol mode (i.e., the backup stripper operating as it currently does as the primary, existing stripper). This information, also provided in this updated application, demonstrates that operating the backup stripper in either TRS or methanol mode results in no change to the PSD applicability conclusions of the project.

#### Methanol Mode Emissions

This section addresses the differences in the project emissions calculations between the backup stripper operating in either TRS or methanol mode. For each pollutant, New-Indy presented emissions factors for both operating modes in the Appendix B calculations, but the worst-case operating mode was used for PSD applicability calculations to demonstrate the flexibility between the two modes.

One key difference between the two operating modes is that methanol mode requires more steam fed to the stripper. Generally, the Mill has updated the post-project emissions calculations for products of combustion resulting from generation of steam for the backup stripper to account for the higher steam requirements of methanol mode, which results in a small increase in post-project emissions from the original application submittal. Since the existing stripper has operated in methanol mode during the entirety of the baseline, steam heat input for the projected backup stripper methanol mode scenario was assumed to equal the baseline value.

Emissions resulting from the incineration of the backup stripper off gases (SOG) in the combination boilers vary, particularly for VOC and TRS compounds (and consequently SO<sub>2</sub>), based on how much of these compounds are present in the SOG prior to combustion, which depends on several variables, including stripper feed flow rate and stripper removal efficiency. The operating mode of the backup stripper affects both of these variables. Although methanol mode results in a higher stripper removal efficiency, it is at a reduced feed rate, which would both impact the mass of VOC and TRS compounds present in the SOG.

For simplicity, New-Indy based emissions from the backup stripper SOG incineration on the assumption that 100% of the VOC and TRS compounds present in the full volume of foul condensates would be stripped into the SOG and then result in incineration emissions. This is the most conservative SOG emissions calculation as it assumes a 100% stripper removal efficiency for both VOC and TRS compounds at the full foul condensate flow rate (nominal 850 gpm).

The key difference between the backup stripper operating modes is the post-project emissions from the ASB. When the backup stripper is in TRS mode, the ASB would receive up to 850 gpm of condensate that has been stripped of TRS compounds but still containing ~55% of its original methanol. When the backup stripper is in methanol mode, the ASB would receive ~500 gpm of foul condensate. TRS compounds would be treated with hydrogen peroxide addition and the methanol would be treated biologically in the ASB.

Appendix B includes the H2SSIM, WATER9, and Form XIII calculations for determining the ASB emissions factors for VOC, TRS, and H<sub>2</sub>S when the backup stripper is operating in TRS mode. This appendix includes H2SSIM, WATER9, and Form XIII calculations for the ASB VOC, TRS, and H<sub>2</sub>S emissions factors when the backup stripper is operating in methanol mode.

New-Indy used the worst-case emissions factor between the two scenarios for each pollutant's PSD applicability calculations to demonstrate that PSD is not triggered during post-project periods that the backup stripper must be operated, whether it operates in TRS or methanol mode.

## Backup Stripper (Methanol Mode) Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings				
(prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.29	0.92	0.24	6.93E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.35	0.19	5.81E-03
ASB Zone 2	0.03	5.66E-03	4.06E-03	1.06E-04
ASB Zone 3	0.02	1.09E-04	1.45E-04	3.51E-06
Total ASB	0.12	0.36	0.19	5.92E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, lb/ODTP	MMC, lb/ODTP
Total ASB	1.05E-02	3.08E-02	1.69E-02	5.12E-04

Post-Project Foul Condensate Flow: 500 gpm Post-Project Foul Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: **Pulp Production** H2S DMDS DMS

0.72 MGD 25.48 MGD 26.20 MGD 1148 L/s 2200 ODTP/day MW 34 94 62

48

MMC

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

#### Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3 –
Zone Location of Hardpipe	1 🚽
Type of Basin	ASB 🚽

#### Data Type 3. Load Characteristics

Loading	Main		
Characteristics	Influent	Hardpipe	Units
Flow	25.48	0.72	MGD -
Total Sulfide	0.252	1.47	mg/L 🚽
Sulfate	390	390	mg/L 🚽

Data Typ	oe 4. Atmos	pheric Conditions
----------	-------------	-------------------

Windspeed	3.55	mph 🚽
Ambient Temperature	79	F 🚽

Data Type 5. Zone Physic	cal and Chemical	Conditions				
Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	Model Controls
Dissolved Oxygen	1.57	4.63	4.66		mg/L	
Temperature	93.34	89.74	86.02		F	Run H2SSIM
рН	7.04	7.24	7.42		s.u.	
Redox Condition	Aerobic 🔽	Aerobic 🔻	Aerobic 🔫	Aerobic 🔫		View
Length	968	1208	1235		feet 🚽	Parameters
Width	968	604	617		feet 🝷	Clear Input
Depth	4.5	3.2	3		feet 💌	Sheet
Mixing	Moderat	Moderat -	Moderat			
Number of Aerators	31	15	6			
Total Horsepower	2325	1125	450		HP	
Impellor Size	1.625	1.625	1.625	1.625		
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms 🝷	
Weir Height	0	0	0		feet 🚽	

Run H2SSIM	
View Parameters	
Clear Input Sheet	

## **H2SSIM Results**

#### Backup Stripper Methanol Mode Scenario

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.121	gms/s
Total Emissions (H <sub>2</sub> S)	8417.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.2	tons/yr
Total Emissions $(H_2S)$	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.9	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5132.3	1762.9	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	26.7	11.8	9.8		gms/m² yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	39.300	6.400	5.600		lbs/yr

Current Parameters					
kgen	0.25				
ThetaGen	1.06				
KDO	0.05				
KSO4	10				
kanox	0.006				
ThetaOx	1.05				
m	1				
n	0.2				
MLVSS	272.2				
O <sub>2</sub> Transfer Coeff.	2				
alpha 1	0.83				
alpha 2	0.6				

Percent Inlet Sulfide Removed 63.0%

SUMMARY FOR EMISSIONS AT UNIT 11 ASB 2 03-14-2024 09:38:13	Zone 1 aerated	d biotreatm	lent		
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	8.367e-1	0.36428	0.61827	1.46e-2	3.499e-1
DIMETHYL SULFIDE (DMS)	2.074e-1	0.80097	0.17688	4.593e-3	1.907e-1
HYDROGEN SULFIDE	2.835e-1	0.98155	0.	5.231e-3	3.195e-1
METHANETHIOL(methyl mercaptan)	5.699e-3	0.8877	0.09361	1.065e-4	5.808e-3
Total rate for all compounds					8.658e-1
SUMMARY FOR EMISSIONS AT UNIT 17 ASB 3 03-14-2024 09:38:13	Zone 3 aerate	d biotreatm	ient		
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	5.231e-4	0.18124	0.76948	2.578e-5	1.088e-4
DIMETHYL SULFIDE (DMS)	2.136e-4	0.58962	0.31941	1.943e-5	1.446e-4
HYDROGEN SULFIDE	2.231e-4	0.88747	0.	2.511e-5	2.273e-4
METHANETHIOL(methyl mercaptan)	4.197e-6	0.72787	0.18714	3.567e-7	3.507e-6
Total rate for all compounds SUMMARY FOR EMISSIONS AT UNIT 18 ASB 03-14-2024 09:38:13	Zone 2 aerate	d biotreatm	nent		4.842e-4
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	1.46e-2	0.3375	0.62668	5.231e-4	5.658e-3
DIMETHYL SULFIDE (DMS)	4.593e-3	0.7705	0.183	2.136e-4	4.063e-3
HYDROGEN SULFIDE	5.231e-3	0.95735	0.	2.231e-4	5.749e-3
METHANETHIOL(methyl mercaptan)	1.065e-4	0.86336	0.09723	4.197e-6	1.056e-4
					1 550- 2

Total rate for all compounds

1.558e-2

Data Date:

PAE - Backup Stripper (Methanol Mode)

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIP	II. OVER	ALL PARAMS	- individual	flows				
	Units	Zone 1	Zone 2	Zone 3			Flow MGD	MeOH mg/L
Number of 75 HP Aerators	#	31	15	6				
Number of 100 HP Aerators	#	0	0	0				
Total Horsepower	HP	2325	1125	450	Inlet Strea	am **	25.48	59.5
Temperature	С	35.4	33.5	31.3	Condense	ate Stream	0.7	3,809
Length	ft	968	1,208	1,235	Outlet		26.2	5.1
Width	ft	968	604	617		** except cond	ensate flow	
Average Depth	ft	4.5	3.2	3				
Aerator Rotation	rpm	1200	1200	1200				
Agitation Area per 75 HP aerator	ft2	1452	1452	1452				
Agitation Area per 100 HP aerator	ft2	2206	2206	2206				
Impellor Diameter	in	19.5	19.5	19.5	NA - indiv	idual flow/cond	c data not av	ailable

			III. HAP DA	ΤΑ						
ow	Flow	MeOH	Methanol			Average	Zone Conce	entration		Detect
3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3		Limit
	26.2	162.5	Conc.	mg/L	162.5	44.6	25.8	8.1		0.5
			Temp.	F		95.7	92.3	88.3		
		5.09824								
mph		3.8								
	ow 3/sec mph	ow Flow 3/sec MGD 26.2 mph	ow Flow MeOH 3/sec MGD mg/L 26.2 162.5 5.09824 mph 3.8	ow Flow MeOH <u>3/sec MGD mg/L</u> 26.2 162.5 5.09824 mph 3.8	w Flow MeOH <u>3/sec MGD mg/L</u> 26.2 162.5 5.09824 mph 3.8	w Flow MeOH <u>3/sec MGD mg/L</u> 26.2 162.5 5.09824 mph 3.8	owFlowMeOHAverage3/secMGDmg/LUnitsInletZone 126.2162.5Conc.mg/L162.544.65.098245.09824F95.7	owFlowMeOH3/secMGDmg/L26.2162.55.098245.09824	bwFlowMeOH3/secMGDmg/L26.2162.55.098245.09824	www     Flow     MeOH       3/sec     MGD     mg/L       26.2     162.5       5.09824       mph     3.8

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	10.1
Fraction remaining in unit effluent	3.1

27% 16% 27% 2021/2022 Zone Reductions

5%

#### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - Backup Stripper (Methanol Mode)

	Equil. Ratio (Hc)								
	Diff in Water Diff in Air Henry's Law or (Keq) MW ScG							Antoine Eqtn	
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С	
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13	
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8	
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27	

Ge	ne	ral
$\sim \sim$		

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	VW
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT KL Params

		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 <b>AND</b> U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA

DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - Backup Stripper (Methanol Mode)

Surface Aeration												
Turbulent Area					Quiescient Area							
	kL, m/s											
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	Н	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s
Zone1						_						
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - Backup Stripper (Methanol Mode)

NAME OF TH COMPOUND Number of 20 VOLUME of 1 Average DEF FLOW RATE FLOW RATE Total waster ESTIMATE C Concentratio Concentratio Concentratio Concentratio TOTAL INLE TOTAL RESI	HE FACILITY of or site specific biorate of pones in the biological treat full-scale system (cubic r PTH of the full-scale system of wastewater to the unit of condensate to the unit of condensate to the unit of condensate to the unit of KL (m/s) n in the wastewater treated n in the condensates (modensity) on in wastewater (total n in the effluent (mg/L) T FLOW (m3/s) line 4 plut IDENCE TIME (s) line 2 of A OF IMPOUNDMENT (not set the s	determination atment unit neters) em (meters) it (m3/s) ing condensates) ed in the unit (mg/L g/L) - inc. cond) in (mg us the number on lin divided by line 10. m2) line 2 divided b	( <b>m3/s)</b> ) <b>g/L)</b> ne 5 (or 5-A) ny line 3	Me           1           2           3           4           5           5-A           6           5           7           8           8-A           10           11           12	thanol 50372.98 0878333 1.116 0.032 1.148 <i>iee table</i> 0.511413 3809 52.53984 0982378 1.148 218116 230157	2.52 days
L	ines 13 through 15 Not Use	ed	Estimate of KI			
Zone (	Concentration for zone	Area of the	in the zone	AIR STR		
Number	Ci (ma/L)	zone. A (m2)	(m/s)	KL A Ci	(a/s)	
1	44.62519102	87091.1501	3.54365E-06	/	13.7723	0.308621
2	25.78937099	67793.7816	2.39719E-06		4.1912	0.162515
3	8.06308953	70821.6825	1.37942E-06		0.788	0.097693
4						
TOTALS - su	im for each zone.	15 225706.614		16	18.75	
Removal by a	air stripping (g/s). Line 1	6.		17	18.75	
Loading in effluent (g/s). Line 9 times line 10.					5.85	
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.					186.6	
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).					162.0	
Fraction biodegraded: Divide line 20 by line 19.					0.868	
Fraction air emissions: Divide line 17 by line 19.					0.101	
Fraction remain	aining in unit effluent. Di	23	0.031			



# NEW CONDENSATE STRIPPER

# **CONSTRUCTION PERMIT APPLICATION**

# NEW-INDY CATAWBA LLC - CATAWBA, SC MILL

**MARCH 2023** 

UPDATED APRIL 2024

RECEIVED

APR 30 2024

**BAQ PERMITTING** 

Submitted by:



New-Indy Catawba LLC – Catawba, SC Mill 5300 Cureton Ferry Road Catawba, SC 29704



Submitted to:

SC Department of Health and Environmental Control Bureau of Air Quality – Division of Air Permitting 2600 Bull Street Columbia, SC 29201



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## 1. INTRODUCTION AND APPLICATION OVERVIEW

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill or the Mill) and currently operates under Title V Operating Permit No. TV-2440-005 (TVOP or TV-2440-0005), effective on July 1, 2019.

New-Indy Catawba has prepared this construction permit application as required by the Consent Order to Correct Undesirable Levels of Air Contaminants ("Consent Order"), issued on November 23, 2022, by the South Carolina Department of Health and Environmental Control (SCDHEC)<sup>1</sup>. For compliance with the provisions of the Consent Order, New-Indy Catawba is proposing a modification to their current foul condensate treatment system (condensate treatment system) to install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper [existing steam stripper (ID 9801)] strictly to backup operation during periods of downtime experienced by the new steam stripper (Project). The Project also includes the installation of a stripper feed tank, methanol storage tank, and hot water tank to serve the new steam stripper. The stripper feed tank and methanol storage tank will be controlled in the LVHC system. The hot water tank is not expected to be a source of emissions. The Project will also satisfy the requirements of Item I.a. of Appendix A of Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (EPA Consent Decree).

This document represents the construction permit application for this Project (Application). This application was originally submitted in March 2023. This application has been updated in April 2024 to reflect the final project description and project emissions calculations at the request of SCDHEC.

<sup>&</sup>lt;sup>1</sup> The November 23, 2022, Consent Order amends and replaces the Order to Correct Undesirable Level of Air Contaminants issued by SCDHEC on May 7, 2021.
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# 2. PROCESS AND PROJECT DESCRIPTION

New-Indy Catawba is comprised of seven distinct process areas that include the following: the woodyard area, the kraft pulp mill area, the paper mill area, the chemical recovery area, the utilities area, the waste treatment area, and a miscellaneous area. A simplified process flow diagram for these process areas is included as Figure 2-1. A description of the process areas is presented below, with more detail provided in the areas that are impacted by the Project.

Southern pine logs and chips are received at the woodyard. Logs are debarked, chipped, and the chips are screened prior to storage for use within the pulping process. Likewise, purchased wood chips received are screened, and processed as needed, prior to use within the pulping processes.

The kraft (sulfate) process area is used to produce pulp. Pulp from the kraft process is produced from "cooking" wood chips in the continuous digester in a caustic solution at an elevated temperature and pressure. The pulp slurry from the continuous digester is sent to the blow tank, then to one of two parallel pulping lines, each consisting of an enclosed deshive refiner and a three-stage drum displacement washer system and associated filtrate tanks. Weak black liquor from the washer filtrate tanks is stored before being recycled to chemical recovery. Rejects from the refiners are sent to the screw presses, with the filtrate being screened and stored before being recycled to chemical recovery. Washed pulp is stored and then sent to the paper mill area. With the exception of the pulp storage tanks after pulp washing, the kraft pulp mill sources are currently collected and routed to the high volume low concentration (HVLC) or low volume, high concentration (LVHC) systems, and emissions are controlled through combustion in the Nos. 1 or 2 Combination Boilers.

Linerboard (the outside layer of a corrugated container) is produced in the paper mill area on one state-of-the-art paper machine. Unbleached market pulp is produced on one pulp dryer. A second paper machine at the Mill is currently idled.

Weak black liquor is concentrated in the Nos. 1-3 Evaporator Sets and is then fired in the recovery furnaces (chemical recovery area) that burn the organics extracted from the chips and recover cooking chemicals. The causticizing area utilizes the chemicals recovered by the recovery furnaces, and after adding lime, provides the cooking chemicals for the kraft process.

Emissions from the Evaporator Sets and Turpentine Recovery System are collected in the LVHC gas collection system and combusted in the Nos. 1 or 2 Combination Boilers. Several weak black liquor tanks are collected in the HVLC system and combusted in the Nos. 1 or 2 Combination Boilers. Evaporator condensates are segregated, with the combined condensates being recycled



to the Brownstock washer system or sewered. The foul condensates are treated in a dual control device configuration: foul condensates are preferentially treated in the existing condensate steam stripper system, with the remaining flow being directed to the aerated stabilization basin (ASB) via the Hardpipe (ID 9802).

Steam and electricity are produced for facility-wide use by two combination boilers. The recovery furnaces also generate steam.

A waste treatment area receives wastewater and mill waste (solid waste) from the various previously mentioned areas of the facility. Wastewater undergoes biological treatment to remove the dissolved organic wastes prior to discharge into the receiving stream. Mill solid waste is deposited in an on-site landfill.

The miscellaneous areas include everything that is not captured in one of the aforementioned process operating areas, such as facility roads and the pulp storage tanks.









This document represents the construction permit application for this Project in accordance with the SCDHEC Consent Order. The Project consists of the following new equipment and proposed changes to the existing treatment scenarios:

- 1. Construct and operate a new low-pressure steam foul condensate stripper system that will process the pulping process condensates (foul condensate) for compliance with 40 CFR Part 63, Subpart S. The resultant stripped methanol will be condensed into a liquid [called stripper rectified liquid (SRL)] and combusted along with the black liquor in the Nos. 2 and 3 Recovery Furnaces (ID Nos. 2505 and 5105). The SRL will be added to the black liquor at a maximum amount of 2% by volume. There are no anticipated changes in black liquor firing as a result of the project. The LVHC gases from the SRL condenser system, stripper feed tank, and SRL tank will be combusted in the No. 3 Recovery Furnace. The LVHC system will include a 1.0 mmBtu/hr natural gas ignitor for combustion of the LVHC gases when black liquor firing is less than 50% of capacity. The existing Nos. 1 and 2 Combination Boilers (ID Nos. 2605 and 3705) will serve as back-up control for the new Stripper's LVHC gases when the SRL condenser system is not in operation. Stripped condensates will be recycled to the Brownstock washers (ID 5230), as needed;
- 2. Operate the existing steam stripper (ID 9801) as a backup to the new low-pressure steam stripper. The existing steam stripper will be operated to process the foul condensate and remove 98% of the total reduced sulfur (TRS) compounds; although with reduced methanol removal efficiency (referred to as "TRS Mode"). Further methanol treatment through biological destruction will be accomplished by routing the stripped condensates to the existing Hardpipe system that discharges the foul condensates below the liquid surface of the existing ASB; and
- 3. Modify the No. 3 Recovery Furnace to combust gases collected in the LVHC system. The Nos. 1 and 2 Combination Boilers will serve as backup control for the LVHC gases following the Project. When these LVHC gases are combusted in the combination boilers, a caustic scrubber will be operated to provide 50% removal of the sulfur prior to combustion.

Figure 2-2 presents a simplified process flow with the possible operating scenarios for treatment of the foul condensates and the associated control scenarios for the new and existing steam stripper vent gases. Section 3.2.2.3 presents the prevention of significant deterioration (PSD) analysis that details the basis for the projected actual emissions (PAE) calculations for the proposed future operating scenarios.





#### **Figure 2-2 Stripper Operating Scenarios**

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# 3. REGULATORY REVIEW

This section summarizes Federal and State air quality regulations that potentially apply to the Project. Discussions pertaining to applicable regulatory requirements are separated into three categories:

- Federal Air Quality Regulations
- South Carolina Air Quality Regulations
- Provisions of the SCDHEC Consent Order and EPA Consent Decree

# 3.1 FEDERAL AIR QUALITY REGULATIONS

For the purpose of this Application, potentially applicable Federal regulations consist of:

- Standards of Performance for New Stationary Sources (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- New Source Review (NSR) and PSD
- Compliance Assurance Monitoring (CAM)
- Requirements for Preparation, Adoption, and Submittal of Implementation Plans
- Title V Operating Permits

A discussion of each specific Federal air quality regulation is provided in the following subsections.

# 3.1.1 Standards of Performance for New Stationary Sources

U.S. EPA has promulgated NSPS at 40 CFR Part 60. NSPS requirements are promulgated under 40 CFR 60 pursuant to Section 111 of the Clean Air Act.

# 3.1.1.1 40 CFR Part 60, Subparts BB and BBa – Standards of Performance for Kraft Pulp Mills

40 CFR Part 60, Subpart BB – Standards of Performance for Kraft Pulp Mills applies to TRS emissions from digesters, brownstock washers, multiple-effect evaporators, recovery furnaces, smelt dissolving tanks, lime kilns, and condensate strippers that commenced construction, reconstruction, or modification after September 24, 1976, and on or before May 23, 2013.



Subpart BBa applies to the same sources that commence construction, reconstruction, or modification after May 23, 2013.

The No. 3 Multi-effect Evaporator Set with Concentrator is currently subject to 40 CFR 60, Subpart BB for TRS (Standards of Performance for Kraft Pulp Mills). The existing condensate stripper system and No. 1 Multi-effect Evaporator Set with Concentrator are currently subject to 40 CFR 60, Subpart BBa for TRS. Compliance with the TRS standards at §60.283(a)(1) and §60.283a(a)(1) is currently demonstrated by combusting the stripper off-gases and evaporator vent gases in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii) [combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds] and §60.283a(a)(1)(iii) [collect the gases in the existing low volume high concentration (LVHC) closed-vent collection system meeting the requirements of §63.450 and combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds]. As there are no physical modifications to the existing condensate stripper and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators, the Mill will continue to combust the existing stripper off-gases in the Nos. 1 and 2 Combination Boilers; however, following the Project, the vent gases from the Nos. 1-3 Multi-effect Evaporator Sets with Concentrators will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(ii) [gases are collected in the existing LVHC closed-vent collection system meeting the requirements of §63.450 and combusted in a recovery furnace subject to §60.283(a)(2)] or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The No. 2 Multi-effect Evaporator Set with Concentrator is not subject to either Subpart BB or Subpart BBa but gases are collected and controlled in the same manner as the other evaporator sets.

Upon completion of the Project, the new condensate stripper system will be subject to 40 CFR Part 60, Subpart BBa for TRS (Standards of Performance for Kraft Pulp Mill Affected Sources for Which Construction, Reconstruction, or Modification Commenced After May 23, 2013). Compliance with the TRS standard at 60.283a(a)(1) will be demonstrated through collection of the stripper off-gases (SOG) in the existing SOG collection system and SRL gases in the existing LVHC closed-vent collection system meeting the requirements of §63.450. The SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The LVHC collection system gases will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(ii) or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). Emissions from the stripper feed tank will also be collected in the LVHC collection system. The Mill will continuously monitor the incineration of SOG and LVHC gases in the No. 3 recovery furnace, each combination boiler, and venting of the SOG and LVHC closed-vent systems as required by §60.284a(d)(3)(iii) and currently utilized for monitoring compliance with Subpart BB.

3-2



New-Indy Catawba will maintain records of excess emissions and malfunctions for the new stripper as required by §60.287a(b)(7) and (c), respectively. The Mill will report periods of excess emissions and malfunctions as required by §60.288a(a) and (d), respectively. As defined in §60.284a(e)(1)(vi), periods of excess emissions from the LVHC closed-vent system (condensate stripper system) that are less than one percent (1%) of operating time during a semi-annual period are not a violation of §60.283a(a)(1)(iii).

The stripper feed tank, methanol tank, hot water tank, Hardpipe, and ASB are not included in the definition of condensate stripper system under §60.281 or §60.281a and are not affected sources under Subparts BB or BBa.

# 3.1.1.2 40 CFR Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

The Project includes a new stripper feed tank, new methanol tank, and a new hot water tank. 40 CFR Part 60, Subpart Kb includes standards of performance for new storage tanks. However, per 60.111b, the definition of storage tank does not include process tanks (tanks that collect material from one part of a process before sending it to another part of the process). Therefore, the new tanks are not subject to Subpart Kb.

# 3.1.2 National Emission Standards for Hazardous Air Pollutants

NESHAP found in 40 CFR Part 61 apply to specific compounds emitted from certain listed processes. 40 CFR Part 61 subparts do not apply to the Mill, and there are no Part 61 subparts that apply to the proposed Project. Applicability of Part 63 NESHAP is discussed below.

# 3.1.2.1 40 CFR Part 63, Subpart S – National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry

New-Indy Catawba is subject to 40 CFR Part 63, Subpart S, also referred to as Maximum Achievable Control Technology (MACT) I for the pulp and paper industry. This standard regulates hazardous air pollutant (HAP) emissions from pulping and bleaching systems. The affected source under this standard is the total of all HAP emission points in the pulping and bleaching systems. The Mill does not produce bleached pulp and is therefore not subject to the requirements of §63.445.

The Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine Recovery System were constructed prior to 1993 and are existing affected sources, while the existing condensate



stripper was constructed after 1993, making it a new source under 40 CFR Part 63, Subpart S. Compliance is currently demonstrated by collecting the gases in the existing LVHC closed-vent system meeting the requirements of §63.450 and combustion of the SOG and LVHC system gases in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i) (introduce the HAP emission stream with the primary fuel or into the flame zone). The Mill currently complies with the pulping condensates collection requirements in §63.446(c)(3) [collect the pulping process condensates from equipment systems listed in §63.446(b)(1) through (b)(5) that in total contain a minimum of 7.2 lb HAP per ton oven dried ton of pulp (lb HAP/ODTP)] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill has utilized concurrent use of the existing steam stripper and Hardpipe for compliance with §63.446(e)(4).

Subpart S requires collection of LVHC gases from steam stripper systems, defined to include the stripper column, associated feed tanks, condensers, and any methanol rectification process. The new condensate stripper, stripper feed tank, methanol condenser, and methanol tank will be subject to this rule upon startup.

Following the completion of the proposed Project, SOG from the existing condensate stripper and vent gases from the existing Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine system will continue to be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and §63.453(k)(1-6). The existing SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). However, the vent gases from the LVHC collection system will be combusted in the No. 3 Recovery Furnace or in the Nos. 1 and 2 Combination Boilers (as backup) per §63.443(d)(4)(i). The Mill will update the leak detection and repair (LDAR) site inspection plan as appropriate per §63.454(b).

The Mill plans to demonstrate compliance with the pulping condensates collection requirements in 63.446(c)(3) [collect the pulping process condensates from equipment systems listed in 63.446(b)(1) through (b)(5) that in total contain 7.2 lb HAP/ODTP] and the treatment requirements in 63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill will utilize the new condensate stripper for compliance with 63.446(e)(4) and will operate a continuous monitoring system for the parameters in 63.453(g)(1-3). Vents from the new condensate stripper (including the stripper feed tank, SRL condenser, and SRL tank) will be collected in the existing LVHC closed-vent system meeting the requirements of 63.450 and combusted in the No. 3 Recovery Furnace or Nos. 1 and 2 Combination Boilers per 63.443(d)(4)(i). The Mill will update the LDAR site inspection plan as appropriate per 63.453(k)(1-6). The new stripper will be included in semi-annual excess emission reports under 63.455. Per 63.446(g), periods of excess



emissions reported under §63.455 are not considered a violation of §63.446(e)(4) provided that the time of excess emissions divided by the total process operating time in a semi-annual reporting period does not exceed 10 percent.

At the request of SCDHEC, the Mill is providing additional information regarding plans to demonstrate continuous compliance with the pulping condensate collection and treatment in the new steam stripper. These are as follows:

- Pulping condensate collection emissions limit of 7.2 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2);
  - Daily sampling of foul condensates for methanol concentration representative of the inlet to the new stripper;
  - Continuous measurement of new steam stripper inlet foul condensate feed flow (gpm);
  - Daily measurement of pulp production (ODTP); and
  - Daily calculation of a 15-day rolling average collection (lbs methanol/ODTP) [Note: The Mill may use historical and/or collect future foul condensate sampling data to support a longer averaging period].
- Pulping condensate treatment in the new steam stripper to remove 6.6 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2); and
  - Daily sampling of stripped condensates for methanol concentration representative of the outlet of the new stripper.
  - Continuous measurement of:
    - New steam stripper inlet foul condensate feed flow (gpm);
    - New steam stripper steam feed flow (lbs/hr);
    - Foul condensate to new steam stripper feed temperature (\*F); and
    - New steam stripper stripped condensate flow (gpm).
  - Daily measurement of pulp production (ODTP).
  - o Daily calculation of the percent methanol removed in the steam stripper .
  - Daily calculation of the treatment in the new steam stripper [15-day (or other averaging period, as justified) rolling average methanol collected (lbs methanol/ODTP) multiplied by the calculated daily methanol percent removal in the new stripper].

Please note that the Mill may choose to establish a methanol concentration factor in lieu of daily methanol sampling at the inlet to the new steam stripper once sufficient data has been collected demonstrating consistency in the foul condensate methanol concentration. In addition, the Mill



may choose to establish an effective steam to feed ratio (ESFR) curve for the new stripper system to be used to establish the methanol removal efficiency across the stripper in lieu of the method described above. The compliance approach will be delineated in the Notification of Compliance Status (NOCS) that will be submitted with the results of the initial compliance demonstration to be conducted within 180 days of startup of the new stripper system.

# 3.1.2.2 40 CFR Part 63, Subpart MM National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills

New-Indy Catawba is subject to 40 CFR Part 63, Subpart MM, also referred to as MACT II for the pulp and paper industry. This standard regulates particulate matter (PM) emissions from existing recovery boilers, smelt tanks, and lime kilns when processing black liquor or calcium oxide. The Nos. 2 and 3 Recovery Furnaces are currently subject to the existing source requirements of this regulation. The proposed Project will modify the LVHC collection system that delivers the LVHC gases to the No. 3 Recovery Furnace for combustion, but no changes in black liquor firing are expected for the recovery furnaces and PM emissions from black liquor combustion are not expected to increase. The Mill will continue to meet the existing PM emission limits under Subpart MM after completion of the Project.

# 3.1.2.3 40 CFR Part 63, Subpart EEEE – National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (non-Gasoline)

Subpart EEEE applies to organic liquids distribution (OLD) operations at major sources of HAP. The Project includes installation of a new methanol tank and a new hot water tank. However, these new tanks are not subject to this rule because they are part of the Mill's pulping system as defined under Subpart S. EPA confirmed that tanks in pulp and paper mills that are part of the pulping or bleaching systems are not subject to Subpart EEEE in a December 2004 determination (ADI Control Number M050008).

# 3.1.2.4 40 CFR Part 63, Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.

New-Indy Catawba is subject to 40 CFR Part 63, Subpart DDDDD, also referred to as Boiler MACT. Boiler MACT sets forth emissions limits and work practice standards; testing and fuel analyses requirements; and monitoring, recordkeeping, notification, and reporting requirements that apply to boilers and process heaters located at major sources of HAP. The Nos. 1 and 2 Combination Boilers are subject to the requirements of 40 CFR Part 63, Subpart DDDDD. The



Nos. 2 and 3 Recovery Furnaces are not subject to the rule per §63.7491(b). The Project will not affect the regulatory applicability of 40 CFR Part 63, Subpart DDDDD, for either combination boiler and will not affect compliance with the applicable emissions limits. The Mill will continue to comply with the currently applicable provisions of 40 CFR Part 63, Subpart DDDDD, in the same manner after completion of the Project.

# 3.1.3 New Source Review

The Mill is located in York County which is classified as in attainment of or unclassifiable for the National Ambient Air Quality Standards (NAAQS) for regulated NSR pollutants. Therefore, Nonattainment New Source Review (NNSR) regulations do not apply to this Project and the Project is analyzed for applicability as it relates to the PSD requirements. Implementation of the PSD regulations (i.e., 40 CFR §51.166) has been delegated in full to the State of South Carolina. Refer to Section 3.2.2.3 for a discussion of PSD applicability.

# 3.1.4 Compliance Assurance Monitoring

U.S. EPA developed the CAM rule at 40 CFR Part 64 as a means for providing reasonable assurance that continuous compliance with applicable requirements is achieved for certain emissions units located at major stationary sources subject to Title V permitting. CAM applies to pollutant-specific emissions units (PSEUs) that (1) are subject to an emissions limit or standard (2) use a control device to achieve compliance with that emissions limit or standard, and (3) have potential pre-control device emissions in the amount required to classify the unit as a major source under Part 70 of the Clean Air Act (CAA). Part 64 does not apply to emissions limitations or standards proposed after November 15, 1990 pursuant to Section 111 or 112 of the Clean Air Act (e.g., post-1990 NSPS or NESHAP). The proposed Project is not subject to CAM requirements because the new steam stripper is subject to 40 CFR Part 60, Subpart BBa and 40 CFR Part 63, Subpart S, which are standards proposed after November 15, 1990.

# 3.1.5 Requirements for Preparation, Adoption, and Submittal of Implementation Plans

U.S. EPA requires air agencies to develop and submit air quality data characterizing maximum 1hour ambient concentrations of sulfur dioxide (SO<sub>2</sub>) through ambient air quality monitoring or air quality modeling analysis at the air agency's election. These requirements are promulgated under 40 CFR Part 51.

# 3.1.5.1 40 CFR Part 51, Subpart BB-Data Requirements for Characterizing Air

# Quality for the Primary SO<sub>2</sub> NAAQS (SO<sub>2</sub> Data Requirements Rule or SO<sub>2</sub> DRR)

The Mill submitted facility-wide air dispersion modeling in November 2016 to comply with 40 CFR 51.1203(d). The Mill updated the facility-wide air dispersion modeling in October 2021. The actual SO<sub>2</sub> emissions following the Project are expected to remain below the SO<sub>2</sub> emission rates included in the modeling analysis submitted in 2016 and 2021. The Mill will continue to perform an annual review of the actual SO<sub>2</sub> emission rates against the 2016 and 2021 model emission rates to determine if an updated modeling demonstration is necessary.

# 3.1.6 Title V Operating Permits

New-Indy Catawba operates under TVOP TV-2440-0005 issued on May 7, 2019, with an effective date of July 1, 2019, and an expiration date of December 31, 2023. New-Indy Catawba submitted a Title V operating permit renewal application on December 1, 2023. SCDHEC determined the Title V operating permit renewal application was complete on December 18, 2023. Through this Application, New-Indy Catawba is requesting a construction permit to perform the Project. Construction permit application forms required by SCDHEC are included in Appendix A. New-Indy Catawba will request a modification to the TVOP within 15 days of startup of the Project, which is required by the Consent Order to be no later than June 30, 2025.

# 3.2 SOUTH CAROLINA AIR QUALITY REGULATIONS

This section addresses the applicability of state air regulatory requirements to the Project.

# 3.2.1 Regulation 61-62.1: Section II, Permit Requirements

This regulation specifies the construction and operating permit requirements for new or modified sources. This permit application is intended to satisfy the construction permitting requirements of Regulation 62.1 Section II. Completed SCDHEC construction permit application forms are included in Appendix A. The original application was submitted in March 2023, prior to implementation of the current SCDHEC ePermitting system. This updated application has been re-submitted in the original hardcopy form and is not in the ePermitting system.

# 3.2.2 Regulation 61-62.5: Air Pollution Control Standards

The list below identifies potentially applicable SC air pollution control regulations and standards associated with the Project.

• Standard No. 2 – Ambient Air Quality Standards



- Standard No. 3 Waste Combustion and Reduction
- Standard No. 4 Emissions from Process Industries
- Standard No. 7 Prevention of Significant Deterioration
- Standard No. 8 Toxic Air Pollutants

## 3.2.2.1 Standard No. 2 - Ambient Air Quality Standards

SCDHEC Standard No. 2 addresses the National Ambient Air Quality Standards (NAAQS). Except for an ambient air quality standard for gaseous fluorides, the SCHDEC ambient air quality standards are equivalent to the Federal NAAQS. New-Indy Catawba has previously submitted facility-wide air dispersion modeling evaluations to demonstrate compliance with Standard No. 2.

The Project may slightly increase the actual emissions of SO<sub>2</sub>, nitrogen oxides (NO<sub>X</sub>), and carbon monoxide (CO) from the No. 3 Recovery Furnace when burning LVHC gases. However, the maximum SO<sub>2</sub> and NO<sub>X</sub> emissions from the No.3 Recovery Furnace when burning LVHC gases will be less than 10 percent of the emissions from burning the LVHC gases in the Nos. 1 and 2 Combination Boilers. The maximum SO<sub>2</sub> and NO<sub>X</sub> emissions from the NO<sub>X</sub> emissions from LVHC combustion in the combination boilers are not expected to change as a result of the project. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers.

The emissions of SO<sub>2</sub>, NO<sub>x</sub>, CO, particulate matter (PM), PM less than 10 microns (PM<sub>10</sub>), and PM less than 2.5 microns (PM<sub>2.5</sub>) from the LVHC System natural gas ignitor in the No. 3 Recovery Furnace are well below the 1.14 pounds per hour modeling exemption threshold in the South Carolina Modeling Guidelines<sup>2</sup>, Section 2.2.3. Therefore, the very small emissions increases from the LVHC natural gas ignitor have not been modeled for this permit application.

The additional steam potentially required from the combination boilers to operate the new condensate stripper will not exceed the current steaming capacity of each combination boiler, as reflected in the SO<sub>2</sub>, NO<sub>x</sub>, CO, PM, PM<sub>10</sub>, PM<sub>2.5</sub> and CO emissions rates modeled previously.

<sup>&</sup>lt;sup>2</sup> South Carolina Modeling Guidelines for Air Quality Permits (Revised April 15, 2019).



Therefore, no updates to the modeled emissions rates from the combination boilers are required for this permit application.

The SO<sub>2</sub> emissions from the Project will decrease by approximately 90 tons per year. The reduction in SO<sub>2</sub> emissions meets the single factor emissions netting option 2 in the South Carolina Other Information Guidance<sup>3</sup>. The modeled SO<sub>2</sub> Emissions Rate from black liquor combustion in the 2016 and 2021 SO<sub>2</sub> DRR modeling is 18.70 lb/hr from the No. 3 Recovery Furnace. The maximum SO<sub>2</sub> emissions rate from burning black liquor in the 2023 Title V renewal application is 5.95 pounds per hour. The additional SO<sub>2</sub> emissions from LVHC gases and methanol combustion is 7.4 pounds per hour, making the new total SO<sub>2</sub> emissions rate from black liquor combustion. Therefore, no updates to the SO<sub>2</sub> modeling submitted previously in 2016 and 2021 have been prepared for this permit application.

The NO<sub>x</sub> emissions will increase from the Project approximately 24 tpy, which is slightly over onehalf the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The NO<sub>x</sub> emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The modeled NO<sub>x</sub> Emissions Rate for Ambient Air Standards in the current Title V permit is 146.03 lb/hr from the No. 3 Recovery Furnace. The maximum NO<sub>x</sub> emissions rate from burning black liquor in the 2023 Title V renewal application is 122.4 pounds per hour. The additional NO<sub>x</sub> emissions from LVHC gases and methanol combustion is 4.3 pounds per hour, making the new total NO<sub>x</sub> emissions rate . Therefore, no updates to the NO<sub>x</sub> modeling submitted previously have been prepared for this permit application.

The CO emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The CO emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers. The modeled CO Emissions Rate for Ambient Air Standards in the current Title V permit is 330.96 lb/hr from

<sup>&</sup>lt;sup>3</sup> Guidance Concerning Other Information Used for Permitting Requirements in Demonstrating Emissions Do Not Interfere With Attainment or Maintenance of any State of Federal Standard (Updated December 12, 2018).



the No. 3 Recovery Furnace. The maximum CO emissions rate from burning black liquor in the 2023 Title V renewal application is 102.9 pounds per hour. The additional CO emissions from LVHC gases and methanol combustion is 8.3 pounds per hour, making the new total CO emissions 111.1 pounds per hour, more than 200 pounds per hour lower than the modeled CO emissions rate. Therefore, no updates to the CO modeling submitted previously have been prepared for this permit application.

Therefore, no updates to the previous Standard No. 2 modeling demonstration are required.

## 3.2.2.1 Standard No. 3 – Waste Combustion and Reduction

Standard No. 3 applies to any source that burns any waste other than virgin fuels for any purpose. The standard contains various exemptions for the pulp and paper source category. Section I.J.1 specifies that recovery furnaces burning black liquor and TRS compounds are not subject to the standard. Section I.J.1 also specifies that gaseous process streams containing TRS compounds that are regulated in accordance with Section XI of Regulation 61-62.5, Standard No. 4, or NSPS are not subject to Standard No. 3. Because the SOG and LVHC collection system gases containing TRS that are regulated in accordance with Standard No. 4 or NSPS Subpart BB/BBa, combustion of those gases in combination boilers or recovery furnaces is not subject to Standard No. 3.

Standard No. 3 specifically states that any "facility with an emission unit and/or control device that complies with all the requirements of an applicable Maximum Achievable Control Technology (MACT) Standard under 40 CFR 63, including the testing and reporting requirements, may request an exemption from this standard." (61 -62.5, Section I.J.3.)

During development of the Pulp and Paper MACT regulations at 40 CFR 63, Subpart S, U.S. EPA reviewed the practice of combusting methanol condensed from stripper-off-gases. The U.S. EPA determined that the methanol condensate "does not appear to contain metal or chlorinated organic HAP's ..." (61 Fed. Reg. 9397) (emphasis added). The U.S. EPA also found that burning methanol condensate "will not increase the potential environmental risk over the burning of the steam stripper vent gases prior to condensation." U.S. EPA reaffirmed this conclusion in 2011 during its Residual Risk and Technology Review (RTR) of the Pulp and Paper (Subpart S) MACT. In the final RTR rule, U.S. EPA stated: "We conclude based on the Residual Risk Assessment cited here that the risks from the subpart S pulp and papermaking source category are acceptable and that the current standard protects the public health with an ample margin of safety. Consequently, we are re-adopting the MACT standards for subpart S pursuant to our 112(f)(2) review." (77 Fed. Reg. 55705)



Therefore, the combustion of black liquor and condensed methanol from stripper-off-gases in the recovery furnaces mill qualifies for the exemption from Standard No. 3 provided in Section I.J.3.

#### 3.2.2.2 Standard No. 4 – Emissions from Process Industries

SCDHEC Regulation 61-62.5, Standard No. 4 establishes standards for opacity and certain other pollutants for specific sources in specific industries and establishes PM and opacity standards for industrial processes not otherwise regulated. The new steam stripper and the new tanks do not cause visible emissions into the atmosphere; therefore, this standard does not apply.

Section XI regulates emissions of TRS from Kraft Pulp Mills where construction or modification commenced prior to September 24, 1976 from recovery furnaces, digester systems, multiple-effect evaporator systems, lime kilns, and condensate stripper systems. The No. 2 Recovery Furnace is currently subject to Standard 4 and will continue to comply with the TRS limits after completion of the Project. The TRS emissions from the No. 3 Recovery Furnace and No. 3 Evaporator Set with Concentrator are subject to 40 CFR Part 60, Subpart BB. The TRS emissions from the No. 1 Evaporator Set with Concentrator, the existing steam stripper, and the new condensate steam stripper are/will be subject to 40 CFR Part 60, Subpart BBa.

# 3.2.2.3 Standard No. 7 – Prevention of Significant Deterioration – Permit Requirements

PSD requirements apply to major stationary sources of regulated NSR pollutants that are located in areas that are in attainment with the NAAQS or unclassifiable. Implementation of the PSD regulations has been delegated in full to the State of South Carolina. These air quality regulations are contained in SCDHEC Regulation 61-62.5, Standard No. 7. The PSD regulations apply to major modifications at major stationary sources, which are considered those sources belonging to any one of the 28 source categories listed in the regulations that have the potential to emit (PTE) 100 tons per year (tpy) or more of an NSR-regulated pollutant, or any other source that has the PTE 250 tpy or more of an NSR-regulated pollutant. The Mill is considered a major stationary source because it emits or has the PTE 100 tpy or more of a regulated NSR pollutant. Because it includes physical changes to the Mill, the installation of the new steam stripper is a "project" as defined in Standard No. 7(b)(40).

New-Indy Catawba has assessed the applicability of PSD to this Project by performing the hybrid test as prescribed under U.S. EPA's PSD rules (as adopted by South Carolina) at 40 CFR 52.21(a)(2)(iv)(f), described as the hybrid test for projects that involve multiple types of emissions



units. The future emissions from the backup steam stripper system, existing foul condensate Hardpipe, existing ASB, existing evaporator and turpentine recovery system LVHC gases, and steam required for the existing steam stripper system are calculated as PAE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41). The future emissions from the new steam stripper and the generation of steam to operate the new steam stripper are PTE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(37).

The PSD applicability analysis has been completed for the applicable NSR regulated air pollutants, including SO<sub>2</sub>, NO<sub>x</sub>, CO, volatile organic compounds (VOC), TRS, H<sub>2</sub>S, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, lead (Pb), sulfuric acid mist, and carbon dioxide (CO<sub>2</sub>). There are no increases in emissions of fluorides from the Project. Emissions calculations used for determining PSD applicability are included in Appendix B.

At this time, New-Indy Catawba has not excluded emissions the mill was capable of accommodating during the baseline period or excluded demand growth from the projected actual emissions as allowed under SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41)(b)(iii). New-Indy Catawba may decide to utilize these two exclusions from PAE during this or future permitting if desirable.

# 3.2.2.3.1 Baseline Actual Emissions

Baseline actual emissions (BAE) from an existing source are defined by Standard No. 7, paragraph (B)(4)(b) as:

"the average rate, in tpy, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the Department for a permit required under this section or under a plan approved by the Administrator, whichever is earlier, except that the 10-year period shall not include any period earlier than November 15, 1990."

BAE for all existing sources and pollutants are based on the 24-month period following conversion of the mill to manufacturing unbleached paper grades starting in March 2021 and extending through February 2023. For simplicity, baseline annual production rates are assumed to occur over 8,760 operating hours. The BAE for the existing steam stripper (aka future backup stripper) off gases (and the required steam) are adjusted using the actual operating days to reflect that the stripper did not return to service until May 3, 2021.



#### Sulfur Dioxide

The baseline actual SO<sub>2</sub> emissions from burning the SOG from the existing steam stripper and LVHC collection system gases are based on the average emissions factors developed from the most recent (October 2021) source testing for SO<sub>2</sub>. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia SO<sub>2</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

## Nitrogen Oxides and Carbon Monoxide

The baseline actual NO<sub>X</sub> and CO emissions from burning the SOG from the existing steam stripper are based on the post-Project Columbia NO<sub>X</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The baseline actual VOC emissions from the existing condensate stripper system are based on the actual amount of methanol stripped from the foul condensate during the baseline period for which records are available. The non-methanol VOC emissions (including the TRS compounds that are also VOC as further described in the next section) from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the U.S. EPA WATER9 Model. To calculate methanol emissions from the ASB, New-Indy Catawba used a spreadsheet version of the WATER9 calculations from the National Council for Air and Stream Improvement (NCASI) to calculate the fractions biodegraded and emitted developed from Procedure 5 (Multiple Zone Concentration Measurements) in 40 CFR Part 63, Appendix C, Form XIII ("NCASI Form XIII calculation spreadsheet"). The WATER9 Model and Form XIII calculation utilize site-specific liquid concentration data, the site-specific configuration of the treatment unit [including the area or length of unit, liquid depth, wind speed, aeration type (i.e., mechanical aeration)], and the total amount of aeration to calculate the emissions rate in grams per second (g/s).

Baseline actual methanol emissions from the ASB are based on the NCASI Form XIII calculations for NESHAP Subpart S performance testing conducted during the baseline period. The baseline actual VOC emissions from the LVHC collection system are based on the post-Project Columbia VOC emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.



#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

The baseline hydrogen sulfide (H<sub>2</sub>S) and total reduced sulfur (TRS) emissions from burning the SOG from the existing steam stripper and the LVHC collection system gases are based on the average emissions factors developed from the June 2021 source testing for H<sub>2</sub>S and TRS. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia H<sub>2</sub>S and TRS emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

The baseline actual H<sub>2</sub>S emissions from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the NCASI Hydrogen Sulfide Emissions Simulator, or "H2SSIM" Model, which utilizes site-specific wastewater configuration, site-specific liquid test results for H<sub>2</sub>S, and site-specific data inputs [e.g., temperature, dissolved oxygen (DO), pH]. H2SSIM inputs are based on May and July 2022 sampling data for H<sub>2</sub>S in the foul condensate, as well as dissolved oxygen (DO) data for the ASB taken during NESHAP Subpart S performance testing during the baseline period. The baseline emissions for methyl mercaptan (MMC), dimethyl disulfide (DMDS), and dimethyl sulfide (DMS) are calculated using WATER9 based on May and July 2022 sampler results were representative of the concentrations before chemical oxidant was added. The Mill has been chemically oxidizing the contents of the Hardpipe prior to entry into the ASB since June 2021. For calculating BAE of H<sub>2</sub>S and TRS emissions from the ASB, the May and July 2022 foul condensate samples were adjusted as follows to account for the effects of the chemical oxidant:

- H<sub>2</sub>S concentrations in the Hardpipe effluent were reduced by 99%.
- DMS concentrations in the Hardpipe effluent were reduced by 90%.
- MMC concentrations in the Hardpipe effluent were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed to not be reduced by chemical oxidant. DMDS concentrations in the Hardpipe effluent were increased to account for the oxidation of MMC to DMDS.

These adjustments are based on NCASI Technical Bulletin No. 949, Section 5.3.1 for Hydrogen Peroxide and additional bench scale study results and curves provided by NCASI. Pertinent pages from NCASI Technical Bulletin No. 949 and the bench scale study are attached as supporting information in Appendix B.



#### Steam Baseline

The BAE of products of combustion (NO<sub>x</sub>, CO, VOC, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, Lead, and CO<sub>2</sub>e) for the steam required by the existing steam stripper are based on the actual heat input from fossil fuels to both combination boilers during the baseline period. New-Indy Catawba operates the two recovery furnaces as base-loaded steam generators with the combination boilers handling most swings in steam load. New-Indy Catawba burns all the biomass available in the combination boilers because biomass is the most cost-effective fuel on an MMBtu basis. Additional steam is generated from burning natural gas and No. 6 fuel oil as needed. During the baseline period, natural gas accounted for 97.9% of the fossil fuel heat input to both combination boilers, with No. 6 fuel oil constituting the remaining 2.1% of the fossil fuel heat input.

## 3.2.2.3.2 Projected Actual Emissions and Potential to Emit

PAE is defined by the SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41) as:

"the maximum annual rate, in tpy, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the five (5) years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the ten (10) years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source."

As described previously, PAE are calculated from the existing steam stripper, existing foul condensate Hardpipe, existing ASB, existing LVHC collection system gases, and steam required for the existing steam stripper.

PTE is defined by the SCDHEC Regulation 61-62.5, Standard No Standard No. 7, paragraph (B)(37) as:

"the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable."

The future emissions from the new steam stripper system and the generation of steam to operate the new steam stripper system are PTE.



PAE and PTE were calculated for three different stripper operating scenarios as shown below in Table 3-1. The new stripper is expected to be online at least 90% of the annual operating time. The backup steam stripper is expected to be online 4.75% of the annual operating time. There will also be periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods until a stripper is returned to service, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds in the condensates will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are required by Part I of Appendix A of the November 16, 2022 EPA Consent Decree to be equal to or less than 460 hours (5.25%) of annual operating time.

The PAE and PTE for all scenarios are based on the design foul condensate sulfur loading [168 parts per million by weight (ppmw)] and maximum design foul condensate flow [850 gallons per minute (gpm)]. Emissions factors [on a pound per air-dried ton of pulp (lb/ADTP) basis] are calculated based on 2,444 ADTP/day, which is at the lower range of production for which the maximum design foul condensate flow is expected. The design foul condensate sulfur loading is based on liquid samples taken during the June 2021 site-specific testing. The sulfur concentration of 168 ppmw at the design foul condensate flow is equivalent to 0.70 pound of TRS as sulfur per ADTP. PAE are calculated for each of the three stripper operating scenarios based on 8,760 hours per year and a maximum pulp production of 2,700 ADTP/day.

The following sections provide further detail and different operating configurations within particular scenarios.

#### New Steam Stripper Online Scenario

While the new steam stripper is operating, the stripped condensate from the new steam stripper will be recycled to the brownstock washers, as needed.

The new stripper has two operating configurations, with and without the rectified methanol system operating. The rectified methanol system will separate methanol from the new stripper's offgases. The rectified methanol is referred to as SRL. As stated previously, the new steam stripper is expected to be online at least 90% of the annual operating time. The rectified methanol system is expected to be online 95% of the time that the new stripper is operating. A summary of the different operating control configurations for when the new stripper is operating is summarized in Table 3-2 below.



New-Indy Catawba LLC Catawba, South Carolina New Condensate Stripper Permit Application

## **Table 3-1 Stripper Operating Scenarios**

	Operating Time				
Stripper Operating Scenario	Operat % 90% 4.75% 5.25%	hrs			
New Stripper Online	90%	7,884.0			
Backup Stripper Online	4.75%	416.0			
No Stripper Online	5.25%	460.0			

#### Table 3-2 New Stripper System Operating Scenarios

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating	Ope Configur	rating ation Time		Controls Operating Time		
	%	hrs	Configuration	%	hrs	Controls	%	hrs	
New Stripper Online	90%	7,884 0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	
			SRL Online	95%	7,489.8	SRULVHC to RF3	25.0%	5.617.4	
			SRL Online	95%	7,489.8	SRULVHC to CB1/CB2	25,0%	1.872.5	
			SRLOffline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	



The SRL is expected to contain approximately 40% of the TRS, with the remaining 60% in the LVHC off-gases from the rectified methanol system. The SRL will be blended with black liquor and burned in both recovery furnaces at a maximum concentration of 2%. The sodium fume inside the recovery furnace absorbs the sulfur from combustion of the black liquor and will also absorb the sulfur from combustion of the SRL. We conservatively assumed 99% absorption within the salt fume based on information provided in NCASI Technical Bulletin No. 604. This is expected to occur 100% of the time the rectified methanol system is operating (SRL mode).

When operating in SRL mode, the LVHC off-gases from the rectified methanol system will be vented into the LVHC System. In addition, the LVHC gases from the evaporators and turpentine recovery system will be vented to the No. 3 Recovery Furnace as part of this project. The No. 3 Recovery Furnace is expected to be available for LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive these gases, the LVHC will be combusted in the combination boilers the remaining 25% of the time. The LVHC gases will pass through the LVHC caustic scrubber prior to being combusted in the combination boilers. The LVHC scrubber removes approximately 50% of the sulfur from the gas stream. The LVHC gas scrubber is not necessary and will not be used when the LVHC gases are being combusted in the No. 3 Recovery Furnace because the salt fume in the recovery furnace provides the expected sulfur control.

#### Sulfur Dioxide, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

As previously stated, the SRL is expected to contain approximately 40% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP. The sodium fume inside the recovery furnace absorbs the sulfur produced from combusting black liquor and will also absorb the sulfur produced by combusting the foul condensate present in the methanol. It is conservatively assumed that 99% of the sulfur from combusting the SRL is absorbed by the sodium fume (NCASI Technical Bulletin 604), and the remaining 1% is oxidized to SO<sub>2</sub>. This is expected to occur 100% of the time in SRL mode.

To calculate TRS and  $H_2S$  emissions from burning the SRL in the recovery furnaces, a sulfur capture of 99% is applied with a 99% conversion factor to  $SO_2$ , for a combined capture and conversion factor of 99.9%.

Similarly, the LVHC gases from the rectified methanol system are expected to contain approximately 60% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP and will be vented into the LVHC System. When the LVHC is combusted in the No. 3 Recovery Furnace, the sodium fume inside the recovery furnace is also expected to absorb 99% of the sulfur from the



LVHC gases before it can be converted to SO<sub>2</sub>. When the LVHC is combusted in the combination boilers, the LVHC scrubber will capture 50% of the sulfur before conversion to SO<sub>2</sub>. H<sub>2</sub>S and TRS emissions from the rectified methanol system LVHC are calculated based on conservatively assuming 99.9% capture or conversion to SO<sub>2</sub> in the recovery furnace and 99% conversion to SO<sub>2</sub> in the combination boilers.

When the rectified methanol system is not operating, SOG from the new stripper will be vented to the combination boilers, and the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP is assumed to be 100% converted to SO<sub>2</sub> to calculate SO<sub>2</sub> emissions. H<sub>2</sub>S and TRS emissions from combusting SOGs in the combination boilers are based on conservatively assuming a 99% conversion to SO<sub>2</sub>.

When the new stripper is operating, regardless of SRL status, there will be no foul or stripped condensate flow to the Hardpipe. Projected emissions of TRS compounds (excluding H<sub>2</sub>S) from the ASB are calculated based on the WATER9 Model. Projected emissions of H<sub>2</sub>S from the ASB are calculated based on the H2SSIM Model. Both WATER9 and H2SSIM emissions calculations are based on the average ASB influent concentrations from data collected during the 2021 and 2022 TRS testing efforts.

#### Nitrogen Oxides

When the rectified methanol system is operating, the methanol condenser is expected to condense more than 90% of the methanol in the SOG. The SOG also contains ammonia, which is also expected to be condensed with the methanol. The remaining ammonia will be vented with the SRL off-gases into the LVHC system. As a result, there will be an increase in ammonia when (1) SRL is mixed with liquor and burned in the recovery furnaces and (2) the SRL LVHC off-gases are combusted in the No. 3 Recovery Furnace.

The ammonia in the methanol is expected to contribute less than 2% of the total nitrogen in the black liquor. The NO<sub>X</sub> emissions from the recovery furnaces have been conservatively assumed to increase 2% when burning SRL and the SRL LVHC.

The NO<sub>x</sub> emissions from combustion of the SRL LVHC and SOG in the combination boilers are based on the post-Project Columbia NO<sub>x</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.



## Carbon Monoxide

In SRL mode, the SRL will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 2%. There is no information to suggest the CO emissions will change when the SRL is burned in the recovery furnaces.

The CO emissions from combustion of the SRL LVHC and SOG are based on the post-Project Columbia CO emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the new steam stripper system are based on the theoretical maximum methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day).

In SRL mode, the SRL will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 2%. The SRL will be combusted in the recovery furnace to an expected 99.9% VOC destruction in the liquid phase.

When the new stripper is operating, there will be no foul or stripped condensate flow to the Hardpipe. Non-methanol VOC emissions (acetaldehyde, methyl ethyl ketone, propionaldehyde, and TRS VOCs) from the ASB are calculated based on WATER9, using the average ASB influent concentrations from data collected during 2021 and 2022 TRS and NESHAP Subpart S testing efforts. Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests.

#### **Backup Stripper Online Scenario**

As stated previously, once the new stripper is installed, the existing stripper will be demoted to the backup steam stripper role. For the purposes of calculating projected actual emissions (PAE), the backup steam stripper is projected to be online a minimum of 4.75% of the annual operating time. The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. In TRS mode, the backup stripper will also remove approximately 45% of the methanol from the foul condensate. The SOG from the backup steam stripper will be vented to the combination boilers. The stripped condensate from the backup steam stripper will be



discharged to the Hardpipe where the remaining unstripped methanol will be biologically treated in the ASB.

After the original submittal of this application and further discussions with SCDHEC, an alternate operating scenario for the backup stripper operating in "methanol mode" was established in addition to the "TRS mode" operation described above. Upon completion of the Project, the Mill can operate the existing stripper in either "TRS mode" or "methanol mode" during the periods the backup stripper is projected to operate. The calculations provided in Appendix B of this application include the emissions rates of each pollutant for both the TRS mode and methanol mode backup stripper operating scenarios. For each pollutant, the worst-case backup stripper operating mode was used to determine PSD applicability. For simplicity, this section will only discuss the TRS mode emissions calculations, consistent with the original submittal. Appendix D to this application provides a detailed description of the backup stripper operating in "methanol mode" as well as the supporting calculation documentation provided to SCDHEC after submittal of the original application.

## Sulfur Dioxide

The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. SO<sub>2</sub> emissions from combustion of the backup stripper SOG in the combination boilers are conservatively calculated assuming all of the 0.70 lb S/ADTP of sulfur present in the foul condensate will be captured in the SOG and converted to SO<sub>2</sub> during combustion.

#### Nitrogen Oxides and Carbon Monoxide

The NO<sub>x</sub> and CO emissions from combustion of SOG are based on the post-Project Columbia NO<sub>x</sub> emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

#### Volatile Organic Compounds

The projected actual VOC emissions for the backup stripper are based on the maximum expected methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day). To calculate VOC emissions from backup stripper SOG combustion, it is conservatively assumed that the methanol present in the foul condensate will be captured with the SOG and combusted with 98% control at the combination boilers.



Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the stripped condensate from the backup stripper is based on the theoretical maximum methanol collection (16 lb/ODTP) in the foul condensate and an expected 45% removal efficiency from the backup stripper operating in "TRS mode."

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline. Emissions of TRS compounds that are also VOC are calculated using WATER9 with the design foul condensate loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode" before entering the ASB.

#### Hydrogen Sulfide and Total Reduced Sulfur Compounds

To calculate TRS and  $H_2S$  emissions from backup stripper SOG combustion, it is conservatively assumed that the design foul condensate sulfur loading will be captured with the SOG and only 99% will be converted to  $SO_2$  at the combination boilers.

Projected emissions of TRS compounds (excluding H<sub>2</sub>S) from the ASB are based on WATER9. Projected emissions of H<sub>2</sub>S from the ASB are calculated based on H2SSIM. Both WATER9 and H2SSIM emissions are based on the average ASB influent concentrations from data collected during 2021 and 2022 TRS testing and the design foul condensate sulfur loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode."

#### No Stripper Online Scenario

The post-Project emissions also account for brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds will be chemically oxidized to reduce the potential for odors from the ASB when operating during these transition periods, which are required by Item I.a of Appendix A of the November 16, 2022 EPA Consent Decree to be less than 460 hours (5.25%) of annual operating time.

When there is no SOG being created by either stripper, there are no emissions of SO<sub>2</sub>, NOx, or CO corresponding to the periods when all foul condensate is treated in the ASB.



## Volatile Organic Compounds, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

Methanol emissions from the ASB are based on NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the foul condensate is based on the maximum methanol collection (16 lb/ODTP).

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline.

Emissions of TRS compounds are calculated using WATER9 and H2SSIM (H<sub>2</sub>S) with the design foul condensate sulfur loadings of TRS compounds being adjusted based on NCASI Technical Bulletin No. 949 to account for the effects of the chemical oxidant, consistent with how baseline actual emissions are calculated.

- H<sub>2</sub>S concentrations in the Hardpipe were reduced by 99%.
- DMS concentrations in the Hardpipe were reduced by 90%.
- MMC concentrations in the Hardpipe were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed not reduced by chemical oxidant. DMDS concentrations of the Hardpipe were increased to account for the MMC oxidized into DMDS.

#### PAE and PTE Independent from Stripper Operating Scenario

#### LVHC Collection System

As stated previously, the No. 3 Recovery Furnace is expected to provide LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive the LVHC gases, the LVHC gases will then be combusted in the combination boilers the remaining 25% of the time. The emissions from combusting LVHC gases are unaffected by the stripper operating scenario. PAE of SO<sub>2</sub>, H<sub>2</sub>S, and TRS are based on 2021 stack testing and SCDHEC approved emissions factors from Construction Permit DF. The VOC PAE from the LVHC collection system are based on the post-project Columbia VOC emissions factors presented Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF. The New Stripper Project does not impact the generation of HVLC gases and associated emissions (i.e., HVLC sources are not affected or modified as a result of the project); therefore, emissions associated with the combustion of HVLC gases are not included in the PAE (or BAE) emissions.



#### No. 3 Recovery Furnace LVHC Ignitor

The No. 3 Recovery Furnace will also have a 1 MMBtu/hr natural gas-fired LVHC ignitor to be used when the black liquor load is less than 50%. The natural gas ignitor is expected to be required no more than 15% of the time the No. 3 Recovery Furnace is in operation. PAE of products of combustion from the ignitor are based on AP-42 emissions factors.

#### Steam for New Stripper and Backup Stripper

The steam requirements for the new stripper and the backup stripper were provided by the vendor and adjusted for the thermal efficiency of the combination boilers firing natural gas and No. 6 fuel oil. The projected fossil fuel usage reflects the highest No. 6 fuel oil usage occurring during the previous 10 years. The highest fuel oil usage was during calendar year 2014 and accounted for 18.4% of the fossil fuel heat input. The PAE and PTE of products of combustion are based on AP-42 emissions factors.

#### 3.2.2.3.3 PSD Non-Applicability

The changes in emissions from the Mill as a result of the Project were compared to the significant emission rates in Standard No. 7, paragraph (B)(49). Based on the emissions calculations described above, presented in Appendix B, and summarized in Table 3-3, the Project is not subject to the PSD permitting requirements in paragraphs (J) through (R) of Standard No. 7.



New-Indy Catawba LLC Catawba, South Carolina New Condensate Stripper Permit Application

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM2.5	NOx	502	co	H2504	TRS	VOC	Pb	H <sub>2</sub> 5	c0,
Baseline Actual Emissions	1.11	1 02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3 61	12.275
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2,43	16.8	260	2.06E-03	5.59	48,200
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.95	26.8	1.95E-03	1.98	35,925
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	-40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

# Table 3-3 Summary of PSD Applicability for the Project (tpy)

A - HF is not emitted from new, modified, or affected emissions units.



# 3.2.2.4 Standard No. 7 – Prevention of Significant Deterioration – Air Dispersion Modeling Requirements

Standard No. 7 also includes PSD air quality increments that apply to all increases and decreases in PSD pollutant emissions following the PSD minor source baseline date. In York County the minor source baseline dates are December 1, 1981, for PM10 and March 3, 2017 for PM2.5. This Application does not trigger PSD review as discussed above; therefore, the project is unlikely to interfere with attainment or maintenance of State or Federal ambient air quality standards.

## 3.2.2.5 Standard No. 8 – Toxic Air Pollutants

SCDHEC Standard No. 8 regulates emissions of air toxics from new and existing sources. The Standard does not apply to fuel burning sources that burn only virgin fuel or specification used oil. Section I.D(1) of Standard No. 8 exempts sources subject to a Federal NESHAP. The Mill is subject to the Federal NESHAP for the pulp and paper source category (Subparts S and MM), industrial boilers (Subpart DDDDD), and reciprocating internal combustion engines (Subpart ZZZZ). Section I.D(2) of Standard No. 8 exempts non-NESHAP sources after a facility-wide residual risk analysis is completed. U.S. EPA published the results of facility-wide residual risk analyses for Subpart S sources on December 27, 2011, and for Subpart MM sources on December 30, 2017. The residual risk analyses completed by U.S. EPA concluded that there was no unacceptable risk from pulp and paper mills. Therefore, all emissions sources of HAP at New-Indy Catawba are exempt from Standard No. 8 under sections I.D(1) and/or I.D(2).

New-Indy Catawba emits two South Carolina toxic air pollutants (TAP) that are not listed HAP, H<sub>2</sub>S and methyl mercaptan. Both compounds are generated by the Kraft pulping process and are components of TRS gases that are contained in LVHC and HVLC gases and in the pulping process condensates. Section I.D(3) allows sources to request an exemption for non-HAPs controlled by MACT controls to reduce HAP. This Project will improve emissions of H<sub>2</sub>S and MMC from the Mill. However, because SCDHEC recently modeled emissions of H<sub>2</sub>S and MMC and to demonstrate that emissions from these two TAPs following the Project remain below the maximum allowable ambient concentrations (MAAC) in Standard No. 8, the Mill has included an updated modeling demonstration in Appendix C.

The updated modeling analysis for TRS (as H<sub>2</sub>S), H<sub>2</sub>S and MMC in Appendix C focused on the changes to the emissions from the aerated stabilization basin. The TRS, H<sub>2</sub>S and MMC emissions from the No. 3 Recovery furnace were not updated due to the insignificant maximum modeled concentrations from the No. 3 Recovery Furnace when compared to the overall maximum modeled concentrations for the Mill. The TRS (as H<sub>2</sub>S) maximum modeled concentrations from



the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the Mill. Similarly, the MMC concentrations were approximately 0.08% of the maximum concentrations from the Mill, and the TRS (as  $H_2S$ ) maximum concentrations from the No. 3 Recovery Furnace were approximately 0.04% of the maximum mill concentrations.

# 3.2.3 Regulation 61-62.60: South Carolina Designated Facility Plan and New Source Performance Standard

Regulation 61-62.60 incorporates the 40 CFR Part 60 Subparts by reference. Refer to Section 3.1.1 for a discussion of 40 CFR Part 60.

# 3.2.4 Regulation 61-62.61 and 61-62.62: National Emission Standards for Hazardous Air Pollutants

Regulation 61-62.61 incorporates the 40 CFR Part 61 Subparts by reference. Refer to Section 3.1.2 for a discussion of the non-applicability of 40 CFR Part 61. Regulation 61-62.63 incorporates the 40 CFR Part 63 Subparts by reference. Refer to Section 3.1.2 for a discussion of applicability of 40 CFR Part 63.

# 3.2.5 Regulation 61-62.70 – Title V Operating Permit Program

Refer to Section 3.1.6 for discussion of the TVOP Program.

# 3.3 PROVISIONS OF THE SCDHEC CONSENT ORDER AND EPA CONSENT DECREE

This section addresses the provisions of the November 23, 2022 SCDHEC Consent Order and Part I of Appendix A of the November 16, 2022 EPA Consent Decree.

#### 3.3.1 November 23, 2022 SCDHEC Consent Order

Items 4 through 6 of the Consent Order require that New-Indy Catawba:

- Install, operate, and maintain a primary stripper that is adequately sized to collect and treat all foul condensate streams in accordance with applicable state and federal air quality regulations. The proposed new stripper will be sized at 850 gpm, which is designed to process foul condensates generated from producing the maximum pulp production of 2,700 ADTP/d, and New-Indy Catawba will operate the unit in accordance with applicable state and federal air quality regulations.
- The primary stripper shall use low-pressure steam and must be designed for both methanol and sulfur compound removal with the off gases being treated in the recovery boilers to



absorb the sulfur compounds in the stripper off gas. The proposed new stripper will utilize 60 pounds per square inch gauge (psig) steam. The new stripper off-gases and SRL will be incinerated in the No. 2 or 3 Recovery Furnace, with the exception of when the SRL system is unavailable (5% of the operating time of the new stripper).

- Complete preliminary engineering and submit a construction permit application for the primary stripper within one hundred and twenty (120) days of the execution of this order. *Preliminary engineering is complete and this application is being submitted by March 23, 2023.*
- New-Indy must optimize, operate, and maintain the existing stripper at its current design capacity to allow it to be operated independently of the primary stripper. To optimize the existing stripper at its current design, it will be operated in "TRS mode" to remove 98% of the TRS and approximately 45% of the methanol from the foul condensate or in "methanol mode" (see Appendix D).
- The following required events have or will be completed in the future:
  - Order the primary stripper within 30 days of submitting the application for the air construction permit.
  - Within 30 days of receiving the air construction permit, New-Indy Catawba must start civil engineering preparation.
  - Within 30 days of receiving the primary stripper, New-Indy Catawba must start installation and testing.
  - New-Indy Catawba must complete startup operations and place the primary stripper into operation no later than June 30, 2025.
  - New-Indy shall operate its steam stripper system, comprised of the primary stripper and the existing stripper, in accordance with all applicable state and federal air quality regulations.
  - In the event the stripping system is out of service and foul condensate must be discharged to the ASB, New-Indy Catawba must use automated control of addition of a chemical oxidant, hydrogen peroxide, to treat the unstripped foul condensate prior to discharging into the ASB to maintain a rolling 90-minute average oxidation reduction potential (ORP) of the foul condensate above 0 millivolts.
  - New-Indy Catawba must notify SCDHEC at least 48 hours prior to any planned downtime and within 24 hours of unplanned downtime for which the primary stripper will not be operational (and for the existing stripper when it should be operating but will not be).



 New-Indy Catawba must submit reports to the Department regarding the implementation of the Consent Order to NewIndyOrderReports@dhec.sc.gov.
For twelve consecutive months after execution of this order, the reports shall be submitted monthly on the 1st business day of the month. Thereafter, reports shall only be submitted every three months on the 1st business day of the month until the order terminates.

## 3.3.2 November 16, 2022 EPA Consent Decree

#### Item I(a) of Appendix A

Item I(a) of Appendix A of the Consent Decree contains requirements related to the uptime and monitoring of the foul condensate steam stripper at the Mill.

- New-Indy Catawba will operate their foul condensate treatment system (inclusive of the new and existing steam strippers) during all times that unbleached kraft pulp is being produced and foul condensate is being generated at the Mill.
- During periods the new steam stripper is experiencing downtime the existing steam stripper will be used.
- Periods of downtime in which both strippers are down will not exceed 576 hours for the first year and 460 hours annually thereafter.
- Peroxide will be added to the non-stripped condensate during the transition to the existing steam stripper and will continue to be added throughout the period in which the existing steam stripper is in operation as necessary to maintain a rolling 90-minute average ORP of the foul condensate above 0 millivolts.
- The Mill will notify the necessary authorities forty-eight (48) hours prior to any scheduled downtime and within twenty-four (24) hours of any unscheduled downtime and will operate both steam strippers, as applicable, for compliance with 40 CFR Part 63, Subpart S.

#### Item I(b) of Appendix A of the Consent Decree

Item I(b) of Appendix A of the Consent Decree covers the maintenance, operation, and calibration of the system used to treat the unstripped foul condensate by the Mill. The Mill's foul condensate treatment system (inclusive of the new equipment to be installed with this application) will be capable of continuously measuring the ORP of the foul condensate, automatically controlling the dosage of hydrogen peroxide to maintain a rolling ninety-minute average of the ORP of the foul



condensate above 0 millivolts (mV) before it is discharged to the ASB, and treating the maximum amount of foul condensate produced when both steam strippers are down and when untreated foul condensate is discharged to the Hardpipe.

#### Item I(c) of Appendix A of the Consent Decree

Item I(c) of Appendix A of the Consent Decree contains recordkeeping requirements for data obtained by the ORP monitoring system used by the Mill. The Mill will maintain continuous records of the ORP monitoring system used by the Mill and will provide data to U.S. EPA upon request.

#### Item I(d) of Appendix A of the Consent Decree

Item I(d) of Appendix A of the Consent Decree includes reporting requirements for the ORP monitoring system used by the Mill. When untreated foul condensate is discharged to the Hardpipe, New-Indy Catawba will include the date, time, and value of any instance of a rolling ninety-minute average of the ORP falling below 0 mV in the Mill's semi-annual report for the previous six months.
# APPENDIX A -PERMIT APPLICATION FORMS



# **Bureau of Air Quality Construction Permit Application** Page 1 of 9

RECEIVED

APR 30 2024

**BAQ PERMITTING** 

#### SECTION 1 - FACILITY IDENTIFICATION

SC Air Permit Number (8-digits only) (Leave blank if one has never been assigned) 2440 - 0005

Application Date

March 2023, updated April 2024

Facility Name/Legal Identity (This should be the official legal name under which the facility is owned/operated and should be consistent with the name registered with the S.C. Secretary of State's office, as applicable.) New-Indy Catawba LLC

Facility Site Name (Optional) (Please provide any alternative or additional identifier of the facility, such as a specific plant identifier (e.g., Columbia plant) or any applicable "doing business as" (DBA) identity. This name will be listed on the permit and used to identify the facility at the physical address listed below.)

Facility Federal Tax Identification Number (Established by the U.S. Internal Revenue Service to identify a business entity) 83-1904423

### **REQUEST TYPE (Check all that apply)**

#### Exemption Request:

Complete Section 1 and attach documentation to support exemption request.

#### **Construction Application:**

Minor New Source Review Project

□ Synthetic Minor Project

Prevention of Significant Deterioration Project

□ 112(g) Project

#### Expedited Review Request:

If checked, include Expedited Form D-2212 in the construction application package.

#### Construction Permit Modification:

Provide the construction permit ID (e.g. CA, CB, etc.) for which modification is requested:

### Application Revision: 🗆

#### CONSTRUCTION PERMIT APPLICATION FORMS BEING REVISED (Amended construction permit forms must be filled out completely and attached to this modification request.) **Date of Original** Form # **Brief Description of Revision** Submittal Updated Faciltiy Air Contact, Owner or Operator, Application Narrative and D-2566 March 2023 Appendix B D-2573 March 2023 Updated Faciltiy Air Contact

	FACILITY PHYSICAL ADDRESS	
Physical Address: 5300 Cureton Ferry Ro	ad	County: York
City: Catawba	State: SC	Zip Code: 29704
Facility Coordinates (Facility coordinates should	l be based at the front door or main entrance o	f the facility)
Latitude: 34°50′37″N	Longitude: 80°	°53′25″W



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FACILITY'S P	RODUCTS / SERVICES
Primary Products / Services (List the primary product and/or s Linerboard / Pulp Manufacturing	service)
Primary <u>SIC Code</u> (Standard Industrial Classification Codes) 2631	Primary <u>NAICS Code</u> (North American Industry Classification System) 322130
Other Products / Services (List other products and/or services)	
Other SIC Code(s):	Other NAICS Code(s):

### **PROJECT DESCRIPTION**

Project Description (What, why, how, etc.): Installation of a new steam stripper system to treat foul condensate prior to being hard piped to the aeration stabilization basin. The new steam stripper will include a new stripper feed tank, new methanol tank, new hot water tank, and a new methanol rectification condenser. The rectified methanol will be burned in the recovery furnaces with the black liquor. The LVHC gases from the methanol condenser system, stripper feed tank, and methanol tank will be combusted in the No. 3 Recovery Furnace. The hot water tank is not expected to be a source of air emissions. The existing steam stripper will serve as a backup to the new steam stripper.

AIR PERMIT FA (Person listed will be in our files as the point of contact for all air per	CILITY CONTACT mitting related questions and will receiv	e all air permitting notifications.)
Title/Position: Environmental Manager Salutation: Ms.	First Name: Rachel	Last Name: Davis
Mailing Address: P.O. Box 7		
City: Catawba	State: SC	Zip Code: 29704
E-mail Address: rachel.davis@new-indycb.com	Primary Phone No.: (803) 981-8206	Alternate Phone No.:

The signed permit will b	e e-mailed to the designated Air Permit Contact.	
If additional individuals need copies of	the permit, please provide their names and e-mail addresses.	
Name E-mail Address		
Steven Moore	smoore@all4inc.com	

#### **CONFIDENTIAL INFORMATION / DATA**

Is <u>confidential information</u> or data being submitted under separate cover? 🛛 No 🗌 Yes\*

\*If yes, submit ONLY ONE COMPLETE CONFIDENTIAL APPLICATION, with original signature, along with the public version of the application.

#### **CO-LOCATION DETERMINATION**

Are there other facilities in close proximity that could be considered collocated? igsqrmathing No igsqrmathing Yes\*

If yes, list potential collocated facilities, including air permit numbers if applicable:

\*If yes, please submit collocation applicability determination details in an attachment to this application.



## **Bureau of Air Quality Construction Permit Application** Page 3 of 9

	OWNER O	ROPERATOR	
Title/Position: Mill Manager	Salutation: Mr.	First Name: Chris	Last Name: Loach
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: chris.loach@new-indycb.com		Primary Phone No.: 803- 981-8000	Alternate Phone No.:
	OWNER OR OPE	RATOR SIGNATURE	
I certify, to the best of my knowled	dge and belief, that no a	applicable standards and/or re	gulations will be contrav

or violated. I certify that any application form, supporting documentation, report, or compliance certification submitted in this permit application is true, accurate, and complete based on information and belief formed after reasonable inquiry. I understand that any statements and/or descriptions, which are found to be incorrect, may result in the immediate revocation of any permit issued for this application.

his toach

Signature of Owner or Operator

APPLICATION PREPARER (if other than Professional Engineer below)					
Title/Position: Consultant	Senior	Managing	Salutation: Mr.	First Name: Steven	Last Name: Moore
Mailing Address	: 630 Davis	Drive, Suite	203		
City: Durham				State: NC	Zip Code: 27560
E-mail Address:	smoore@a	ll4inc.com		Phone No.: (919) 234-5981	Cell No.: (864) 616-4711

PROFESSIONAL ENGINEER INFORMATION				
Consulting Firm Name: ALL4 LLC		SC Certificate of Authority Li	cense No.: 6409	
Title/Position: PE	Salutation: Ms.	First Name: Sheryl	Last Name: Watkins	
Mailing Address: 300 Chastain Cen	ter Blvd, Suite 395			
City: Kennesaw		State: Georgia	Zip Code: 30144	
E-mail Address: swatkins@all4inc.c	om	Phone No.: (678) 293-9428	Cell No.: (386) 503-0266	
SC License/Registration No.: 34347	,			

#### **PROFESSIONAL ENGINEER SIGNATURE**

I have placed my signature and seal on the engineering documents submitted, signifying that I have reviewed this construction permit application as it pertains to the requirements of South Carolina Regulation 61-62, Air Pollution Control Regulations and Standards.

ergl Watterny 4-26-24 Signature of Professional Engine No. 34347 111111 DHEC 2566 (03/2021)

This form is subject to Retention Schedule 16303.

Date



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	EQUIPMENT / PROCESS INFORMATION						
Equipment ID/ Process ID	Action	Equipment / Process Description	Maximum Design Capacity (Units)	Control Device ID(s)	Emission Point ID(s)		
9801	Add Remove Modify Existing	Existing Steam Stripper	850 gallons/minute	9820, 2605, 3705, 2901	2610S2, 2610S1, Fugitive		
9802	Add Remove Modify Existing	Hardpipe	850 gallons/minute	2901	Fugitive		
9803	Add Remove Modify Existing	New Steam Stripper (Methanol Condenser)	6.5 gallons/minute	5260, 5260C, 2605, 3705, 5105	5105S, 2610S2, 2610S1		
9803	Add Remove Modify Existing	New Steam Stripper (Condensed Methanol)	6.5 gallons/minute	2505, 5105	2505S, 5105S		
9803	Add Remove Modify Existing	New Steam Stripper (Stripper Off Gases)	850 gallons/minute	9820, 2605, 3705	2610S2, 2610S1		
9804	Add Remove Modify Existing	New Steam Stripper Feed Tank	80,400 gallons	5260, 5260C, 5105, 2605, 3705	261052, 261051, 51055		
9805	Add Remove Modify Existing	New Steam Stripper Rectified Liquid Methanol Tank	1,300 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S		



## Bureau of Air Quality Construction Permit Application Page 5 of 9

		CONT	ROL DEVICE INFO	ORMATION				
Control Device ID	Action	Control Device Description	Maximum Design Capacity (Units)	Inherent/ Required/ Voluntary	Pollutants Controlled (Include CAS #)	Capture Efficiency	Destruction/ Removal Efficiency	Emission Point ID(s)
2505	Add Remove Modify Existing	No. 2 Recovery Furnace	412,140 tons BLS/year	Required	See Ap	pendix B/Na	arrative	25055
2605	Add Remove Modify Existing	No. 1 Combination Boiler	405 MMBtu/hr	Required	See Ap	pendix B/Na	arrative	261052
2901	Add Remove Modify Existing	Aerated Biotreatment (Aerated Stabilization Basin)	N/A	Required	See Ap	pendix B/Na	arrative	Fugitive
3705	Add Remove Modify Existing	No. 2 Combination Boiler	720 MMBtu/hr	Required	See Appendix B/Narrative		arrative	261051
5105	Add Remove Modify Existing	No. 3 Recovery Furnace	744,600 tons BLS/year	Required	See Appendix B/Narrative		arrative	5105S
9820	Add Remove Modify Existing	Stripper Off Gases Collection System	2,700 ADTP/day	Required	See Ap	pendix B/Na	arrative	2610S1, 2610S2
5260	Add Remove Modify Existing	LVHC Collection System	2,700 ADTP/day	Required	See Appendix B/Narrative		2610S1, 2610S2, 5105S	
5260C	Add Remove Modify Existing	LVHC Collection System Caustic Scrubber	2,700 ADTP/day	Required	See Ap	pendix B/Na	arrative	2610S1, 2610S2, 5105S



## Bureau of Air Quality Construction Permit Application Page 6 of 9

Check Box for information addressed	Required Information
	Source identification and emissions:
$\boxtimes$	Name of each source, process, and control device.
$\boxtimes$	<ul> <li>Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application.</li> </ul>
$\boxtimes$	Assign an Emission Point ID for each source.
$\boxtimes$	Assign a Control Device ID for each control device.
$\boxtimes$	List each pollutant the source will emit.
$\boxtimes$	<ul> <li>List the Uncontrolled, Controlled, and PTE emissions for each source or equipment in lb/hr and tons/year.</li> </ul>
$\boxtimes$	<ul> <li>Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.</li> </ul>
$\boxtimes$	• Provide the CAS# for each Hazardous Air Pollutant (HAP) and/or Toxic Air Pollutant (TAP).
	Information to support emission rates:
	Sample calculations.
$\boxtimes$	<ul> <li>Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.</li> </ul>
$\boxtimes$	Explanation of assumptions, bottlenecks, etc.
	<ul> <li>Source test information: A copy of the source test results may be requested. If the test results are not included in the application, the application should cite whether this was a DHEC approved test, and if not, explain where the test was conducted and other identifying information.</li> </ul>
	Manufacturer's data.
	Vendor guarantees that support control device efficiencies.
$\boxtimes$	New Source Review (NSR) analysis.
$\boxtimes$	Other (e.g. example particle size analysis)

	Existing (Permitted) Facilities	
Check Box	Required Information	Location in Application
	<ul> <li>Facility-wide emissions prior to construction/modification:</li> <li>Include an explanation if these emissions do not match the facility-wide emissions submitted in the last application.</li> </ul>	Appendix B
$\boxtimes$	<ul><li>Facility-wide emissions after construction/modification:</li><li>Include net change, if applicable.</li></ul>	Appendix B
	As applicable for the construction/ modification:	
	Name of each source.	See Equipment/Process Information Above

DHEC 2566 (03/2021)

This form is subject to Retention Schedule 16303.



## Bureau of Air Quality Construction Permit Application Page 7 of 9

	Existing (Permitted) Facilities	
Check Box	Required Information	Location in Application
	<ul> <li>Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application or on your current construction / operating permit.</li> </ul>	See Equipment/Process Information Above
	Assign a Control Device ID for each control device.	See Equipment/Process Information Above
	<ul> <li>Assign an Emission Point ID for each source.</li> </ul>	See Equipment/Process Information Above
$\boxtimes$	List each pollutant the source will emit.	Appendix B
	<ul> <li>List the Uncontrolled, Controlled, and PTE (if applicable) emissions for each source or equipment.</li> </ul>	Appendix B
	<ul> <li>Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.</li> </ul>	Appendix B
$\boxtimes$	Provide the CAS# for each HAP and/or TAP.	Appendix B
	Information to support facility-wide emission rates:	
	Sample calculations.	Appendix B
	<ul> <li>Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.</li> </ul>	Narrative, Appendix B
$\boxtimes$	<ul> <li>Explanation of assumptions, bottlenecks, etc.</li> </ul>	Narrative
	<ul> <li>Source test information: A copy of source the test results may be requested. If the results are not included in the application, the application should cite whether this was a DHEC approved test and if not, explain where the test was conducted and other identifying information.</li> </ul>	Appendix B
	Manufacturer's data.	
	<ul> <li>Vendor guarantees that support control device efficiencies.</li> </ul>	
$\boxtimes$	NSR analysis.	Narrative
$\boxtimes$	Other (please explain)	Appendix B



# Bureau of Air Quality Construction Permit Application Page 8 of 9

Check Box	State and Federal Air Pollution Control Regulations and Standards
$\boxtimes$	S.C. Regulation 61-62.1 Section II.E Synthetic Minor Construction Permits
$\boxtimes$	S.C. Regulation 61-62.5 Air Pollution Control Standards
	Standard No. 1 Emissions from Fuel Combustion
$\boxtimes$	Standard No. 2 Ambient Air Quality
$\boxtimes$	<ul> <li>Standard No. 3 Waste Combustion and Reduction (state only)</li> </ul>
$\boxtimes$	<ul> <li>Standard No. 4 Emissions from Process Industries (Note: If Section VIII of this Standard applies, include the process weight rate (PWR) in ton per hour for each applicable source or process.)</li> </ul>
	Standard No. 5 Volatile Organic Compounds
	<ul> <li>Standard No. 5.2 Nitrogen Oxides Lowest Achievable Emission Rate</li> </ul>
$\boxtimes$	Standard No. 7 Prevention of Significant Deterioration (PSD)
	<ul> <li>Standard No. 7.1 Nonattainment New Source Review (NSR)</li> </ul>
$\boxtimes$	Standard No. 8 Toxic Air Pollutants (TAPs) (state only)
	S.C. Regulation 61-62.6 Control of Fugitive Particulate Matter
$\boxtimes$	S.C. Regulation 61-62.60 and 40 CFR Part 60 New Source Performance Standards (NSPS)
$\boxtimes$	S.C. Regulation 61-62.61 and 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP)
$\boxtimes$	S.C. Regulation 61-62.63 and 40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories
$\boxtimes$	40 CFR Part 64 Compliance Assurance Monitoring (CAM)
	S.C. Regulation 61-62.68 and 40 CFR Part 68 Chemical Accident Prevention Provisions
$\boxtimes$	S.C. Regulation 61-62.70 and 40 CFR Part 70 Title V Operating Program
	Other S.C. Air Pollution Control Regulations, as applicable.
	Other Federal Air Pollution Control Regulations, as applicable.
	40 CFR 98 Green House Gas (GHG) emissions (Note: Quantify GHG emissions, if S.C. Regulation 61-62.5, Standard No. 7 or S.C. Regulation 61-62.5, Standard No. 7.1 is triggered.)



## Bureau of Air Quality Construction Permit Application Page 9 of 9

Check Box	Completeness Checklist:								
	Applicability Determination:								
$\boxtimes$	Is this regulation applicable, reasonably applicable, potentially applicable, or not applicable?								
$\boxtimes$	Is the basis for the applicability determination explained?								
	Affected Sources:								
$\boxtimes$	Is the name and identification of each emission source or process included?								
	Compliance Demonstration:								
$\boxtimes$	How will compliance be demonstrated?								
$\boxtimes$	• Are specific methods or activities to be utilized by the facility to demonstrate compliance with each specific limitation and/or requirement provided?								
	Are control devices and control device requirements included?								
$\boxtimes$	<ul> <li>Are monitoring, recordkeeping, and reporting requirements necessary to demonstrate compliance included?</li> </ul>								
	Regulatory Citations:								
$\boxtimes$	Are the regulatory citations identified?								



# Bureau of Air Quality Emission Point Information Page 1 of 4

A. APPLICATION IDENTIFICATION								
1. Facility Name: New-Indy Catawba LLC								
2. SC Air Permit Number (if known; 8-digits only): 2440 - 0005 3. Application Date: March 2023, updated April 2024								
4. Project Description: New Condensate Stripper Permit Application								
5. Are other facilities collocated for air compliance? 🗌 Yes 🛛 No 🛛 6. If Yes, provide permit numbers of collocated facilities:								

	B. AIR	CONTACT	
Consulting Firm Name (if applicable):			
Title/Position: Environmental Manager	Salutation: Ms.	First Name: Rachel	Last Name: Davis
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: rachel.davis@new-indycb.com		Phone No.: (803) 981-8206	Cell No.:

	C. EMISSION POINT DISPERSION PARAM	AETERS
<ul> <li>Source data requirements are based on the a</li> </ul>	ppropriate source classification.	
Each emission point is classified as a point, fla	are, area, area circular, area polygon, volume, open	i pit, line, or buoyant line source.
Contact the Bureau of Air Quality for clarificat	ion of data requirements.	
• Include sources on a scaled site map. Also, a	picture of area or volume sources would be helpfu	Il but is not required.
A user generated document or spreadsheet n     the same order, units, etc. as presented in the	hay be substituted in lieu of this form provided all ese tables.	of the required emission point parameters are submitted in
<ul> <li>A user generated document or spreadsheet n the same order, units, etc. as presented in the <u>Abbreviations / Units of Measure</u>:</li> </ul>	nay be substituted in lieu of this form provided all ese tables.	of the required emission point parameters are submitted in
<ul> <li>A user generated document or spreadsheet n the same order, units, etc. as presented in the <u>Abbreviations / Units of Measure</u>:</li> <li>AGL = Above Ground Level</li> </ul>	<ul> <li>• °F = Degrees Fahrenheit</li> </ul>	<ul> <li>K = Kelvin</li> </ul>
<ul> <li>A user generated document or spreadsheet n the same order, units, etc. as presented in the <u>Abbreviations / Units of Measure</u>:</li> <li>AGL = Above Ground Level</li> <li>BTU/hr = British Thermal Unit per hour</li> </ul>	<ul> <li>• °F = Degrees Fahrenheit</li> <li>• ft = feet</li> </ul>	<ul> <li>K = Kelvin</li> <li>m = meters</li> </ul>



# Bureau of Air Quality Emission Point Information Page 2 of 4

Reminder: For all Emission Points, list the unique Emission Point ID for that source. Use the same emission point ID as shown in the current permit and provided in the last modeling submittal (as applicable). If the emission point ID has been changed from what was previously submitted, please list the current emission point ID with the old emission point ID in parenthesis

				D. POI	NT SO	JRCE				A			
Emission	Description (Alexand	UTM Coordinates (NAD83)		Release Height	Exit	Exit	Inside	Discharge	Rain	Distance To Nearest	Building		
Point ID	Description/Marrie	Easting (m)	Northing (m)	AGL (ft)	(°F)	(ft/s)	(ft)	Diameter Orienta- (ft) tion	Cap? (Y/N)	Property Boundary (ft)	Height (ft)	Length (ft)	Width (ft)
2610S1	No. 2 Combination Boiler Stack	510039.32	3855689.18	228	364	47.2	10.0	Vert.	N	3,937	N/A	N/A	N/A
261052	No. 1 Combination Boiler Stack	510020.32	3855678.18	228	405	62.3	10.0	Vert.	N	3,937	N/A	N/A	N/A
25055	No. 2 Recovery Furnace	510095.85	3855743.58	195	365	99.1	7.0	Vert.	Ň	3,953	N/A	N/A	N/A
5105S	No. 3 Recovery Furnace	510032.37	3855802.28	225	342	61.7	10.5	Vert.	N	4,134	N/A	N/A	N/A

				E. FLAF	RE SOURCE					_		
Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release	Heat	Exit	Exit	Heatlass	Distance To Nearest	Building		
		Easting (m)	Northing (m)	AGL (ft)	Rate (BTU/hr)	Velocity (ft/s)	Temp. (°F)	Fraction	Property Boundary (ft)	Height (ft)	Length (ft)	Width (ft)
a second second second												

				F. AREA S	DURCE				
Emission Point ID	Description (Alexand	UTM Coordinates (NAD83)		Release Height	Easterly Length	Northerly Length	Angle From	Initial Vertical	Distance To Nearest
	Description/Name	Easting (m)	Northing (m)	AGL (ft)	(ft)	(ft)	North (°)	Dimension σ <sub>z</sub> (ft)	(ft)



# Bureau of Air Quality Emission Point Information Page 3 of 4

		100 A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A	G.	AREA CIRCULAR	SOURCE			
Emission Point ID	Description (Name	UTM Coordinates (NAD83)		Release Height	Radius of Area	Number of	Initial Vertical	Distance To Nearest
	Description/Name	Easting (m)	Northing (m)	AGL (ft)	(ft)	Vertices	Dimension σ <sub>z</sub> (ft)	Property Boundary (ft)
						-		

	H. AREA POLYGON SOURCE												
Emission Point ID	Description (Name	UTM Coordinates (NAD83)		Release Height	Initial Vertical	Number of	Area	Distance To Nearest					
	Description/Name	Easting-1 (m)	Northing-1 (m)	AGL (ft)	(ft)	Vertices	(ft²)	(ft)					
Fugitive	Aerated Stabilization Basin (Zone 1)	510803.40	3856319.69	20	0	15	547,769	1,969					
Fugitive	Aerated Stabilization Basin (Zone 2)	510964.42	3856054.20	20	0	18	733,653	1,510					
Fugitive	Aerated Stabilization Basin (Zone 3)	511052.13	3855887.21	20	0	10	783,500	1,180					

			I. VOLUME S	SOURCE				
Description (News)	UTM Coordinates (NAD83)		Release Height	Physical	Initial Horizontal	Physical Vertical	Initial Vertical	Distance To Nearest Property
Description/Name	Easting (m)	Northing (m)	AGL (ft)	Horizontal Dimension (ft)	Dimension σ <sub>y</sub> (ft)	Dimension (ft)	Dimension σ <sub>z</sub> (ft)	Boundary (ft)
	Description/Name	UTM Cod (NA Easting (m)	Description/Name UTM Coordinates (NAD83) Easting Northing (m) (m)	I. VOLUME S       UTM Coordinates (NAD83)     Release Height       Description/Name     Easting (m)     Northing (m)	I. VOLUME SOURCE         UTM Coordinates (NAD83)       Release Height AGL       Physical Horizontal Dimension (ft)         Easting (m)       Northing (m)       AGL       Dimension (ft)	I. VOLUME SOURCE         UTM Coordinates (NAD83)       Release Height AGL (m)       Physical Horizontal Dimension (ft)       Initial Horizontal Dimension σy (ft)	I. VOLUME SOURCE         Description/Name       UTM Coordinates (NAD83)       Release Height AGL (m)       Physical Horizontal (ft)       Initial Horizontal Dimension $\sigma_y$ (ft)       Physical Vertical Dimension (ft)         Lasting (m)       Northing (m)       (ft)       Initial Horizontal Dimension (ft)       Physical Vertical Dimension (ft)         Lasting       Northing (m)       (ft)       Initial Horizontal Dimension (ft)       Physical Vertical Dimension (ft)	I. VOLUME SOURCE         Description/Name       UTM Coordinates (NAD83)       Release Height Morthing (m)       Physical AGL (ft)       Initial Horizontal Horizontal Dimension Gy (ft)       Physical Vertical Dimension Gy (ft)       Initial Vertical Dimension (ft)         Image: Description/Name       Easting (m)       Northing (m)       Release Height (ft)       Physical Horizontal Dimension (ft)       Physical Vertical Dimension (ft)       Initial Vertical Dimension (ft)         Image: Description/Name       Image:

				J. OPEN PIT SOL	IRCE	x		
Emission Point ID	Description (Name	UTM Coordinates (NAD83)		Release Height	Easterly Length	Northerly Length	Pit Volume	Angle From North
	Description/Name	Easting (m)	Northing (m)	AGL (ft)	(ft)	(ft)	(ft³)	(°)



# Bureau of Air Quality Emission Point Information Page 4 of 4

				K. LINE SOL	JRCE				
Emission	Description (News)		UTM Cool (NAD	rdinates 83)		Release Height	Line Length	Line Width	Initial Vertical
Point ID	Description/Name	Start Easting (m)	Start Northing (m)	End Easting (m)	End Northing (m)	AGL (ft)	(ft)	(ft)	Dimension σ <sub>z</sub> (ft)

	L. BUOYA	ANT LINE SOURCE (m	ust complete Line	e Source and Buo	yant Line Source ta	ables)	
Emission Point ID	Description/Name	Average Building Length (ft)	Average Building Height (ft)	Average Building Width (ft)	Average Line Source Width (ft)	Average Building Separation (ft)	Average Buoyancy Parameter (m <sup>4</sup> /s <sup>3</sup> )

		M. EMISSION	RATES			
Emission Point ID	Pollutant Name	CAS #	Emission Rate (lb/hr)	Same as Permitted? <sup>(1)</sup>	Controlled or Uncontrolled	Averaging Period
2610S2,						
261051						
25055		Refer to	Appendix B			
51055						
Fugitive						

(1) Any difference between the rates used for permitting and the air compliance demonstration must be explained in the application report.

APPENDIX B -EMISSIONS CALCULATIONS

#### NEW-INDY CATAWBA MILL STRIPPER PROJECT

	Operat	ing Time
Stripper Operating Scenario	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	4.75%	416.0
No Stripper Online	5.25%	460.0

LVHC Control	Operat	ing Time
<b>Operating Scenario</b>	%	hrs
RF3 Available for LVHC	75%	6,570.0
LVHC to CB1/CB2	25%	2,190.0

# Summary of PSD Applicability (tons/year)

Pollutant <sup>(A)</sup>	PM	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	со	H2504	TRS	voc	Pb	H <sub>2</sub> S	CO2
Baseline Actual Emissions	1.11	1.02	0.959	124	737	25.2	1.23	12.8	233	1.10E-04	3.61	12,275
Projected Actual Emissions	13.3	10.3	8.37	148	646	62.8	2.43	16.8	260	2.06E-03	5.59	48,200
Net Emissions Changes (PAE - BAE)	12.2	9.32	7.41	23.8	-91.2	37.6	1.20	3.95	26.8	1.95E-03	1.98	35,925
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

# 502 EMISSIONS REFERENCES

	Strippe	er Scenario ting Time		Operating I	Configuration		Cont	rois ve Time	Producti	on Rate		502 Finissions Earlor	Sultur	SO2 Fm	ceinne
A CONTRACTOR OF A CONTRACTOR O									in the second se				Capture	1000	CINE
Stripper Operating Scenario	*	hrs	Operating Configuration	R	hrs	Controls	*	hrs	Value	MON	Ib/UOM	Reference	*	h/hr	Adj
						BASELINE ACT	UAL EMISSIO	NS (March 20	21 - February	2023	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Backup Stripper SOG <sup>a</sup>	%5 16	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	1.06	October 2021 Stack Test, Combination Bollers No. 1 and No. 2 average. DHEC Approved Test.	NA	60.4	241.8
LVHC Collection System	100%	8,750.0	NA	100%	8,750.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	1 97	October 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test.	NA	112.0	490.6
Backup Stripper Steam <sup>A</sup>	967.16	8,004.0	Natural Gas <sup>IM</sup>	365.76	7,835.7	NA	100.0%	7.255.7	26.0	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	MA	0.02	0.1
Backup Stripper Steam <sup>A</sup>	%7 16	8,004.0	No. 6 OI <sup>lar</sup>	2.1%	168.3	NA	100,0%	168.3	24.8	mmBtu/hr	2.206+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	54.6	4.6
SO2 BASELINE ACTUAL EMISSIONS (BAE															737.0
							PROJECTED A	CTUAL EMISS	SNOR						
New Stripper Online	30.06	7,884.0	SRL Online	95%	7,489.8	5RL Methanol to RF2/3 <sup>a</sup>	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor / Preliminary Design Information	%66	9.0	2,4
New Stripper Online	%0'06	7,884.0	SRL Online	825%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	9666	6.0	2.7
New Stripper Online	360:06	7,884.0	SRL Online	85%	7,489.8	SRL LVHC to CB1/CB2 <sup>a</sup>	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor / Preliminary Design Information	2056	47.2	44.2
New Stripper Online	30.0%	7,884.0	SRL Offline	5%	394.2	50G ta CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	%0	157.4	31.0
Backup Stripper Online <sup>11</sup>	4.75%	416.0	NA	100%	416.0	50G to CB1/CB2	100.0%	416.0	2,700	ADTP/day	1.40	Vendor / Preliminary Design Information	0%	157.4	32.7
No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,750.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.87	Project Columbia Projected Emission Factor <sup>1</sup> , Combination Bollers No. 1 and No. 2 maximum. Pre-control emissions based on UNI: Concluber Entitionry (Sols) and estimated based and university studier espirate (2009) from 2023 study test.	%66	6.6	21.7
LVHC Collection System.	100%	8,760.0	МА	100%	8,760.0	LVHC to CB1/CB2	25.0%	0.061,5	2,700	ADTP/day	5.87	Project Columbia Projected Emissions Factor <sup>1</sup> , Combination Boliens No. 1 and No. 2 maximum. Pre-control emissions based on UNC: Ecoudeae Erlibeiroy (2053) and estimated maximum. Priv. and Varia San Sulfur estimated 2005). Teom 2023. Stack test.	%0%	330.3	361.7
Recovery Furnace #3 LVHC ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5	NA	100.0%	985.5	1,0	mmBtu/hr	6.006-04	AP-42 Table 1.4-2	NA	00.00	0.0
New Stripper Steam - Natural Gas	\$0.06	7,884.0	Natural Gas <sup>Drf</sup>	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42 Table 1.4-2.	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	30.0%	7,884.0	No. 6 Oil <sup>by</sup>	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>bit</sup>	81.6%	339.5	NA	100.0%	339.5	26.0	mmBtu/hr	6.006-04	AP-42 Table 1.4-2.	NA	0.02	0.003
Backup Stripper Steam - No. 6 Oil <sup>1</sup>	4.75%	416.0	No. 6 Oil <sup>0,5</sup>	18.4%	76.5	NA	100.0%	76.5	24.8	mmBtu/hr	2.20E+00	AP-42 Table 1.3-1. 2.1% Sulfur Content.	NA	57.0	2.1
SO2 PROJECTED ACTUAL EMISSIONS (PA	(E)														645.80
						N	T EMISSIONS	CHANGE (PA	E - BAE)		l				
NET EMISSIONS CHANGE (PAE - BAE)															17.16-

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

Additional process steam to operate condensate stream stripper from fosal flue combustion. Average fosal their distribution in Combination Balliers No. 1 and No. 2 during baseline.
 Suffic capture in recovery furnase: 299, suffic capture in UHC causher SOR, suffic combination fooliers 95%.
 Suffic capture in recovery furnase: 299, suffic capture in UHC causher SOR, suffic combination fooliers 95%.
 Henderschilt Wight man of a procession of the combination of a suffic capture in the suffic capture of the software stream used at a SO gpm from version.
 Henderschilt Wight methanic and SOS of TRS/HSS secrets into UHC System.
 Host actual procession stream and SOS of TRS/HSS secrets into UHC System.
 Host actual processing at a SO gpm from version and SOS of TRS/HSS secrets into UHC System.
 Host actual processing at a suffic required when recover furnance is used into UHC System.
 Host actual processing at a suffic required when recover furnance is used into UHC System.
 Host actual processing at a suffic required when recover furnance is stating to the SOG semisions are conservatively based upon all of the suffic being captured in the SOG.
 Host actual stream statement is higher when size and soft and host lights traces assumed equal to BME.
 Host actual stream statement is higher when size and soft and host lights traces assumed equal to BME.
 Recovery furnance is a stream Soft and baseline stream stream and soft.
 Recovery stream stream actual wave stream stream actual stream stream actual stream stream actual stream stream actual stream actual stream stream actual stream actos actual stream actual stream actual stream actual stream a

# H2SO4 EMISSIONS REFERENCES

	Strippe	r Scenario		Oper	ating		Con	trols				H2SO4	Sulfur	3	
	Operat	ting lime		Configura	ation lime		Operati	ing Time	Product	ion Rate		Emissions Factor	Capture	H2SO4 Er	nissions
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	%	hrs	Controls	%	hrs	Value	MON	Ib/ADTP	Reference	%	lb/hr	tpy
					BASELINE A	CTUAL EMISSIONS (March 20.	21 - February 2	023)							
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.3	1.2
H2SO4 BASELINE ACTUAL EMISSIONS	(BAE)														1.2
						PROJECTED ACTUAL EMISS	SNOI								
LVHC Callection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	1.82
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	0.61
H2SO4 PROJECTED ACTUAL EMISSION	IS (PAE)														2.43
						NET EMISSIONS CHANGE (PAI	E-BAE)	3							
NET EMISSIONS CHANGE (PAE - BAE)															1.20

A Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boiliers No. 1 and No. 2 during baseline.

C - Sultur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%

D - Historically high fuel oil percentage of fossil fuel heat input (2014)

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023 F - Projected steam usage at 850 gpm from vendor. G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

1 Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

# NOX EMISSIONS REFERENCES

	Stripper	Scenario		Operal	ting		Con	trols	0			NOX	Ammonia		
	Operati	ing lime		Configurati	on Time		Operati	ng Time	Produc	tion Rate		Emissions Factor	Increase	NOXE	nissions
Stripper Operating Scenario	*	hrs	Operating Configuration	ĸ	hrs	Controls	R	hrs	Value	MON	Ib/UOM	Reference	8	lb/hr	1pv
						BASELINE ACTUA	T EMISSIONS	March 2021 -	February 20	(6)					
Backup Stripper SOG <sup>6</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,365	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	23.6	545
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	Natural Gas <sup>6,6</sup>	97.9%	7,835.7	NA	100%	7,835.7	26.0	mmBtu/hr	2.806-01	AP-42 Table 1.4-2.	AN	7.3	28.6
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No 6 DI <sup>RIE</sup>	2.1%	168.3	NA	100%	168.3	24,8	mmBtu/hr	3.135-01	AP-42 Table 1.3-1	NA	7.8	0.7
NOX BASELINE ACTUAL EMISSIONS															123.72
				1		BR	DIECTED ACTL	AL EMISSION	5		See. Con				
New Stripper Online	30%	7,884.0	SRL Online	92.0%	7,489.8	SRL Methanol to RF2/3 <sup>d</sup>	100%	7,489.8	2,852	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12	2.0%	36	13.4
New Stripper Online	340%	7,884.0	SRL Online	%0'56	7,489.8	SRL LVHC to RF3 <sup>6</sup>	75%	5,617.4	316.9	TBLS/day	1.500	NCASI Technical Bulletin 884, Table 4.12,	2.0%	0.4	1.1
New Stripper Online	3006	7,884.0	SRL Online	35.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>6</sup>	25%	1,872.5	270.0	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	4.7	4.4
New Stripper Online	3406	7,884.0	SRL Offline	5.0%	394.2	506 to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	9.2
Backup Stripper Online <sup>H</sup>	4 75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100%	416.0	2,700	ADTP/day	0.415	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	46.7	5.2
No Stripper Online	5,25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100%	460.0	NA	NA	AN	NA	NA	NA	AN.
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas <sup>1</sup>	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.806-01	AP-42 Table 1.4-2	NA	0.3	1.0
New Stripper Steam - Natural Gas	30%	7,884.0	Natural Gas <sup>tur</sup>	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.806-01	AP-42 Table 1.4-2.	NA	27.2	87.2
New Stripper Steam - No. 6 Oil	%06	7,884.0	No, 6 Oil <sup>D.F</sup>	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3 136-01	AP-42 Table 1.3-1.	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>ti</sup>	81.6%	339.5	NA	100%	339.5	26.0	mmBtu/hr	2.805-01	AP-42 Table 1.4-2.	NA	7.3	1.2
Backup Stripper Steam - No. 6 Oil *	4 75%	416.0	No. 6 Oll <sup>0</sup>	18.4%	76.5	NA	100%	76.5	24.8	mmBtu/hr	3.136-01	AP-42 Table 1.3-1.	NA	7.8	0.3
NOX PROJECTED ACTUAL EMISSIONS															147.54
						NET	MISSIONS CH	ANGE (PAE - B	AE)						
PAE - BAE															23.82

A: Current (future backup) condensate steam stripper returned operation on May 3, 2021.
B: Additional process steam to operate activation stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 3 and No. 2 during baseline.
C: Ammonia input to recovery lumace increases >358 with maximum addition of SRI of 26 by volume (representative of "18 by volume pure mechanic).
D: Historically Mph luel of preventinger front from (2014)

E - Baseline actual stream usage based on average net stream used by existing stripper 5/3/2021 through 2/28/2023 F - Projected steam usage at 850 gram from vendor design.
G - 300% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.</p>

H - No change in NO, emissioni factor between Backup Stripper TRS mode and Mechanol mode. |- Natural gas ignitor required when recovery furnace is less than 50% load on black liquor. |- Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBu rates assumed equal to BAE

# CO EMISSIONS REFERENCES

Appendication         V         Inclust Configuration         V         Inclust Configuration         V         Note         Ord         Inclust Configuration         V         Note         V         Note         Note <th< th=""><th></th><th>Strippe</th><th>er Scenario ating Time</th><th></th><th>Open Configurat</th><th>rting Ion Time</th><th></th><th>Con Operatir</th><th>trols vg Time</th><th>Productio</th><th>on Rate</th><th></th><th>CO Emissions Factor</th><th>CO Control</th><th>COB</th><th>nissions</th></th<>		Strippe	er Scenario ating Time		Open Configurat	rting Ion Time		Con Operatir	trols vg Time	Productio	on Rate		CO Emissions Factor	CO Control	COB	nissions
Material Strepting St	Stripper Operating Scenario	*	hrs	Operating Configuration	*	hrs	Controls	*	hrs	Value	MON	Ib/UOM	Reference	*	lb/hr	tov
Guida         Distant						and and and	BASELINE ACTUAL EN	<b>Ward Mard</b>	h 2021 - Febr	(ary 2023)						
014         0.040         Number of the sector         0.144         0.040         Number of the sector	Backup Stripper SOG <sup>4</sup>	91.4%	8,004.0	NA	100.0%	8,004.0	50G ta CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	0.0728	July 2019 Project Columbia Application. Page 8-2 for kraft Mill NCG System	NA	E.F.	16.6
Busic Steper Stant         State         State <td>Sackup Stripper Steam<sup>A</sup></td> <td>\$1.4%</td> <td>8,004.0</td> <td>Natural Gas<sup>®</sup></td> <td>34.5%</td> <td>7,8357</td> <td>NA</td> <td>100.0%</td> <td>7,835.7</td> <td>26.0</td> <td>mmBtu/hr</td> <td>8.40E-02</td> <td>AP-42 Table 1.4-2</td> <td>AA</td> <td>2.2</td> <td>B.6</td>	Sackup Stripper Steam <sup>A</sup>	\$1.4%	8,004.0	Natural Gas <sup>®</sup>	34.5%	7,8357	NA	100.0%	7,835.7	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2	AA	2.2	B.6
OCCUPIE COLUMN C	šackup Stripper Steam <sup>x</sup>	%9 16	8,004.0	No 6 Oll <sup>6</sup>	2.1%	168.3	AA	100.0%	168.3	24.8	mmBtu/hr	3,335-02	AP-42 Table 1.3-1	NA	0.8	0,1
Part Part Part Part Part Part Part Part	CO BASELINE ACTUAL EMISSIONS															25.22
ee Stigne Onlie 9% 2, 2,840 3% 0, 0,01 3% 0,01 3,840 3% 0,013 3,84 3% 0,013 3,44 3,70 3,74 3,74 3,70 3,74 3,74 3,70 3,74 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 3,77 3,74 111110,55 4,74 11110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 11110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,74 111110,55 4,75 11110,55 4,75 11110,55 4,75 11110,55 4,75 11110,55 4,75 111110,55 4,75 111110,55 4,75 11110,55 11110,55 111							PROJEC	TED ACTUAL E	SNOISSIM							
es Sriper Calie 90% 248.0 % 10% 248.0 % 10% 248.8 % 10% 248.8 % 10% 247.8 % 54.1 % 2.70 % 2073 % 10,2032 Project Calmañ Angleizato Fære 21 or cart MING Syrem NA 2 2 0 % 2 % 2 % 2 % 2 % 2 % 2 % 2 % 2 %	vew Stripper Online	%06	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	AN
westignee Onlie         956         7,480         SR UNIC GAL(FR)         5/54         4,775         2/00         0/17 day         0/03         up/2019 front columna appliation lage 21 or cut MINCG System         Na         2/2         2/2         1/2 <th< td=""><td>Vew Stripper Online</td><td>%06</td><td>7,884.0</td><td>SRL Online</td><td>92°0%</td><td>7,489.8</td><td>SRL LVHC to RF3</td><td>75%</td><td>5,617.4</td><td>2,700</td><td>ADTP/day</td><td>0.0728</td><td>July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System</td><td>NA</td><td>8.2</td><td>0.E2</td></th<>	Vew Stripper Online	%06	7,884.0	SRL Online	92°0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	0.E2
web/stope Chile         958         784.0         510.0	iew Stripper Online	306	7,884.0	SRL Online	92:0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0,0728	July 2019 Project Columbia Application. Page 8-2 for Kraft Mill NCG System	NA	8.2	1.1
atug Stripper Onliv <sup>*</sup> 2 75% 2 160 Mu 2006 4 160 Solds Cal/Ca <sup>3</sup> 1 200 4 160 2 200 4 160 2 200 4 160 2 200 4 160 2 200 4 160 100 2 200 2 1	lew Stripper Online	1606	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page B-2 for Kraft Mill NCG System	NA	8.2	1.6
Construction         5.13%         49:0         Four definition         10000         49:0         NA	ackup Stripper Online <sup>c</sup>	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.0728	July 2019 Project Columbia Application. Page 8-2 for Kraft Mill NCG System	NA	8.2	1.7
second functed 1 VL (galate         75%         6.5700         Natural Galati         15.0%         955.5         1.0         mellufity         2.46.00         Marcal Galati         Natural Galati	to Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	NA	NA	NA	NA	NA	NA	NA
(everyperform-Natural Gas)         81.6%         0.543.3         NA         1000%         6.433.3         6.643.3         NA         1000%         6.433.3         6.643.3         NA         1000%         6.433.3         6.660         10.43.6%         NA         1000%         10.40.6%         10.40.6%         NA         10.40	ecovery Furnace #3 LVHC ignitor.	75%	6,570.0	Natural Gas	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.406-02	AP-42 Table 1.4-2.	NA	0.1	0.0
we service the field of the fie	lew Stripper Steam - Natural Gas	%06	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433,3	NA	100.0%	6,433,3	96.8	mmBtu/hr	8,40E-02	AP-42 Table 1.4-2.	NA	8.1	26.2
aktyc Stroper Steam - Natural Ga <sup>0</sup> 475% 4460 hattrai Ga <sup>0</sup> 816% 3395 Na 1000% 3395 260 methyl. F <u>446</u> 2 0 <i>Ap</i> -427 Tabe 14-42. NA 22 04 aktyc Stroper Steam - Natural Ga <sup>0</sup> 4.75% 4460 ha. 60/ <sup>10</sup> 13-4% 765 NA 1000% 765 78 Na 100% 355 07 0 <i>Ap</i> -427 Tabe 13-1. NA 108 00 aktyc Stroper Steam - Natural Ga <sup>0</sup> 4.75% 4460 ha. 60/ <sup>10</sup> 13-4% 765 NA 1000% 765 763 783 07 0 <i>Ap</i> -427 Tabe 13-1. NA 08 00 Ovolet Ctro Tauta Massions At a steam - Natural Ga <sup>0</sup> 3355 0.0 Na 100% 765 NA 100% 765 763 17 18 0.0 Na 100% 765 763 17 18 0.0 Na 100% 763 763 763 763 763 763 763 763 763 763	ew Stripper Steam - No. 6 Oil	%06	7,884.0	No. 6 OIP	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3 336-02	AP-42 Table 1.3-1.	NA	3.1	2.2
akiugStrigersteam-No.601 <sup>4</sup> 4.75% 4160 No.601 <sup>6</sup> 13.4% 765 NA 1000% 76.5 24.8 mmBtu/h <sup>*</sup> 3.38.02 AP-42.Table.1.3.1. NA 0.8 0.0 0 Peoricrito arrua tensions AP-42.Table.1.3.1. AP-42.Table.1.3.1. NA 0.8 0.0 0 Peoricrito arrua tensions AP-42.Table.1.3.1. NA 0.8 0.0 0.1 0 Peoricrito arrua tension AP-42.Table.1.3.1. NA 0.8 0.0 0.1 0 Peoricrito arrua tension AP-42.Table.1.1. NA 0.8 0.0 0.1 0 Peoricrito arrua tension AP-42.Table.1.1. NA 0.8 0.0 0.1 0 Peoricrito arrua tension AP-42.Table.1.1. NA 0.8 0.0 0.1 0 Peoricrito arrua tension AP-42.Table.1. NA 0.8 0.0 0.1	ackup Stripper Steam - Natural Gas <sup>G</sup>	4.75%	416.0	Natural Gas <sup>to</sup>	81.6%	339.5	NA	100.0%	339.5	26.0	mmBtu/hr	8.40E-02	AP-42 Table 1.4-2.	NA	2.2	0.4
0 Pisoti Etta Acritut Erissionis O Pisoti Etta Acritut Etta Acritu	ackup Stripper Steam - No. 6 Oil <sup>d</sup>	4.75%	416.0	No. 6 Oil <sup>0</sup>	18.4%	76.5	NA	100.0%	76.5	24.8	mm8tu/hr	3.33E-02	AP-42 Table 1.3-1.	NA	0.8	0.0
AE BAE NET EMISSIONS CHAVASE [PAE - BAE] 37.60	<b>O PROJECTED ACTUAL EMISSIONS</b>															62.81
31.60							NET EMIS	SIONS CHANGE	(PAE - BAE)							
	AE - BAE															37.60

A. Current (Influere backup) condensate stream stripber fraumed operation on May 3, 2021.
B. Additional process stream or operate condensate stream stripper from food (lost combustion. Average food) (lost cluticulor in Combination Bollers No. 1 and No. 2 during baseline C. - No. Assess stream or operate consensate stream stripper from food (lost combustion. Average food) (lost cluticulor in Combination Bollers No. 1 and No. 2 during baseline C. - No. Assess the C. Ore stream expert between flow and struct Westand mode.
C. - No charge from C. Ore ensistent effected relevance in the Average from (lost combustion). Average from flow food in the Average from the Average f

# VOC EMISSIONS REFERENCES

Quarter         Quarter <t< th=""><th></th><th>Strippe</th><th>er Scenario</th><th></th><th>Ope</th><th>rating</th><th></th><th>Contre</th><th>sk</th><th></th><th></th><th></th><th>VOC</th><th></th><th></th><th></th><th></th></t<>		Strippe	er Scenario		Ope	rating		Contre	sk				VOC				
Interfaction         i </th <th></th> <th>Oper.</th> <th>ating Time</th> <th></th> <th>Configur</th> <th>ation Time</th> <th></th> <th>Operating</th> <th>Time</th> <th>Production</th> <th>Rate</th> <th></th> <th>Emissions Factor</th> <th>Remo</th> <th>al<sup>6</sup> VC</th> <th>C Emissions</th> <th></th>		Oper.	ating Time		Configur	ation Time		Operating	Time	Production	Rate		Emissions Factor	Remo	al <sup>6</sup> VC	C Emissions	
Interfactor	Stripper Operating Scenario	*	hrs	Operating Configuration	*	hrs	Controls	*	Ę	Value	NOM N	/nom/	Reference	*	d/al	th	
Operation         0				Contraction of the second second		Service 1	BASELINE ACTUAL EMISSIONS (I	Aarch 2021 - Feb	ruary 2023)			00000					
meterel beneficial         000         5000 <td>Backup Stripper SOG<sup>a</sup></td> <td>91.4%</td> <td>8,004,0</td> <td>NA</td> <td>100.0%</td> <td>8,004.0</td> <td>LVHCto CB1/CB2</td> <td>100.0%</td> <td>8,004.0</td> <td>1,365 A</td> <td>DTP/day</td> <td>4 35</td> <td>Average daily methanol stripped based on daily Subpart S compliance through 2/38/3023.</td> <td>98.0</td> <td>86'F</td> <td>8,61</td> <td>=</td>	Backup Stripper SOG <sup>a</sup>	91.4%	8,004,0	NA	100.0%	8,004.0	LVHCto CB1/CB2	100.0%	8,004.0	1,365 A	DTP/day	4 35	Average daily methanol stripped based on daily Subpart S compliance through 2/38/3023.	98.0	86'F	8,61	=
Increase         Biol         Target         Biol         Biol </td <td>Aerated Stabilization Basin (A5B)</td> <td>100,0%</td> <td>8,760.0</td> <td>Foul Condensate to Hard Pipe</td> <td>100.0%</td> <td>8,760.0</td> <td>NA</td> <td>100.0%</td> <td>8,760.0</td> <td>1,365 A</td> <td>DTP/day B.</td> <td>51E-01</td> <td>WATER9 inputs and Outputs Provided</td> <td>NA</td> <td>5.84</td> <td>2112</td> <td>96</td>	Aerated Stabilization Basin (A5B)	100,0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,365 A	DTP/day B.	51E-01	WATER9 inputs and Outputs Provided	NA	5.84	2112	96
Image: biole interval int	LVHC Collection System	100.0%	8,760.0	NA	300.0%	8,750.0	LVHC to CB1/CB2	100.0%	8,760.0	1.365 A	DTP/day 3.	106-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	NA	0.18	0.7	~
Image: form the	Backup Stripper Stearn <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>e</sup>	946'16	7,835.7	NA	100.0%	7,835.7	26.0 m	mBtu/hr 5	50E-03	AP-42 Table 1.4-2	NA	0,1	0,6	
Molecular constrained constrain	Backup Stripper Steam <sup>*</sup>	%7 I6	8,004.0	No. 6 Ol <sup>8</sup>	2.1%	168.3	NA	100.0%	168.3	24.8 m	mBtu/hr 1.	87E-03	AP-42 Table 1.3-3 NMTOC for no 6 oil.	AN	0.0	0.0	
Image: Claim         Set of the state	VOC BASELINE ACTUAL EMISSIONS															233.	
Musicalization         Sist         Sisted         S							PROJECTED ACTU	AL EMISSIONS									Π
we strater oline         9%         2%0         5%1         6%1         5%1	New Stripper Online	9406	7,884.0	SRL Online	95 CM	7,489.8	SRL Methanol to BF2/3 <sup>6</sup>	100%	3,489.8	2.700 A	DTP/day	14.40	Vendor / Preliminary Design information	6 66	% T 62	6.0	E
Weistingen Online         5%         7.84.0 <th<< td=""><td>New Stripper Online</td><td>3406</td><td>7,884.0</td><td>SRL Online</td><td>95.0%</td><td>7,489.8</td><td>SRL LVHC to RF3<sup>G</sup></td><td>75%</td><td>5,617.4</td><td>2,700 A</td><td>OTP/day</td><td>1.60</td><td>Vendor / Preliminary Design information</td><td>686</td><td>3.60</td><td>101</td><td>d</td></th<<>	New Stripper Online	3406	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3 <sup>G</sup>	75%	5,617.4	2,700 A	OTP/day	1.60	Vendor / Preliminary Design information	686	3.60	101	d
Biological discription         5%         78%         0%         78%         0%         94.2         50.00         171/40         1000         0000         1010         1000         0000         1010         1000 <td>New Stripper Online</td> <td>%06</td> <td>7,884.0</td> <td>SRL Online</td> <td>820.55</td> <td>7,489.8</td> <td>SRL LVHC to CB1/CB2<sup>6</sup></td> <td>25%</td> <td>1,872.5</td> <td>2.700 A</td> <td>UTP/day</td> <td>1.60</td> <td>Vendor / Preliminary Design Information</td> <td>686</td> <td>3.60</td> <td>3.3</td> <td>~</td>	New Stripper Online	%06	7,884.0	SRL Online	820.55	7,489.8	SRL LVHC to CB1/CB2 <sup>6</sup>	25%	1,872.5	2.700 A	UTP/day	1.60	Vendor / Preliminary Design Information	686	3.60	3.3	~
Bit Model         175         410         W         MM	New Stripper Online	\$406	7,884.0	SRL Offline	5.0%	394.2	50G to CB1/CB2	100%	394.2	2,700 A	OTP/day	16.00	Vendor / Preliminary Design information	686	36,0	1.1	0
Bit weitwigten         13%         41%         13%         41%         13%         41%         13%         41%         13%	Backup Stripper Online (TRS Mode) <sup>H</sup>	4.75%	416.0	NA	100.0%	416.0	\$06 to CB1/CB2	100%	216.0	2.700 A	UTP/day	7.20	Vendor / Preliminary Design Information	686		-	
Referencie         90%         7 Bad         No         7 Bad         2 Mod         0 Mod         7 Bad         0 Mod         1 Bad         1 Bad <th< td=""><td>Backup Stripper Online (Methanol Mode) "</td><td>4.75%</td><td>416.0</td><td>NA</td><td>100.0%</td><td>416.0</td><td>50G to CB1/CB2</td><td>100%</td><td>416.0</td><td>2,700 A</td><td>DTP/day</td><td>16.00</td><td>Assume methanol mode captures all VOC in SOG</td><td>685</td><td>36.0</td><td>24</td><td></td></th<>	Backup Stripper Online (Methanol Mode) "	4.75%	416.0	NA	100.0%	416.0	50G to CB1/CB2	100%	416.0	2,700 A	DTP/day	16.00	Assume methanol mode captures all VOC in SOG	685	36.0	24	
dist-leavent         13%         610         05%         610         010%         010%	ASB - New Stripper Online	%06	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2.700 A	Veb/410	0.29	WATER9 Inputs and Outputs Provided.	AN	32.8	129.	8
Gene         Constraint         Constraint <td>ASB - Backup Stripper Online (TRS Mode)<sup>1</sup></td> <td>475%</td> <td>416.0</td> <td>TRS Stripped From Foul Condensate</td> <td>100.0%</td> <td>416.0</td> <td>NA</td> <td>100%</td> <td>416.0</td> <td>2,700 A</td> <td>DTP/day</td> <td>1.43</td> <td>WATER9 inputs and Outputs Provided</td> <td>AN</td> <td></td> <td></td> <td></td>	ASB - Backup Stripper Online (TRS Mode) <sup>1</sup>	475%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100%	416.0	2,700 A	DTP/day	1.43	WATER9 inputs and Outputs Provided	AN			
Microlity         2.35k         46:0         Fould memorator bundle         2000k         49:0         2.00k         2000k         2.00k         49:00         2.00k         Microlity         Microli	ASB - Backup Stripper Online (Methanol Mode) 1	4.75%	416.0	S00 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2.700 A	Veb/day	1.54	WATER9 inputs and Outputs Provided.	AN	173.2	36.0	m
OWE clateleto System         10008         3 7800         0.000         3 10-03         0.000         3 7800         0.000         3 10-03         0.000         0	ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	NA	100%	460.0	2.700 A	DTP/day	2.20	WATER9 inputs and Outputs Provided.	NA	247,1	4 56.8	4
UNC Concretioned system         10005         3 700         VM         1000         3 1000         VM         0.005         3 700         VM         0.005         0.	LVHC Collection System	100.0%	3,760.0	NA	100.0%	8,760.0	LVHC to RF3	15%	6,570.0	2,700 A	DTP/day 3.	10E-03	July 2019 Project Columbia Application. Page C.3 for Total LVHC Emissions.	AN	0.35	11	
Record for the P1UK (price         75%         6.700         Number/of         5.850         Number/of         5.850         Number/of         Number/of <th< td=""><td>LVHC Collection System</td><td>100.056</td><td>8,760.0</td><td>VN</td><td>100.0%</td><td>8,760.0</td><td>LVHC to CB1/CB2</td><td>25%</td><td>2,190.0</td><td>2.700 A</td><td>DTP/day 3</td><td>10E-03</td><td>July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.</td><td>AN NA</td><td>0.35</td><td>0.3</td><td></td></th<>	LVHC Collection System	100.056	8,760.0	VN	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2.700 A	DTP/day 3	10E-03	July 2019 Project Columbia Application. Page C-3 for Total LVHC Emissions.	AN NA	0.35	0.3	
like stripper Stear: Natural Ges         978         2,840         B1.85%         6,433         956         Amblity/IC         556-03         0.42,13.like 1.3.2         0.4         0.5         1,430,7         0.5         0.42,13.like 1.3.2         0.4         0.5         1,430,7         0.5         0.42,13.like 1.3.2         0.4         0.5         1,430,7         0.5         0.44,71.like 1.3.2         0.4         0.5         1,430,7         0.5         0.44,71.like 1.3.2         0.4         0.5         1,430,7         0.5         0.4         1,430,7         0.5         0.44,71.like 1.3.2         0.4         0.2         0.1         0.0           Ruku Stripper Steam-Not Gos <sup>1</sup> 4,35         3,80         Mmbu/M         5,87         3,05         Mmbu/M         5,87         0.1         0.2         0.2         0.2           Ruku Stripper Steam-Not Gos <sup>1</sup> 4,35         3,80         Mmbu/M         5,87         3,68         Mmbu/M         5,87         0.1         0.2         0.2         0.2           Ruku Stripper Steam-Not Gos <sup>1</sup> 4,35         3,68         Mmbu/M         5,87         3,89         N         0.2         0.2         0.2         0.2         0.2         0.2         0.2         0.2         0.2         <	Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas	15.0%	985.5	NA	100%	985.5	1.0 1	mBtu/hr 5.	50E-03	AP-42 Table 1.4-2	NA	5.50E	33 Z.71E	5
Wexistion         \$0%         2.84/0         We 6.0 <sup>10</sup> 12.4%         1.460.7         2.00         1.54.00         2.44.00         1.84.00         MM-10.00         MM-10.00 </td <td>New Stripper Steam - Natural Gas</td> <td>%06</td> <td>7,884.0</td> <td>Natural Gas<sup>B</sup></td> <td>81.6%</td> <td>6,433.3</td> <td>NA.</td> <td>100%</td> <td>6,433.3</td> <td>96.B T.</td> <td>mBtu/hr 5.</td> <td>50E-03</td> <td>AP-42 Table 1.4-2</td> <td>NA</td> <td>0.5</td> <td>1)</td> <td></td>	New Stripper Steam - Natural Gas	%06	7,884.0	Natural Gas <sup>B</sup>	81.6%	6,433.3	NA.	100%	6,433.3	96.B T.	mBtu/hr 5.	50E-03	AP-42 Table 1.4-2	NA	0.5	1)	
Baddup Stepen Natural Gas <sup>4</sup> Bask         Bask         Sask         Social         Mathr         No         Social         Mathr         No         No         Social         No	New Stripper Steam - No. 6 Oil	30%	7,884.0	No 6 DIP	18.4%	1,450.7	NA	100%	1,450.7	92.2 1	mBtu/hr 1.	87E-03	AP-42 Table I.3-3 NMTOC for no. 6 oil.	NA	0.2	0.1	
Backup Streper Istern. In. 60 <sup>16</sup> 137K         4150         Na. 60 <sup>16</sup> 18.4K         76.5         NA         7050         28.8         mmBlu/hr         187E-03         AF-4212/bite 1.33. M/TOC terms 6.04.         NA         20.9         0.0           VOC Frontering for this state         1.37K         4.150         18.4K         76.5         24.8         mmBlu/hr         1.87E-03         AF-4212/bite 1.33. M/TOC terms 6.04.         NA         29.39           VOC Frontering for this state         AF-4212         AF-4212         AF-4212         AF-4212         1.47         20         20         20           VOC Frontering AFTUAL threstons         AF-4212         AF-4212         AF-4212         AF-4212         AF-4212         AF-4212         AF-4212         AF-4212         21.54         <	Backup Stripper Stearn - Natural Gas "	475%	416.0	Natural Gas <sup>p</sup>	81.6%	339.5	NA	100%	339.5	26.D m	mBtu/hr 5.	50E-03	AP-42 Table 1 4-2	A.A	1.0	0.0	
VIC PROJECTE A.C.U.A. EMISSIONS VET EMISSIONS CHARGE (M.R BAE) MET EMISSIONS CHARGE (M.R BAE) A.R BAE	Backup Stripper Steam - No. 6 Oil <sup>x</sup>	4.75%	416.0	No. 6 OI <sup>D</sup>	18.4%	76.5	NA	100%	76.5	24.8 m	mBtu/hr 1.	87E-03	AP-42 Table 1.3-3. NMTOC for no. 6 oil.	NA.	0.0	0.0	
NET EMISSIONS CIANGE (PAE - BAE) 26-79	VOC PROJECTED ACTUAL EMISSIONS															259.2	68
P46-846							NET EMISSIONS CHA	NGE (PAE - BAE)									
	PAE-BAE															26.7	2

# PAE -

A - Curtent (Hurde backup) condensates ateam stripper featured coperation on May 3, 2021.
B - Additional provess steam to operate condensate stream stripper from foosil heal combation. Average foosil feel discribution in Combination Boilets No. 3 and No. 2 during baseline.

C. VOC destruction 295% In valor phase.
 D. Histonchy Applit Hol oli encentage of loss line has most (2014).
 E seerine actual forem use based on everage net recommy (2014).
 E seerine actual forem use based on everage net recommy line has most (2014).
 F regreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 F - Frogreead starm use par 850g pm from wholer delay.
 How has a from the factor starm use base una higher from one whole we chain a medianel mode.
 How has a from the factor starm to the starget of methanel mode base musices last this are shown in the table, pin A58 emissions are based on methanel mode operation.
 Mathen Backup Stroper scenaries in higher three supper is operating in methanel mode Bach multiture to base of methanel mode starm to back to back the stroper scenaries in higher stare sources deviation.

# TRS EMISSIONS REFERENCES

	Stripper	r Scenario Ung Time		Configura	tion Time		Cont	rols g Time	Productio	n Rate		TRS Emissions Factor	Sulfur Capture <sup>c</sup>	TRS Em	issions	
Stripper Operating Scenario	*	hrs	Operating Configuration	*	hrs	Controls	*	hrs	Value	MON	Ib/UOM	Reference	*	lb/hr	tpy	
	1					BASELINE ACTUAL EMISSIONS (A	farch 2021 - Fe	bruary 2023)								
Backup Stripper SOG <sup>A</sup>	%7.16	B,004.0	AN	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	2.886-03	June 2021 Stack Test, Combination Boillers No. 1 and No. 2 average. DHEC Approved Test.	NA	0.16	0.65	-
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,365	ADTP/day	4.08E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	2.32	10.16	-
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.001	8,760.0	1,365	ADTP/day	8.01E-03	June 2021 Stack Test, Combination Bollers No. 1, and No. 2 average, DHEC Approved Test.	MA	0.46	2.00	-
TRS BASELINE ACTUAL EMISSIONS															12.81	-
						PROJECTED ACTUA	<b>SNOISSIME TO</b>									-
New Stripper Online	%0.06	7,884.0	SRL Online	340'56	7,489.8	SRL Methanol to RF2/3 <sup>G/1</sup>	100.0%	7,489.8	2,700	ADTP/day	6.33	Vendor / Preliminary Design Information	36.99	0.04	0,14	
New Stripper Online	%0'05	7,884.0	SRL Online	92:0%	7,489.8	SRL LVHC to RF3 <sup>G,H</sup>	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	%6'66	0.05	0.15	
New Stripper Online	\$0.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2 <sup>6</sup>	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor / Preliminary Design Information	9465	0.55	0.51	100
New Stripper Online	%0.06	7,884.0	SRI Offline	5.0%	394.2	50G to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor / Preliminary Design Information	%66	16.0	0,18	100
Backup Stripper Online	4.75%	416.0	NA	100.0%	416.0	SOG to CB1/CB2	100.07%	416.0	2,700	ADTP/day	18.0	Vendor / Preliminary Design Information	%66	16.0	0.19	100
ASB - New Stripper Online	\$0.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9 Inputs and Outputs Provided.	AN	2.72	10.74	100
ASB - Backup Stripper Online (TRS Mode)	4.75%	416.0	TRS Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	2.726-02	H2SSIM/WATER9 inputs and Outputs Provided	NA			100
ASB - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day	5.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided	NĂ	165	1.24	100
ASB - No Stripper Online	5.25%	460.0	Foul Condensate to Hard Pipe	100.0%	460.0	Mydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9 Inputs and Outputs Provided	AA	8.19	1.88	1000
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	June 2021 Stack Text, Combination Bollers No. 1 and No. 2 maximum. Pre- control emissions based on LVHC scrubber efficiency (50%) and estimated 99% combustion efficiency in combination bollers.	\$6.66	0.20	0.65	
LVHC Collection System	100.0%	8,760.0	NA	300,001	8,760.0	LVHCto CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Test.	NA	66'O	1,08	
TRS PROJECTED ACTUAL EMISSIONS															16.76	-
						NET EMISSIONS CHA	NGE (PAE - BAL									-
PAE-BAE															3.95	1000

Current (future backup) conformate steam stripper resumed operation on May 3, 2021.
 Salditoval process steams on construction contraction for Sal Livel Combustion. Average fosal fuel distribution fields for a fill of the comparison contraction contraction. A second back of the comparison for the comparison. Average fosal fuel distribution fooliers 99%.
 Historically High fuel of percentage of losal for the field in the Carcinese SSN, suffice conversion in complexiton (2014).
 Historically High fuel of percentage of losal for the field of TRS/H2S vented into LVHC System.
 Fooliers staam carge has 50 gam form verder degar.
 Fooliers SSD gam form verder degar.
 Also of TRS/H2S contensed into methanol and ESN of TRS/H2S vented into LVHC System.
 Also of TRS/H2S contensed into methanol and ESN of TRS/H2S vented into LVHC System.
 Rescore Virture explanae 3950 contensions are higher if the suffice stripeer Statematic the soft of the high string stripeer Statematic stripeer Statematic stripeer Statematic stripeer stripeer SSD contensions are existed in methanol and ESN defineer 10 the suffice to construction for the stripeer is constructing backuper Statematic stripeer stripeer SSD constructions are higher if the stripeer is constructing to constructions are higher if the stripeer is constructing to constructions are higher if the stripeer is constructing to construction are higher if the stripeer is constructing to constructing to constructing to constructing to constructing to constructing the methanol mode. Both emissions factors are shown in the stable, but ASB emissions are based on methanol mode constructing to const

HZS EMISSIONS REFERENCES

	Opera	or Scenario		Oper Configurat	ating ion Time		Contr Operation	ols E Time	Productio	n Rate		H25 Emissions Factor	Sulfur Capture <sup>C</sup>	H25 En	vissions
Stripper Operating Scenario	*	his	Operating Configuration	*	his	Controls	*	hrs	Value	MOU	Ib/UOM	Reference	R	1b/hr	tpy
						BASELINE ACTUAL EMISS	IONS (March	021 - Februar	y 2023)						
Backup Stripper SOG <sup>A</sup>	%P 16	8,004.0	NA	100.00%	8,004.0	LIVING to CB1/CB2	100.0%	8,004.0	1,365	ADTP/day	4.135-04	June 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test,	MA	20.0	60.0
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,365	ADTP/day	1.36E-02	H255IM/WATER9 Inputs and Outputs Provided.	NA	0.77	3.39
LVHC Collection System	100.0%	8,760.0	NA	100.001	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,365	ADTP/day	5.036-04	lune 2021 Stack Test, Combination Boilers No. 1 and No. 2 average. DHEC Approved Test	NA	0.03	£1.0
H25 BASELINE ACTUAL EMISSIONS									1						3.61
						PROJECTE	D ACTUAL EMI	SIONS							
New Stripper Online	30.06	1,884.0	SRL Online	30.56	7,489.8	SRL Methanol to RF2/3 <sup>6,8</sup>	100.0%	7,489.8	2,700	AD/TP/day	0.24	Vendor / Preliminary Design Information	36'66	.E0.0	0,10
New Stripper Online	90'06	7,884.0	SRI Online	%0'56	7,489.8	SRL LVHC to RF3 <sup>a,11</sup>	30.57	5,617.4	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	\$6.66	0.04	0.12
New Stripper Online	30,0%	1,884.0	SRL Online	840'56	7,489.8	SRI IVHC to CB1/CB2 <sup>6</sup>	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor / Preliminary Design Information	366	0.41	0.39
New Stripper Online	80.06	7,884.0	SRL Offline	S.ON	2.455	50G to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	366	0,69	0.14
Backup Stripper Online	4.75%	416.0	NA	100.0%	416.0	50G to CB1/CB2	100.0%	416.0	2,700	ADTP/day	0.61	Vendor / Preliminary Design Information	366	0.63	0.14
ASB - New Stripper Online	90.0%	1,884.0	No Foul Condensate to Hard Pipe	100.07%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM/WATER9 inputs and Outputs Provided.	NA	1 04	4.11
ASB - Backup Stripper Online [TRS Mode] 1	4.75%	416.0	H25 Stripped From Foul Condensate	100.0%	416.0	NA	100.0%	416.0	2,700	ADTP/day	9.816-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA	1.10	0.23
A5B - Backup Stripper Online (Methanol Mode)	4.75%	416.0	500 gpm Foul Condensate to Hard Pipe	100.0%	416.0	Hydrogen Peroxide Addition	100.0%	416.0	2,700	ADTP/day.	9.45E-03	H2SSIM/WATER9 Inputs and Outputs Provided.	NA		
ASB - No Stripper Online	5 25%	0.095	Foul Condensate to Hard Pipe	100.0%	460.0	Hydrogen Peroxide Addition	100.0%	460.0	2,700	ADTP/day	9.546-03	H2SSIM/WATER9 inputs and Outputs Provided.	NA	101	0.25
I VHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	15.0%	0.052.0	2,700	ADTP/day	10-371-1	June 2023 Stack Feyt, condination Bollers No. 1 and No. 2 maximum Pre-control envisoons bared on LVIC strubber efficiency (SSS) and estimated 99% combustion efficiency (no condination ballers	96.66	10:0	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	32.0%	2,190.0	2,700	ADTP/day	5.87E-04	June 2021 Stack Text, Combination Boilers No. 1 and No. 2 maximum. DHEC Approved Text.	MA	0.07	0.07
HZS PROJECTED ACTUAL EMISSIONS															5.59
						NET EMISSIO	NS CHANGE (F	AE - BAE)							
PAF - RAF															36.1

A. Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

A data manual sector scenario contractive for information, we age focul food daribution in Confination Bolers No. 1 and No. 2 during barefiles.
 A data manual sector is correct to correct the processing of the information we age focul food daribution in Confination Bolers No. 1 and No. 2 during barefiles.
 Caller agree are recomplying that all percensage of the information of the information of the SA.
 E Booline and dream user SAD stores that part (No. 1004).
 E Booline and dream user as 200 million barefiles of the store of the store

PM EMISSIONS REFERENCES

	Stripper	· Scenario		Oper	ating		Con	rols				PM	Md		
	Operat	ing Time		Configura.	tion Time		Operati	ig Time	Product	on Rate		Emissions Factor	Control	PM Emi	ssions
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	*	hrs	Controls	%	hrs	Value	MOM	Ib/UOM	Reference	%	lb/hr	tpy
					8	ASELINE ACTUAL EMISSIO	NIS (March 202	- February 2	(620)						-
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	Natural Gas <sup>8</sup>	%6.16	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	No. 6 Oil <sup>b</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1 61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.3
PM BASELINE ACTUAL EMISSIONS															1.1
						PROJECTED	ACTUAL EMISSIN	SNC						of the second	
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	5,285		100.0%	985.5	1.0	mmBtu/hr	7.601-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	%0.06	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	%0.0%	7,884.0	No. 6 OIL	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No, 6 Oll <sup>C</sup>	4.75%	416.0	No. 6 Oil <sup>0</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.61E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	4.0	0.2
PM PROJECTED ACTUAL EMISSIONS															13.33
						NET EMISSION	S CHANGE (PAE	- BAE)							
PAE - BAE															12.22

A - Gurrent (fluture backup) condensate steam stripper resumed operation on May 3, 2021.
B - Additional process steam to operate condensate stream stripper from fossil fuel combuston. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.
C - Backup Stripper Steam requirement is fugher when operating in methanol mode. Steam MMBU rates assumed equal to BAE.
D Historically high fuel oil percentage of tossil fuel heat input (2014).
E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023.
F Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

1 - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor

PM10 EMISSIONS REFERENCES

	Strippe	r Scenario ing Time		Oper Configurat	ating tion Time		Con Operati	trols 1g Time	Producti	on Rate		PM10 Emissions Factor	PM10 Control	PM10 Emi	issions
Stripper Operating Scenario	%	hrs	<b>Operating Configuration</b>	*	hrs	Controls	*	hrs	Value	MOU	Ib/UOM	Reference	*	lb/hr	tpy
	1					BASELINE ACTUAL EMISSION	VS (March 2021	- February 20	3)						
Backup Stripper Steam <sup>a</sup>	81.4%	8,004.0	Natural Gas <sup>8</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>*</sup>	91.4%	8,004.0	No. 6 Oil <sup>8</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.176-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.2
PM10 BASELINE ACTUAL EMISSIONS															1.02
						PROJECTED A	CTUAL EMISSIO	dis							
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	385.5	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	30.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	30.08	7,884.0	No. 6 Dil <sup>‡</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1,17E-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4.75%	416.0	No. 6 O(1 <sup>51</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.176-01	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.9	0.1
PM10 PROJECTED ACTUAL EMISSIONS															10.34
						NET EMISSIONS	CHANGE (PAE -	BAE)							
PAE - BAE															5.32

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
 B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Biollers No. 1 and No. 2 during baseline.
 C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBtv rates assumed equal to BAE.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

G - reserved H - reserved - Natural gas ignitor required when recovery furmace is less than SO% load on black liquor

# PM2.5 EMISSIONS REFERENCES

	Stripper Operati	r Scenario Ing Time		Configura	ating tion Time		Cor	trols ng Time	Produc	tion Rate		PM2.5 Emissions Factor	PM2.5 Control	PM2.5 E	missions
Stripper Operating Scenario	*	hrs	<b>Operating Configuration</b>	*	hrs	Controls	*	hrs	Value	MOU	Ib/UOM	Reference	%	lb/hr	tpv
						<b>BASELINE ACTUAL EMISSION:</b>	5 (March 2021 -	ebruary 202	10						
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>®</sup>	%6.16	7,835.7		100.0%	7,258,7	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.8
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>6</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															96.0
						PROJECTED AC	TUAL EMISSION								
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	5:586	1.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	7.605-03	3.74E-03
New Stripper Steam - Natural Gas	%0.06	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7,60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	80.0%	7,884.0	No, 6 OIl <sup>0</sup>	18.4%	1,450.7		100.0%	1,450.7	5.26	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	8,1	5.9
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	7.60E-03	AP-42 Table 1.4-2. Filterable and Condensable.	NA	0.2	0.0
Backup Stripper Steam - No. 6 Oil <sup>5</sup>	4.75%	416.0	No. 6 Oil <sup>0</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	8.80E-02	AP-42 Tables 1.3-1 (filterable) and 1.3-2 (condensable).	NA	2.2	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															8.37
						NET EMISSIONS C	HANGE (PAE - B	NE)							
PAE - BAE															7.41

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil tuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Backup Stripper Steam requirement is higher when operating in methanol mode. Steam MMBIU rates assumed equal to BAE.

D · Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023

F - Projected steam usage at 850 gpm from vendor design.

reserved.
 reserved.
 1 - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

# LEAD EMISSIONS REFERENCES

	Oneral	r Scenario		Configura	tion Time		Oneratio	trols	Droducti	on Bate		Emissions Eartor	Control	I and Em	victione
Stripper Operating Scenario	*	hrs	Oneratine Configuration	*	hrs	Controls	*	hrs	Value	MON	Ib/tiOM	Reference	%	lh/hr	trive
			0		BA	SEUNE ACTUAL EMISSIONS (	March 2021 - F	ebruary 2023							11
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>6</sup>	97.9%	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	5.10E-05
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	No. 6 Oil <sup>6</sup>	2.1%	168.3		100.0%	168.3	24,8	mmBtu/hr	2.80E-05	U.5. EPA document "Estimating Air Toxic Emissions from Coal and Oll Combustion Sources" [EPA.450/2 89-001] for Uncontrolled Residual Oll-freed Utility Boliers (Table 4-1)	NA	6.95E-04	5.85E-05
LEAD BASELINE ACTUAL EMISSIONS															1.10E-04
						PROJECTED ACTU	<b>JAL EMISSIONS</b>								
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas <sup>D</sup>	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	AA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil <sup>a</sup>	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and OI Combustion Sources" [EPA-450/2- 89-001] for Uncontrolled Residual OIF freed Utility Boulers (Table 4-1)	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas <sup>2</sup>	4.75%	416.0	Natural Gas <sup>D</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	5.00E-07	AP-42 Table 1.4-2.	NA	1.30E-05	2.21E-06
Backup Stripper Steam - No. 6 Oil <sup>C</sup>	4,75%	416.0	No. 6 Oil <sup>p</sup>	18.4%	76.5		100,0%	76.5	24.8	mmBtu/hr	2,80E-05	U.S. EPA document "Estimating Air Toxic Emissions from Coal and OII Combistion Sources" [EPA 450/2- 89-001] for Uncontrolled Residual OII-freed Utility Boliers (Table 4-1)	NA	6.95E-04	2.66E-05
LEAD PROJECTED ACTUAL EMISSIONS															2.06E-03
						NET EMISSIONS CH	ANGE (PAE - BA	(8)		1					
PAE - BAE															1.95E-03

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.
B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Biolers No. 1 and No. 2 during baseline
C - Backup Stripper Steam requrement is higher when operating in methanol mode. Steam MMBtu rates assumed equal to BAE.
D - Historically high fuel oil percentage of tossil fuel basin input (2014)
E - Baseline actual steam usage based on average net steam used by existing stripper 5/3/2021 through 2/28/2023
E - Baseline actual steam usage at 850 gpm from word design.
H - reserved.
H - reserved.

1 - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

# CO2 EMISSIONS REFERENCES

	Strippe	er Scenario		Oper	ating Time		Cont	rols a Time	Development	an Data		CO2	CO2	cus co	decione
Carlana Caracter Caracter	and o	- Percent	Continue Confirmation	00 mm	her	Canterole	openedo -	- Prove	Video	110MA	BATHONA	Deference	1011100	th/hr	tow
stripper operating scenario	2	ULS I	Operating comparison	8	DI N	CONTROLS	R	2112	Adlue	MIDD	WOD/RI	Vereience	8	NI/Di	Arth
						BASELINE ACTUAL EMISSION	(S (March 2021	- February 20.	23)		and the second se		and the second second		
Backup Stripper Steam <sup>a</sup>	91.4%	8,004.0	Natural Gas <sup>8</sup>	846.16	7,835.7		100.0%	7,835.7	26.0	mmBtu/hr	1.176+02	40 CFR Part 98, Table C-1	NA	3,044.8	11,929
Backup Stripper Steam <sup>A</sup>	91.4%	8,004.0	No. 6 Oil <sup>6</sup>	2.1%	168.3		100.0%	168.3	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	346
CO2 BASELINE ACTUAL EMISSIONS															12,275
						PROJECTED AL	TUAL EMISSIOF	VS		2					
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	116.9	58
New Stripper Steam - Natural Gas	30.0%	7,884.0	Natural Gas	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	40 CFR Part 98, Table C-1	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 OIP	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66€+02	40 CFR Part 98, Table C-1	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	4.75%	416.0	Natural Gas <sup>0</sup>	81.6%	339.5		100.0%	339.5	26.0	mmBtu/hr	1.176+02	40 CFR Part 98, Table C-1	NA	3,044.8	517
Backup Stripper Steam - No. 6 Oil	4.75%	416.0	No. 6 Oil <sup>D</sup>	18.4%	76.5		100.0%	76.5	24.8	mmBtu/hr	1.66E+02	40 CFR Part 98, Table C-1	NA	4,109.9	157
CO2 PROJECTED ACTUAL EMISSIONS															48,200
						NET EMISSIONS	CHANGE (PAE -	BAE)					2		
PAE - BAE															35,925

A. Current (future backup) condensate steam stripper resumed operation on May 3. 2021.
B. Additional process steam to operate condensate stream stripper from fossi fuel combustion. Average fossi fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.
C. Backinsonal process steam requerentage of the stream stream

#### SUMMARY OF ASB EMISSIONS FACTORS

				ASB Emissions F	actors (Ib/ODTP)			
Scenario	H <sub>2</sub> S	DMDS	DMS	ммс	TRS as H <sub>2</sub> S	Methanol	VOC <sup>A</sup>	TRS <sup>B</sup>
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	3.37E-02	0.89	0.95	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	1.99E-02	0.30	0.32	0.0269
Backup Stripper Scenario - TRS Mode	0.0109	0.0033	0.0147	1.30E-03	2.23E-02	1.53	1.59	0.0302
Backup Stripper Scenario - Methanol Mode	0.0105	0.0308	0.0169	5.12E-04	4.24E-02	1.62	1.71	0.0587
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	5.81E-02	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

#### BAE Other VOC Emissions Factors

Date of Subpart S Performance Testing	Acetadehyde, ppm	MEK, ppm	Prop., ppm
7/9/2021	24.3	7.7	1.1
7/10/2021	25.3	5.7	4.0
7/11/2021	25.0	6.5	7.0
10/26/2021	25.0	12.3	0.8
10/27/2021	27.5	13.3	1.0
10/28/2021	10.6	6.6	1.2
10/29/2021	15.0	8.6	0.9
2/14/2022	16.7	7.5	0.7
2/15/2022	17.0	9.5	0.6
2/16/2022	15.7	8.6	1.0
5/4/2022	20.7	7.1	1.0
5/5/2022	16.3	7.3	1.0
5/6/2022	15.0	6.8	1.0
8/9/2022	15.3	5.9	0.7
8/10/2022	25.0	7.2	1.1
8/11/2022	20.3	6.0	1.0
9/27/2022	14.3	5.3	0.7
9/28/2022	15.0	5.2	0.7
9/29/2022	18.0	5.6	0.9
10/18/2022	25.0	5.6	1.0
10/19/2022	23.7	5.5	1.1
10/20/2022	23.0	6.6	0.9
AVG ppm:	19.72	7.28	1.34
Lbs into ASB	55.48	20.49	3.78
Fair estimated from WATER9 properties	0.55	0.38	0.43
Lbs emitted	30.73	7.73	1.61
Average Pulp Production during Subpart S testing		1716	
Ib/ODTP	0.018	0.005	0.001

			P/ lb/O	E DTP	
	BAE Ib/ODTP	New Stripper	Backup Stripper TRS Mode	No Stripper	Backup Stripper Methanol Mode
Methanol	0.89	0.30	1.53	2.31	1.62
Acetadehyde	0.018	0.006	0.031	0.046	0.033
МЕК	0.005	0.002	0.008	0.012	0.008
Propionaldehyde	0.001	0.000	0.002	0.002	0.002
DMDS	0.0114	0.0028	0.0033	0.0504	0.0308
DMS	0.0185	0.0136	0.0147	0.0192	0.0169
MMC	3.28E-04	1.88E-04	1.30E-03	7.42E-04	5.12E-04
VOC:	0.95	0.32	1.59	2.44	1.71

Month	Pulp Production	Pulp Production	Methanol Emissions Factor	Emissions Factor Reference
	ADTP	ODTP	Ib/ODTP	
Mar-21	42,474	38,226	1.50	
Apr-21	43,075	38,767	1.50	
May-21	46,962	42,266	1.50	
Jun-21	42,867	38,581	1.50	Average of 2021 Subpart
Jul-21	49,371	44,434	1.50	S Performance Tests.
Aug-21	44,614	40,152	1.50	Representative of ASB
Sep-21	40,177	36,159	1.50	operation from March
Oct-21	47,234	42,510	1.50	2021 to February 2022.
Nov-21	39,185	35,266	1.50	
Dec-21	38,734	34,860	1.50	
Jan-22	43,690	39,321	1.50	
Feb-22	37,736	33,962	0.33	
Mar-22	43,944	39,549	0.33	
Apr-22	40,046	36,041	0.33	
May-22	38,896	35,006	0.33	Average of 2022 Subpa S Performance Tests Representative of AS
Jun-22	23,184	20,866	0.33	
Jul-22	39,890	35,901	0.33	
Aug-22	53,396	48,057	0.33	
Sep-22	45,044	40,539	0.33	operation from February
Oct-22	47,517	42,765	0.33	2022 to February 2023.
Nov-22	40,133	36,120	0.33	
Dec-22	33,859	30,474	0.33	
Jan-23	35,464	31,918	0.33	
Feb-23	39,276	35,348	0.33	
aseline Methan	ol Emissions Factor (Puli	Weighted Average	0.89	Ib/ODTP

### New Indy Catawba ASB BAE Methanol Emissions Factor

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

			Con	centration (pp	m)	
Date	Sample Time	Hydrogen Sulfide	Methyl Mercaptan	Dimethyl Sulfide	Dimethyl Disulfide	Total TRS
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all	l data	142.9	15.4	16.3	14.8	189.4
Max of 6/24 of	or 6/25	146.7	16.0	17.0	15.0	194.7

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Convert compound to equivalent S (ppm)

Hyd	drogen	Methyl	Dimethyl	Dimethy	Dimethyl	
Sul	fide	Mercaptan	Sulfide	Disulfide	1	
	138.0	10.7		8.8	10.2	
	82.3%	6.4%	5.	2%	6.1%	

S (ppm)	168 Maximum feed to stripper (AHI
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP) <sup>a</sup>	0.7001

<sup>a</sup> Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP \* ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

#### Assumption

1. Assume no losses in feed tank

2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

#### New-Indy Catawba Monthly Production

Month	Kraft Mill	Combination Boiler No. 1 Natural Gas	Combination Boiler No. 2 Natural Gas	Total Natural Gas	Combination Boiler No. 1 No. 6 Fuel Oil	Combination Boiler No. 2 No. 6 Fuel Oil	Total No. 6 Fuel Oil	Total No. 6 Fuel Oil
	ADTP	mmBtu	mmBtu	mmBtu	gallons	gallons	gallons	mmBtu
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0
May-21	46,962	38,834	63,467	102,301	0	0	0	0
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0
May-22	38,896	39,982	73,918	113,900	0	0	0	0
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384
Feb-23	39,276	78,431	96,813	175.244	21,626	53	21,679	3,252
Total	996,766			3,237,544				69,553
Annual Average	498,383							
				97.9%				2.1%

# WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PEROXIDE ADDITION





9


-+H25 (ug/t) --- MM (ug/t) --- DMS (ug/t) --- DMOS (ug/t)

80



NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT

# SUMMARY OF INDUSTRY EXPERIENCE WITH ODOR MINIMIZATION AT WASTEWATER TREATMENT PLANTS

TECHNICAL BULLETIN NO. 949 MAY 2008

by Diana Cook NCASI West Coast Regional Center Corvallis, Oregon

### 5.3 Oxidation

Several oxidizing agents have been used for destruction of odors resulting from  $H_2S$ . The approach is to oxidize the sulfide into nonvolatile forms such as elemental sulfur, thiosulfate, sulfite, and sulfate. Chemical oxidation reactions are generally slower than biochemical oxidation reactions (ASCE 1989). In the presence of large organic loads, as with industrial wastewaters, the economics of oxidizing agent use can be prohibitive due to competitive reactions with organic materials. Some of the commonly used oxidizing agents are chlorine, chlorine dioxide, hypochlorite, oxygen, and hydrogen peroxide. Industry experience with use of oxidizing agents is summarized herein.

### 5.3.1 Hydrogen Peroxide

Hydrogen peroxide  $(H_2O_2)$  can be used to chemically oxidize  $H_2S$  into either elemental sulfur or sulfate (the former at pH <8 to 9; the latter at pH >8 to 9), as shown in Equations 5.6 and 5.7. In the range of pH 7 to 9, both reactions may occur. Excess  $H_2O_2$  can oxidize other wastewater components or decompose to release oxygen and water.

$$H_2O_2 + H_2S \rightarrow S + 2H_2O \qquad (Eq. 5.6)$$

$$4H_2O_2 + S^{2-} \rightarrow SO_4^{2-} + 4H_2O$$
 (Eq. 5.7)

 $H_2O_2$  is a clear, colorless, nonflammable compound that is miscible with water in all proportions and is normally sold as a solution expressed as a percentage of the solution's weight (e.g., a 35% solution contains 35%  $H_2O_2$  and 65% water by weight). Solutions of >8% are classified as oxidizers by the U.S. Department of Transportation.  $H_2O_2$  can be obtained in small drums or tanks equipped with metering pumps and plumbed to the addition point. Storage containers must be properly vented because contamination or excess heat can accelerate decomposition to oxygen and water. Special safety handling is required, including eye protection and protective clothing.

Davies, Christy, and O'Connor (2000) reported on the effectiveness of using  $H_2O_2$  to control odors resulting from release of  $H_2S$  at four locations around the WWTP at a pulp and paper mill in Canada. The specific objectives were to reduce  $H_2S$  concentration in an anaerobic spill basin effluent returned to the effluent clarification and treatment system; treat anaerobic sludge from the spill basin; minimize odors arising from sewering condensates; and treat all foul condensates from the mill during a scheduled shutdown of the steam stripper.

 $H_2O_2$  was found to be effective for odor reduction at all the locations. It was added to the anaerobic spill basin effluent at a location that promoted good mixing prior to introduction into the clarifier. The residence time associated with transfer of effluent from the spill basin to the clarifier was sufficient to oxidize  $H_2S$  and minimize odor. Sludge dewatering equipment consisted of a screen, an agitation tank, a centrifuge, and a belt press.  $H_2O_2$  was added to the agitation tank. In addition, an odor-controlling spray (Ecosorb) was applied to the air around the screens to capture any residual odors.  $H_2O_2$  was also used to reduce odors during occasional sewering of condensates. Dosage levels were selected based on laboratory studies that indicated that ~200 mg  $H_2O_2/L$  of treated condensate was sufficient to remove odors. A solution containing 50%  $H_2O_2$  was also used to reduce odors during steam stripper downtime events when foul condensates were piped directly into the aeration pond.

H<sub>2</sub>O<sub>2</sub> and calcium peroxide (CaO<sub>2</sub>) have been used in the presence of peroxidase, an enzyme found in horseradish, to remove odors in swine manure. Swine manure is known to contain large amounts of VFAs, phenolic compounds, and indolic compounds that have been implicated in odor. Peroxidase, in the presence of peroxides, has been found to polymerize phenolic odorants, thereby reducing associated odors (Govere et al. 2007).

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 $H_2O_2$  has also been used successfully as one element of a multi-pronged approach to control odor attributed to VFA generation in anaerobic environments (Davis and Smith 2001).  $H_2O_2$  would be particularly beneficial for use in mills with high levels of water reuse (e.g., some recycle mills). Oxygen-limited environments in the process water transport system at those facilities can be ideal for anaerobic bacterial growth. Traditional oxidizers such as sodium hypochlorite, chlorine, and chlorine dioxide increase total chloride and conductivity in the reused effluent, which can disrupt process performance and cause corrosion. The multi-pronged approach used at a 100% recycled corrugating medium mill focused on good operating practices aimed at oxygenation, biocide application to control the amount of aerobic bacteria, and  $H_2O_2$  use to prevent anaerobic environments in the secondary treatment system (Davis and Smith 2001).

NCASI assisted a bleached kraft mill that conducted a trial to investigate the effects of adding  $H_2O_2$  to foul condensates. Foul condensates were piped directly to the first basin of a multi-stage ASB. Samples were collected at two locations (just prior to addition of peroxide and just following the addition point) over a five-day period to assess impacts on sulfide concentrations. Samples were analyzed using direct injection GC/PFPD (NCASI Method RSC-02.02; NCASI 2007).  $H_2O_2$  was added as a 50% solution at a rate of 1.78 gallons per minute (GPM) to the foul condensate stream, which had a flow rate of 3 MGD, resulting in a concentration of approximately 0.51 g  $H_2O_2/L$  of foul condensate. The average reduction in sulfide concentration was over 79%, as illustrated in Figure 5.3.



**Figure 5.3** Sulfide Concentrations after Peroxide Addition (0.51 g/L) to a Foul Condensate [numbers above bars represent percent reductions in total sulfide observed each day]

Dosage and retention time trends were evaluated using a screening technique that involved collecting 25-mL samples in a 500-mL bottle that was closed and agitated for one minute. The cap was removed and a Jerome air monitor was used to measure volatile  $H_2S$  in the headspace. The effect of peroxide dose and retention time are illustrated in Figure 5.4. Reductions of >90% were observed after the first minute, and at some dosage rates they increased modestly with additional retention time. Figure 5.5 illustrates trends for doses of 0.5 and 1.0 GPM of a 50%  $H_2O_2$  solution to the 3 MGD foul condensate at the four sampling locations (drop legs 1 through 4). Although some variability was observed, a significant reduction in sulfide was observed at the first drop leg under both addition rates investigated and increased gradually as the foul condensate progressed through the drop legs.



**Figure 5.4** Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Retention Time on Sulfide Removal Efficiency [headspace measurements]



Figure 5.5 Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Sample Location on Sulfide Removal Efficiency [headspace measurements]

Another example of  $H_2O_2$  use at a bleached kraft mill is illustrated in Figure 5.6. The mill conducted a bench study prior to an odor reduction trial to determine the dose-response curve for peroxide addition to foul condensates. Foul condensates were treated with the oxidant (50%  $H_2O_2$ ; density 1.2 g/mL) volumes shown in the figure (equivalent to 0.14, 0.29, 0.43, and 0.56 g  $H_2O_2/L$  of foul condensate) at 50°C for 30 minutes in sealed vials. Samples were removed and analyzed by direct aqueous injection GC/sulfur chemiluminescence detectors (SCD) for sulfide, MeSH, DMS, and

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DMDS. The data indicate that sulfide and MeSH were readily removed, but that DMS required significantly higher doses to achieve equivalent levels of removal. DMDS was not removed and in fact increased with peroxide dose, presumably due to oxidation of MeSH.



Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Following the bench studies, a mill trial was conducted over a five day period.  $H_2O_2$  was added to the foul condensate tank (pH 9.0 to 9.3) at a rate of 1 gallon (100%  $H_2O_2$ ) to every 500 gallons of condensate, which is equivalent to 2.8 g  $H_2O_2/L$  of foul condensate. This addition point provided a retention time of ~30 minutes prior to the WWTP. The trial resulted in overall average reductions in sulfide, MeSH, and DMS of 38.8, 64.6, and -3.9%, respectively (Table 5.1). The level of DMDS increased (probably due to oxidation of MeSH to DMDS) during the addition but reportedly did not affect overall odor from the WWTP (NCASI files). The mill continues to feed  $H_2O_2$  to the foul condensate and has reported a reduction in odor at the WWTP.

Day of Study	$H_2S$	MeSH	DMS
1	26.1	67.3	-20.8
2	68.3	74.7	16.5
3	38.1	57.0	1.9
4	36.4	60.0	2.6
5	25.3	63.8	-19.5
Average	38.8	64.6	-3.86

Table 5.1	Percent Reduction in Hydrogen Sulfide, Methyl Mercaptan, and Dimethyl Sulfide
	during a Peroxide Addition Trial Conducted in a Foul Condensate

National Council for Air and Stream Improvement

## WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION BASELINE ACTUAL EMISSIONS

## May/July 2022 Baseline Emissions Calculations H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

		Method: GC/SCD Reduced Sulfur Analysis (Average)			
Sample Date	Sample Location	ALS H2S, ppb	ALS DMDS, ppb	ALS DMS, ppb	ALS MMC, ppl
2021/2022	Avg. ASB Influent (2021 and 2022)	252	86.78	199	2.60
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	105,667	6,633	14,667	8,267
5/17/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
Sector States	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1,057	14,647	1,467	82.67
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	58,333	5,633	5,400	3,900
7/19/2022	Predicted % Reduction from H <sub>2</sub> O <sub>2</sub>	0.99	MMC converted into DMDS	0.90	0.99
and the second second	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	583	9,414	540	39.00
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	76,200	6,932	7,140	7,393
7/20/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
and the second second	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	762	14,099	714	73.93
	Foul Condensate (prior to H <sub>2</sub> O <sub>2</sub> )	62,500	8,967	9,200	6,533
7/21/2022	Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
1	Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	625	15,300	920	65.33
		ALS H2S, ppm	ALS DMDS, ppm	ALS DMS, ppm	ALS MMC, ppm
	Avg. Foul Condensate Concentration (after peroxide)	0.76	13.36	0.91	0.07
Flow Weight Average	Avg. ASB Inlet Concentration	0.25	0.09	0.20	2.60E-03
Loading Calculation	Avg. Hardpipe Flow, MGD	0.34	1		
Louding culculation	Avg. ASB Inlet Flow, MGD	23.96			
1	Total Flow	24.30	-		
	Flow Weight. Avg. Loading (ppm)	0.2593	0.2712	0.2088	0.0035
1. 1. 1. 1.	H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
1944	ASB Zone 1		0.10	0.15	2.74E-03
Results and Emissions	ASB Zone 2	Multiple	1.43E-03	3.05E-03	4.63E-05
Factors Calculation	ASB Zone 3	H2SSIM runs.	2.57E-05	1.01E-04	1.43E-06
	Total ASB		0.10	0.16	2.78E-03
N. Start	Baseline Emissions Factor 2200 ODTP/day	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
and the state	Baseline Emissions Factor	1.51E-02	1.14E-02	1.85E-02	3.28E-04

Type of unit is		
1 Total water added at the unit $(1/s)$	50	0
2 Area of openings at unit (cm2)		50
3 Radius of drop pipe (cm)		5
4 Drop length to conduit (cm)		61
5 Humidity of inlet air (%)		40
6 Temperature of air (C)		25
7 Drain air velocity (ft/min)		84
8 manhole air velocity (ft/min)		128
9 Conduit air velocity (ft/min)		66
10 Wind speed (cm/s at 10 m)		447
11 distance to next unit (cm)		500
12 slope of underflow conduit		.015
13 friction factor liquid		.016
14 friction factor gas		.006
15 radius of underflow conduit (cm)		12
16 Underflow T (C)		25
17 oscillation cycle time (min)		5
18 design collection velocities (ft/s)		2
19 design branch line fraction full		. 4
Type of unit is		
8 HL partition flag=1, adjust for sorption		0
9 unit recycle convergence number		200
10 oil molecular weight		0
11 oil density (g/cc)		0
12 NaUT 1=municipal 2=industrial 3=turb.		0
13 NaUT 1=mass tr. 2=equil		0
14 parts biomass per 1000 parts COD		
15 oil water partition method 0=owpc		
16 use UNIFAC aqueous data base =1		

17 specify mass transfer for unit, =1

18 Use biomass for unit option, =1

19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment	
1 Description of unit	11 ASB Zone 1
2 Wastewater temperature (C)	34.08
3 length of aeration unit (m)	295
4 width of aeration unit (m)	295
5 depth of aeration unit (m)	1.4
6 Area of agitation (each aerator,m2)	135
7 Total number of agitators in the unit	31
8 Power of agitation (each aerator, HP)	75
9 Impeller diameter (cm)	49.53
10 Impeller rotation (RPM)	1200
11 Agitator mechanical efficiency	0.83
12 aerator effectiveness, alpha	0.83
13 if there is plug flow, enter 1	0
14 Overall biorate (mg/g bio-hr)	19
15 Aeration air flow (m3/s)	0
16 active biomass, aeration (g/l)	0.3
17 If covered, then enter 1	0
18 special input	Q
19 pH (enter 0 for no pH adjustment)	7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
hl = 0.001714 \text{ atm-m3/mol} vp = 45.945 \text{ mmHg} (0.88868 \text{ psia})
       95.2 V/X
      0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.26179 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
  Biomass production
   The biomass production rate is 0.mg/hr. (0. mg/L)
   The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface ___ Springer__
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.753e-04 m/s.
The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1907.493 min. (31.792 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.11781
  KL aerated (m/s)
                                           0.017486
 KL OVERALL AERATED (m/s)
                                           0.005609
 KG quiescent (m/s)
                                           0.005703
 KL quiescent (m/s)
                                           5.971e-06
  KL OVERALL QUIESCENT (m/s)
                                          5.883e-06
                                           2.753e-04
 KL OVERALL (m/s)
 air stripping time constant (min)
                                          84.752
 FRACTION SURFACE VOLATILIZED
                                          0.36432
                                         0.
 FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
                                           0.36432
  FRACTION BIOLOGICALLY REMOVED
                                           0.61949
  FRACTION ABSORBED
                                           0.
  TOTAL AIR EMISSIONS (g/s)
                                          0.095374
                   (Mg/year)
                                           3.00772
  EMISSION FACTOR (g/cm2-s)
                                          1.096e-10
  UNIT EXIT CONCENTRATION (ppmw)
                                          0.003981
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                      WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08
COMPOUND: DIMETHYL DISULFIDE
```

Type of unit is system exit stream		
1 Description of unit	12	def.system exit st

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Ο.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)1.096e-10UNIT EXIT CONCENTRATION (ppmw)6.079e-06DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain		
1 Description of unit	13	default open hub d
2 Underflow T (C)		43.89
3 Total water added at the unit $(1/s)$		0
4 Area of openings at unit (cm2)		50
5 Radius of drop pipe (cm)		5
6 Drop length to conduit (cm)		61
7 Open surface=1		1
8 Subsurface entrance=1		0
9 subsurface exit =1		0
10 radius of underflow conduit (cm)		12
11 distance to next unit (cm)		500
12 slope of underflow conduit		0.015
16 velocity air at drain opening (ft/min)		84
17 municipal waste in conduit =1		0
18 Assume equilibrium in unit, =1		0
19 pH (enter 0 for no pH adjustment)		8.9
Total drain flow is 1064.53 1/s. Weight fraction down is 2.712E-07 Gas concentration in 0 mol fraction. Gas flow 1064.53 L/s Weight fraction out at base of drop is fraction transferred in the drain drop fraction loss in wastel drop to hub fraction loss in waste2 drop to hub fraction loss in waste3 drop to hub fraction loss in collection hub drop fraction loss in unit fraction loss in unit	2.459 from h 0. 0. 0. 0.09 0. 0.	16666343852E-07 ub is .093228 3228
component upstream of unit, g/s	Ο.	
mol fract. headspace upstream (y)	Ο.	
headspace at conduit discharge, y	Ο.	
headspace end of conduit (y)	3.13	4e-19
mol fract. headspace vent base	6.97	8e-06
headspace flow out vent (cc/s)	-1.0	65e+06
headspace flow down line (cc/s)	1.06	5e+06
KG surface (m/s)	1860	.422
KL surface (m/s)	6.37	e-09
flow of waste down hub (1/s)	Ο.	
component flow in waste into unit (g/s)	0.28	87
total component into unit, g/s	0.26	179
TOTAL AIR EMISSIONS (g/s)	0.02	6915
(Mg/year)	0.84	879
EMISSION FACTOR (g/cm2-s)	1.09	6e-10
UNIT EXIT CONCENTRATION (ppmw)	0.24	592
DETAILED CALCULATIONS at Unit 17 ASB Zone	3	
Type: aerated biotreatment		

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

```
30.01
2 Wastewater temperature (C)
                                               376
3 length of aeration unit (m)
4 width of aeration unit (m)
                                               188
                                               0.91
5 depth of aeration unit (m)
6 Area of agitation (each aerator,m2)
                                             135
7 Total number of agitators in the unit
                                              6
                                              75
8 Power of agitation (each aerator, HP)
                                               49.53
9 Impeller diameter (cm)
                                               1200
10 Impeller rotation (RPM)
                                              0.83
11 Agitator mechanical efficiency
                                            0.83
0
19
0
12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
                                               0.3
16 active biomass, aeration (g/l)
17 If covered, then enter 1
                                               0
                                               0
18 special input
19 pH (enter 0 for no pH adjustment)
                                               7.42
Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
   hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia)
       78.352 y/x
      0.056726 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr d1= 1.027e-05 cm2/s dv= 0.085991 cm2/s
Compound flow rate from inlet water is 1.411e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.785 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 329,675.
kl is estimated as 5.918e-06 m/s.
kg is estimated as 0.005575 m/s. Model: 2
kg is estimated as 0.005575 m/s. Model: 2
The Schmidt number is 1.74436.
The friction velocity is 37.398 m/s
kg is estimated as 0.012742 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.1143 m/s.
kl (agitated) is estimated as 0.015772 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 5.972e-05 m/s.
 The effective stripping time (surface + diffused air) is 253.944 minutes, (4.2324
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1007.112 min. (16.785 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.11644
 KL aerated (m/s)
                                          0.015772
                                           0.004711
  KL OVERALL AERATED (m/s)
  KG quiescent (m/s)
                                           0.005679
  KL quiescent (m/s)
                                          5.918e-06
  KL OVERALL QUIESCENT (m/s)
                                           5.813e-06
   KL OVERALL (m/s)
                                           5.972e-05
   air stripping time constant (min)
                                           253.944
```

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FRACTION SURFACE VOLATILIZED	0.18189
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.18189
FRACTION BIOLOGICALLY REMOVED	0.77225
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	2.567e-05
(Mg/year)	8.094e-04
EMISSION FACTOR (g/cm2-s)	3.631e-14
UNIT EXIT CONCENTRATION (ppmw)	6.079e-06
DETAILED CALCULATIONS at Unit 18 ASB Zone 2	
Type: aerated biotreatment	

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:17:08 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment		
1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.08
3 length of aeration unit (m)		368
4 width of aeration unit (m)		184
5 depth of aeration unit (m)		0.97
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		15
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.24
86.579 y/x 0.062258 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^ k1= 0. L/g-hr dl= 1.034e-05 cm Compound flow rate from inlet water is 0.0 Compound flow rate from inlet vent is 0. g Compound flow rate from inlet duct is 0. g Submerged aeration rate from inlet vent is Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139 h Biomass production The biomass production rate is 0.mg/hr	(T-25) 2/s d 04238 1/s. (/s. 0. m3 ar. (0.	, deg. C lv= 0.087022 cm2/s g/s. 3/s. mg/L)
The fraction dissolved solids converte	d is 0	
The estimated biomass exit concentrati	on is	0. mg/L.
Quiescent wind shear surface Spr	inger	
The fetch to depth ratio is 302.703.		
kl is estimated as 5.945e-06 m/s.		
kg is estimated as 0.005633 m/s. Model: 2	5	
kg is estimated as 0.005633 m/s. Model: 2	5	
The Schmidt number is 1.72371.		
The friction velocity is 37.398 m/s		
kg is estimated as 0.012836 m/s. Model: 3	f	
Agitated surface	-	Sec.
The rotation speed is 125.654 radians per	second	
The rotation factor NRW is 2.052e+06.		
The power number NPR is 7.881e-04.		

```
kg (agitated) is estimated as 0.11498 m/s.
k1 (agitated) is estimated as 0.016622 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes.
 (1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1028.32 min. (17.139 hr.)
The ratio of the pump mixing to the residence time is 0.
                                         0.11714
  KG aerated (m/s)
                                         0.016622
  KL aerated (m/s)
  KL OVERALL AERATED (m/s)
                                           0.005152
  KG quiescent (m/s)
                                           0.005738
  KL quiescent (m/s)
                                           5.945e-06
  KL OVERALL QUIESCENT (m/s)
                                           5.85e-06
                                           1.598e-04
  KL OVERALL (m/s)
  air stripping time constant (min)
                                           101.198
  FRACTION SURFACE VOLATILIZED
                                       U.33837
O.
0.33837
O.62833
O.
0.001434
O.045218
2.1180 10
                                          0.33837
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
  TOTAL AIR EMISSIONS (q/s)
                    (Mg/year)
  EMISSION FACTOR (g/cm2-s)
                                           2.118e-12
                                      1.326e-04
  UNIT EXIT CONCENTRATION (ppmw)
```

Type of unit is		
1 Total water added at the unit $(1/s)$	50	0
2 Area of openings at unit (cm2)		50
3 Radius of drop pipe (cm)		5
4 Drop length to conduit (cm)		61
5 Humidity of inlet air (%)		40
6 Temperature of air (C)		25
7 Drain air velocity (ft/min)		84
8 manhole air velocity (ft/min)		128
9 Conduit air velocity (ft/min)		66
10 Wind speed (cm/s at 10 m)		447
11 distance to next unit (cm)		500
12 slope of underflow conduit		.015
13 friction factor liquid		.016
14 friction factor gas		.006
15 radius of underflow conduit (cm)		12
16 Underflow T (C)		25
17 oscillation cycle time (min)		5
18 design collection velocities (ft/s)		2
19 design branch line fraction full		. 4
Type of unit is		
8 HL partition flag=1, adjust for sorption		0

o in particion itag i, adjust for superon	U
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	0
14 parts biomass per 1000 parts COD	
15 oil water partition method 0=owpc	
16 use UNIFAC aqueous data base =1	
17 specify mass transfer for unit, =1	
18 Use biomass for unit option, =1	
19 biogrowth Monod half concentration ppm	

DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment		
1 Description of unit	11	ASB Zone 1
2 Wastewater temperature (C)		34.08
3 length of aeration unit (m)		295
4 width of aeration unit (m)		295
5 depth of aeration unit (m)		1.4
6 Area of agitation (each aerator, m2)		135
7 Total number of agitators in the unit		31
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.04
	10 10 10	the state of the

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

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```
hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13,629 psia)
       162.463 v/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.19189 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
   Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s. Model: 2
kg is estimated as 0.007917 m/s. Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s. Model: 3
 Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14978 m/s.
kl (agitated) is estimated as 0.021024 m/s.
   The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 4.77e-04 m/s.
 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1907.493 min. (31.792 hr.)
 The ratio of the pump mixing to the residence time is 0.
 KG aerated (m/s)
                                             0.15258
  KL aerated (m/s)
                                            0.021024
  KL OVERALL AERATED (m/s)
                                            0.009769
                                           0.008066
  KG quiescent (m/s)
                                            7.634e-06
   KL quiescent (m/s)
                                            7.574e-06
  KL OVERALL QUIESCENT (m/s)
  KL OVERALL (m/s)
                                             4.77e-04
                                        4.77e-02
48.915
0.80226
0.
0.80226
0.17717
   air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
  FRACTION SUBMERGED VOLATILIZED
   TOTAL FRACTION VOLATILIZED
   FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                            0.
   TOTAL AIR EMISSIONS (g/s)
                                            0.15394
                    (Mg/year)
                                           4.85471

        (Mg/year)
        4.85471

        EMISSION FACTOR (g/cm2-s)
        1.769e-10

        UNIT EXIT CONCENTRATION (ppmw)
        0.003708

DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                       WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13
COMPOUND: DIMETHYL SULFIDE (DMS)
```

Type of unit 1	s system exit	scream	
1 Description	of unit	12	def.system exit st

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TOTAL AIR EMISSIONS (g/s)

Ο.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)1.769e-10UNIT EXIT CONCENTRATION (ppmw)1.362e-05DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain Type of unit is open hub drain1 Description of unit132 Underflow T (C)43.893 Total water added at the unit (1/s)04 Area of openings at unit (cm2)505 Radius of drop pipe (cm)56 Drop length to conduit (cm)61 8 Subsurface entrance=1 9 subsurface exit =1 7 Open surface=1 1 0 0 10 radius of underflow conduit (cm)1211 distance to next unit (cm)50012 slope of underflow conduit0.0 500 11 distance to next unit (om/12 slope of underflow conduit16 velocity air at drain opening (ft/min)17 municipal waste in conduit =10 17 municipal waste in conduit =1018 Assume equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)8,9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1064.53 1/s. Weight fraction down is 2.088E-07 Gas concentration in 0 mol fraction. Gas flow 1064.53 L/s Weight fraction out at base of drop is 1.80253671574623E-07 fraction transferred in the drain drop from hub is .136716 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub 0. fraction loss in waste3 drop to nup (.) fraction loss in collection hub drop (0.13672) (.) fraction loss in collection hub drop0.13672fraction loss in unit0.fraction loss in line run0.component upstream of unit, g/s0.mol fract. headspace upstream (y)0.headspace at conduit discharge, y0.headspace end of conduit (y)4.509e-19mol fract. headspace vent base1.195e-05headspace flow out vent (cc/s)-1.065e+06headspace flow down line (cc/s)1.065e+06KG surface (m/s)2626.947KL surface (m/s)8.245e-09flow of waste down hub (1/s)0.component flow in waste into unit (g/s)0.22227 component flow in waste into unit (g/s) 0.22227 total component into unit, g/s0.22227total component into unit, g/s0.19189TOTAL AIR EMISSIONS (g/s)0.030388(Mg/year)0.95833EMISSION FACTOR (g/cm2-s)1.769e-10UNIT EXIT CONCENTRATION (ppmw)0.18025 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

30.01 2 Wastewater temperature (C) 3 length of aeration unit (m) 376 4 width of aeration unit (m) 188 0.91 5 depth of aeration unit (m) 135 6 Area of agitation (each aerator, m2) 7 Total number of agitators in the unit 6 75 8 Power of agitation (each aerator, HP) 49.53 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 0.83 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 19 14 Overall biorate (mg/g bio-hr) 0 15 Aeration air flow (m3/s) 0.3 16 active biomass, aeration (g/l) 0 17 If covered, then enter 1 0 18 special input 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F) hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia) 139.945 y/x 0.10132 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1= 0. L/g-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s Compound flow rate from inlet water is 1.708e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.785 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.566e-06 m/s. kg is estimated as 0.007884 m/s. Model: 2 kg is estimated as 0.007884 m/s. Model: 2 The Schmidt number is 1.03989. The friction velocity is 37.398 m/s kg is estimated as 0.017611 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14804 m/s. kl (agitated) is estimated as 0.018962 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.053e-04 m/s. The effective stripping time (surface + diffused air) is 144.073 minutes. (2.40122 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1007.112 min. (16.785 hr.) The ratio of the pump mixing to the residence time is 0. 0.15081 KG aerated (m/s) KL aerated (m/s)0.018962 KL OVERALL AERATED (m/s) 0.00854 KG quiescent (m/s) 0.008032 KL quiescent (m/s) 7.566e-06 KL OVERALL QUIESCENT (m/s) 7.497e-06 KL OVERALL (m/s) 1.053e-04 air stripping time constant (min) 144.073

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FRACTION SURFACE VOLATILIZED	0.59355
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.59355
FRACTION BIOLOGICALLY REMOVED	0.32154
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	1.014e-04
(Mg/year)	0.003197
EMISSION FACTOR (g/cm2-s)	1.434e-13
UNIT EXIT CONCENTRATION (ppmw)	1.362e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2	
Type: aerated biotreatment	

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment		
1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.08
3 length of aeration unit (m)		368
4 width of aeration unit (m)		184
5 depth of aeration unit (m)		0.97
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		15
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.24
k1= 0. L/g-hr dl= 1.495e-05 c Compound flow rate from inlet water is 0. Compound flow rate from inlet vent is 0. Compound flow rate from inlet duct is 0. Submerged aeration rate from inlet vent i Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139	m2/s ( 003948 g/s. g/s. s 0. m hr.	dv= 0.14597 cm2/s g/s. 3/s.
Biomass production		7 × 3
The blomass production rate is U.mg/n	$\mathbf{r}$ . (U.	mg/L)
The iraction dissolved solids convert	ion ie	0 mg/I
Ouioscont wind shear surface Sp	ringer	O. Mg/L.
The fetch to depth ratio is 302 703	TTUGGT	
kl is estimated as 7.6e-06 m/s		
kg is estimated as 0.007966 m/s. Model:	2	
kg is estimated as 0.007966 m/s. Model:	2	
The Schmidt number is 1.02758.		
The friction velocity is 37.398 m/s		
kg is estimated as 0.017744 m/s. Model:	3	
Agitated surface		
The rotation speed is 125.654 radians per	secon	d.
The rotation factor NRW is 2.052e+06.		
The power number NPR is 7.881e-04.		
The rotation factor NFR is 797.027.		

kg (agitated) is estimated as 0.14892 m/s. kl (agitated) is estimated as 0.019984 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 2.809e-04 m/s. The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1028.32 min. (17.139 hr.) The ratio of the pump mixing to the residence time is 0. 0.15171 KG aerated (m/s) KL aerated (m/s) 0.019984 KL OVERALL AERATED (m/s) 0.009148 KG quiescent (m/s) KL quiescent (m/s) 0.008115 7.6e-06 KL OVERALL QUIESCENT (m/s) 7.537e-06 2.809e-04 KL OVERALL (m/s) 57.552 0.77311 air stripping time constant (min) FRACTION SURFACE VOLATILIZED 0. 0.77311 0.18362 0. FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 

 TOTAL AIR EMISSIONS (g/s)
 0.003052

 (Mg/year)
 0.096247

 EMISSION FACTOR (g/cm2-s)
 4.507e-12

 UNIT EXIT CONCENTRATION (ppmw)
 1.605e-04

 (Mg/year) EMISSION FACTOR (g/cm2-s)

Type of unit is	
1 Total water added at the unit (1/s) 50	0
2 Area of openings at unit (cm2)	50
3 Radius of drop pipe (cm)	5
4 Drop length to conduit (cm)	61
5 Humidity of inlet air (%)	40
6 Temperature of air (C)	25
7 Drain air velocity (ft/min)	84
8 manhole air velocity (ft/min)	128
9 Conduit air velocity (ft/min)	66
10 Wind speed (cm/s at 10 m)	447
11 distance to next unit (cm)	500
12 slope of underflow conduit	.015
13 friction factor liquid	.016
14 friction factor gas	.006
15 radius of underflow conduit (cm)	12
16 Underflow T (C)	25
17 oscillation cycle time (min)	5
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
Type of unit is	
8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	0

16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm
DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment

14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan)

ASB Zone 1
34.08
295
295
1.4
135
31
75
49.53
1200
0.83
0.83
0
19
0
0.3
0
0
7.04

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
h1= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia)
       230.99 v/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 (T-25), deg. C
   k1= 0. L/g-hr dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.003078 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0, g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
   Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s. Model: 2
kg is estimated as 0.010871 m/s. Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18977 m/s.
kl (agitated) is estimated as 0.021167 m/s.
   The specified and growth biomass is 0.3 \text{ g/L}.
The effective KL (surface + diffused air) is 6.265e-04 m/s.
The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1907.493 min. (31.792 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                     0.19332
  KL aerated (m/s)
                                          0.021167
  KL OVERALL AERATED (m/s)
                                          0.012876
                                          0.011075
  KG quiescent (m/s)
  KL quiescent (m/s)
                                           7.703e-06
                                          7.672e-06
  KL OVERALL QUIESCENT (m/s)
                                          6.265e-04
  KL OVERALL (m/s)
                                      37.242
0.88891
  air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                       Ο.
  FRACTION SUBMERGED VOLATILIZED
   TOTAL FRACTION VOLATILIZED
                                          0.88891
                                       0.093739
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                          0.
  TOTAL AIR EMISSIONS (g/s)
                                          0.002736
                                         0.086272
                   (Mg/year)
  EMISSION FACTOR (g/cm2-s)
                                          3.144e-12
                                  5.017e-05
  UNIT EXIT CONCENTRATION (ppmw)
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                      WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)
```

Type	OI	unit	15	system	exit	stream				
1 De	scri	ptior	i of	f unit			12	def.system	exit	st

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TOTAL AIR EMISSIONS (g/s)

Q.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)3.144e-12UNIT EXIT CONCENTRATION (ppmw)1.458e-07DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain	
1 Description of unit	13 default open hub d
2 Underflow T (C)	43.89
3 Total water added at the unit $(1/s)$	0
4 Area of openings at unit (cm2)	50
5 Radius of drop pipe (cm)	5
6 Drop length to conduit (cm)	61
7 Open surface=1	1
8 Subsurface entrance=1	0
9 subsurface exit =1	0
10 radius of underflow conduit (cm)	12
11 distance to next unit (cm)	500
12 slope of underflow conduit	0.015
16 velocity air at drain opening (ft/min)	84
17 municipal waste in conduit =1	0
18 Assume equilibrium in unit, =1	0
19 pH (enter 0 for no pH adjustment)	8.9
Equilibrium partitioning in drain drop hu	b is assumed.
Total drain flow is 1064.53 1/s.	
Weight fraction down is 3.5E-09	
Gas concentration in 0 mol fraction.	
Gas flow 1064.53 L/s	
Weight fraction out at base of drop is	2.89099406807993E-09
fraction transferred in the drain drop	from hub is .174002
fraction loss in wastel drop to hub	0.
fraction loss in waste2 drop to hub	0.
fraction loss in waste3 drop to hub	0.
fraction loss in collection hub drop	0.174
fraction loss in unit	0.
fraction loss in line run	0.
component upstream of unit, g/s	0.
mol fract. headspace upstream (y)	0.
headspace at conduit discharge, y	0.
headspace end of conduit (y)	9.429e-21
mol fract. headspace vent base	3.292e-07
headspace flow out vent (cc/s)	-1.065e+06
headspace flow down line (cc/s)	1.065e+06
KG surface (m/s)	3602.086
KL surface (m/s)	8.324e-09
flow of waste down hub (1/s)	0.
component flow in waste into unit (g/s)	0.003726
total component into unit, g/s	0.003078
TOTAL AIR EMISSIONS (g/s)	6.483e-04
(Mg/year)	0.020445
EMISSION FACTOR (g/cm2-s)	3.144e-12
UNIT EXIT CONCENTRATION (ppmw)	0.002891
DETAILED CALCULATIONS at Unit 17 ASB Zone	3
Type: aerated biotreatment	

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

```
30.01
 2 Wastewater temperature (C)
                                               376
 3 length of aeration unit (m)
                                               188
 4 width of aeration unit (m)
 5 depth of aeration unit (m)
                                               0.91
 6 Area of agitation (each aerator,m2)
                                              135
                                              6
 7 Total number of agitators in the unit
 8 Power of agitation (each aerator, HP)
                                               75
                                               49.53
 9 Impeller diameter (cm)
                                               1200
 10 Impeller rotation (RPM)
                                              0.83
 11 Agitator mechanical efficiency
                                              0.83
 0.
                                               19
 15 Aeration air flow (m3/s)
                                               0
 16 active biomass, aeration (g/l)
                                             0.3
                                               0
 17 If covered, then enter 1
                                               0
 18 special input
 19 pH (enter 0 for no pH adjustment)
                                               7.42
 Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
  hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
        204.826 y/x
        0.14829 g/L gas per g/L liquid
    Temperature adjustment factor = 1.046 (T-25), deg. C
    k1= 0. L/g-hr dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
Compound flow rate from inlet water is 1.957e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.785 hr.
     Biomass production
     The biomass production rate is 0.mg/hr. (0. mg/L)
     The fraction dissolved solids converted is 0. .
     The estimated biomass exit concentration is 0. mg/L.
         Quiescent wind shear surface Springer
 The fetch to depth ratio is 329.675.
 kl is estimated as 7.635e-06 m/s.
 kg is estimated as 0.010826 m/s. Model: 2
 kg is estimated as 0.010826 m/s. Model: 2
 The Schmidt number is 0.64779.
 The friction velocity is 37.398 m/s
 kg is estimated as 0.023814 m/s. Model: 3
        Agitated surface
 The rotation speed is 125.654 radians per second.
 The rotation factor NRW is 2.052e+06.
 The power number NPR is 7.881e-04.
 The rotation factor NFR is 797.027.
 kg (agitated) is estimated as 0.18756 m/s.
 kl (agitated) is estimated as 0.019092 m/s.
     The specified and growth biomass is 0.3 \text{ g/L}.
  The effective KL (surface + diffused air) is 1.391e-04 m/s.
  The effective stripping time (surface + diffused air) is 109.038 minutes.
  (1.81731 hrs.)
  The pump mixing time is 5 x the pumping recirculaion time, 0. min.
  The ratio of the mixing to the striping (surface + diffused air) is 0.
  The mean residence time is 1007.112 min. (16.785 hr.)
  The ratio of the pump mixing to the residence time is 0.
    KG aerated (m/s)
                                           0.19108
    KL aerated (m/s)
                                          0.019092
                                          0.011483
    KL OVERALL AERATED (m/s)
                                          0.011029
    KG quiescent (m/s)
    KL quiescent (m/s)
                                           7.635e-06
    KL OVERALL QUIESCENT (m/s)
                                          7.6e-06
    KL OVERALL (m/s)
                                          1.391e-04
    air stripping time constant (min)
                                          109.038
```

```
B-45
```

FRACTION SURFACE VOLATILIZED	0.7324
FRACTION SUBMERGED VOLATILIZED	Ο.
TOTAL FRACTION VOLATILIZED	0.7324
FRACTION BIOLOGICALLY REMOVED	0.1883
FRACTION ABSORBED	Ο.
TOTAL AIR EMISSIONS (g/s)	1.433e-06
(Mg/year)	4.52e-05
EMISSION FACTOR (g/cm2-s)	2.028e-15
UNIT EXIT CONCENTRATION (ppmw)	1.458e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment	2
Type: aerated biotreatment	

WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 1 Description of unit 2 Wastewater temperature (C) 3 length of aeration unit (m) 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/1) 17 If covered, then enter 1 18 special input 19 pH (enter 0 for no pH adjustment)	18 ASB Zone 2 32.08 368 184 0.97 135 15 75 49.53 1200 0.83 0 19 0 0.3 0 7.24
Properties of METHANETHIOL (methyl mercapt. hl= 0.003921 atm-m3/mol vp= 2142. 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor = 1.046 k1= 0. L/g-hr dl= 1.515e-05 cm Compound flow rate from inlet water is 5. Compound flow rate from inlet vent is 0. Compound flow rate from inlet vent is 0. Submerged aeration rate from inlet vent i Total submerged aeration is 0. m3/s. The residence time in the unit is 17.139 Biomass production The biomass production rate is 0.mg/h The fraction dissolved solids convert The estimated biomass exit concentrat Quiescent wind shear surface Sp The fetch to depth ratio is 302.703. k1 is estimated as 7.67e-06 m/s. kg is estimated as 0.010938 m/s. Model: kg is estimated as 0.010938 m/s. Model: he friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: Agitated surface The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The power NPR is 7.881e-04.	<pre>an) at 32.1 deg.C (89.7 deg.F) 771 mmHg (41.446 psia) ^(T-25), deg. C m2/s dv= 0.23433 cm2/s 341e-05 g/s. g/s. g/s. g/s. s 0. m3/s. hr. r. (0. mg/L) ed is 0 ion is 0. mg/L. ringer_ 2 2 3</pre>

kg (agitated) is estimated as 0.18868 m/s. kl (agitated) is estimated as 0.020121 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 3.715e-04 m/s. The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 1028.32 min. (17.139 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.19222 KL aerated (m/s) 0.020121 KL OVERALL AERATED (m/s) 0.012174 KG quiescent (m/s) KL quiescent (m/s) 0.011143 7.67e-06 KL OVERALL QUIESCENT (m/s) 7.637e-06 3.715e-04 KL OVERALL (m/s) 43.518 0.86584 air stripping time constant (min) FRACTION SURFACE VOLATILIZED FRACTION SURFACE VOLATILIZED0.86584FRACTION SUBMERGED VOLATILIZED0.TOTAL FRACTION VOLATILIZED0.86584FRACTION BIOLOGICALLY REMOVED0.097514FRACTION ABSORBED0.TOTAL AIR EMISSIONS (g/s)4.625e-05(Mg/year)0.001458EMISSION FACTOR (g/cm2-s)6.83e-14UNIT EXIT CONCENTRATION (ppmw)1.838e-06

#### BAE H2S Factor Summary of H2SSIM Inputs and Outputs

	H2SSIN	A Inputs		Windspee	d: 3.55	moh		H2SSIM C	utputs		
5/17/2022		0.004.000									
	Zone 1	Zone 2 2	Zone 3					Zone 1	Zone 2	Zone 3	Total ASB
DO	1.57	4.63	4.66		Main Inlet	Hardpipe Units	H2S g/s	0.07	0.02	0.02	0.111 g/s
Temp	87.52	83.91	80.19	Flow	25.11	0.35 MGD		-			1723 ODTP
pH	6.77	7.19	7.44	Total Sulfide	0.060	1.06 mg/L					0.012 Ib/ODTP
Length	968	1208	1235	Sulfate	390	390 mg/L					
Width	968	604	617								
Aerators	31	15	6								
Total HF	2325	1125	450								
7/19/2022											
	Zone 1	Zone 2 Z	Zone 3					Zone 1	Zone 2	Zone 3	Total ASB
DO	1.57	4.63	4.66		Main Inlet	Hardpipe Units	H2S g/s	0.09	0.03	0.02	0.144 g/s
Temp	96.27	93.37	89.26	Flow	25.32	0.42 MGD					1900 ODTP
pH	7.17	7.37	7.48	Total Sulfide	0.921	0.583 mg/L					0.014 lb/ODTP
Length	968	1208	1235	Sulfate	390	390 mg/L					
Width	968	604	617								
Aerators	31	15	6								
7/20/2022											
	Zone 1	Zone 2 Z	Zone 3					Zone 1	Zone 2	Zone 3	Total ASB
DO	1.57	4.63	4.66		Main Inlet	Hardpipe Units	H2S g/s	0.06	0.03	0.02	0.111 g/s
Temp	94.80	91.27	87.57	Flow	25.48	0.39 MGD					1900 ODTP
pH	7.10	7.22	7.39	Total Sulfide	0.053	0.762 mg/L					0.011 Ib/ODTP
Length	968	1208	1235	Sulfate	390	390 mg/L					
Width	968	604	617								0.01
Aerators	31	15	6								
7/21/2022											
	Zone 1	Zone 2 Z	one 3					Zone 1	Zone 2	Zone 3	Total ASB
DO	1.57	4.63	4.66		Main Inlet	Hardpipe Units	H2S a/s	0.06	0.03	0.02	0.111 d/s
Temp	94.76	90.42	87.08	Flow	19.93	0.19 MGD				1 0.02	940 ODTP
pH	7.10	7.19	7.35	Total Sulfide	0.094	0.625 mg/L					0.022 lb/ODTP
Lenath	968	1208	1235	Sulfate	390	390 ma/L					
Width	968	604	617	a mana	22.1						
Aerators	31	15	6								
		*DO are bas	ed on average	of all DO readings fro	m 2021 and 2	022 Subpart S performa	ance testing.		AVG:		0.015 lb/ODTP
		0.0 404 404	No in chicker			Sector Particular	2000 C 2 2 00 0		100.20		

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

ta Type 1. Site Identification	a standard and a
Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3 🕶
Zone Location of Hardpipe	1 🗸
Type of Basin	ASB 🗸

#### Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.11	0.35	MGD 🔫
Total Sulfide	0.06	1.057	mg/L 🝷
Sulfate	390	390	mg/L 🝷

#### Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph 👻
Ambient Temperature	79	F 🗸

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	s	Model Controls
Dissolved Oxygen	1.571780303	4.6275	4.659734848	Sec. Date	mg/l	L	Second Second
Temperature	87.52	83.91	80.19	1 - Geren	F	-	Run H2SSIM
рН	6.77	7.19	7.44		s.u.		
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌			View
Length	968	1208	1235		feet	•	Parameters
Width	968	604	617		feet	•	Clear Input
Depth	4.5	3.2	3		feet	-	Sheet
Mixing	Moderat -	Moderat -	Moderat -	194			
Number of Aerators	31	15	6				
Total Horsepower	2325	1125	450		HP		
Impellor Size	1.625	1.625	1.625		feet	•	
Impellor RPM	1200	1200	1200		RPM	1	
Diffused Air Flow	0	0	0	10	cms	•	
Weir Height	0	0	0	A. 70%	feet	-	

5/17/2022

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7726.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.02	0.02	in the	gms/s
Zone Emissions (H <sub>2</sub> S)	4978.9	1486.3	1261.7		lbs/yr
Emission Flux (H <sub>2</sub> S)	25.9	9.9	8.1		gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000	200	mg/L
Liquid Sulfide Load (lbs/yr)	34.400	6.200	5.200		lbs/yr

**Current Parameters** kgen 0.25 ThetaGen 1.06 KDO 0.05 KSO4 10 kanox 0.006 ThetaOx 1.05 1 m n 0.2 MLVSS 272.2 O<sub>2</sub> Transfer Coeff. 2 alpha 1 0.83 alpha 2 0.6

Percent Inlet Sulfide Removed -35.4%

## 5/17/2022

# NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Ide	entification	1			Data Type 5. Zone Physi	cal and Chemical	Conditions						
Company N	lame	New	v-Indy		Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	5	Model Controls	
Facility Na	ime	Catav	wba SC		Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/l		in the second	
Basin Nar	me	A	SB		Temperature	96.27	93.37	89.26		F	•	Run H2SSIM	
Data Type 2. Model	Zone Informat	tion			рН	7.17	7.37	7.48	10.00	s.u.			
Number of Zones	3 -				Redox Condition	Aerobic 💌	Aerobic 🔻	Aerobic 💌	Aerobic 🔻	1.1.1		View	
Zone Location of Hardpipe	1 -				Length	968	1208	1235		feet	•	Parameters	
Type of Basin	ASB 🗸				Width	968	604	617		feet	*	Clear Input	
Data Type 3. Load Ch	naracteristics				Depth	4.5	3.2	3		feet	•	Sheet	
Loading Characteristics	Main Influent	Hardpipe	Unit	s	Mixing	Moderat -	Moderat -	Moderat -					
Flow	25.32	0.42	MGD	•	Number of Aerators	31	15	6					
Total Sulfide	0.921	0.583	mg/L	•	Total Horsepower	2325	1125	450		HP			
Sulfate	390	390	mg/L	•	Impellor Size	1.625	1.625	1.625		feet	•		
Data Type 4. Atmosp	heric Conditio	ons			Impellor RPM	1200	1200	1200		RPM			
Windspeed	3.55	mph 🗸			Diffused Air Flow	0	0	0	1	cms	-		
Ambient Temperature	79	F 🗸			Weir Height	0	0	0	16 37	feet	-		

#### 7/19/2022

## **H2SSIM Results**

<b>Basin Emissions</b>	192123	Units
Total Emissions (H <sub>2</sub> S)	0.145	gms/s
Total Emissions (H <sub>2</sub> S)	10050.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	5.0	tons/yr
Total Emissions (H <sub>2</sub> S)	4.6	tonnes/yr
Emission Flux (H <sub>2</sub> S)	20.2	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.09	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	6430.8	1936.5	1683.0	N.S.S.S	lbs/yr
Emission Flux (H <sub>2</sub> S)	33.5	13.0	10.8		gms/m <sup>2</sup> yr
Liquid Conc. (Total Sulfide)	0.005	0.000	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	60.200	6.100	5.400		lbs/yr

<b>Current Parameters</b>		
kgen	0.25	
ThetaGen	1.06	
KDO	0.05	
KSO4	10	
kanox	0.006	
ThetaOx	1.05	
m	1	
n	0.2	
MLVSS	272.2	
O <sub>2</sub> Transfer Coeff.	2	
alpha 1	0.83	
alpha 2	0.6	

Percent Inlet Sulfide Removed 86.0%

R-52

## 7/19/2022

## NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

ata type 1. Site identification	
Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

#### Data Type 2. Model Zone Information

Number of Zones	3	-
Zone Location of Hardpipe	1	-
Type of Basin	ASB	•

## Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units		
Flow	25.48	0.39	MGD -		
Total Sulfide	0.053	0.762	mg/L 🔻		
Sulfate	390	390	mg/L 🝷		

#### Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph 🗸	
Ambient Temperature	79	F	•

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	s	Model Controls
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/l	L	1
Temperature	94.8	91.27	87.57	1000	F	•	Run H2SSIM
рН	7.1	7.22	7.39		s.u.		
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌		-	View
Length	968	1208	1235		feet	•	Parameters
Width	968	604	617	1	feet	•	Clear Input
Depth	4.5	3.2	3		feet	-	Sheet
Mixing	Moderat -	Moderat •	Moderat -				
Number of Aerators	31	15	6	1992			
Total Horsepower	2325	1125	450	100	НР		
Impellor Size	1.625	1.625	1.625	14.56	feet	•	
Impellor RPM	1200	1200	1200	A SAFE	RPM	1	
Diffused Air Flow	0	0	0	10 - L 1	cms	•	
Weir Height	0	0	0	Contraction of	feet	•	

#### 7/20/2022

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7721.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4266.3	1852.9	1602.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	22.2	12.4	10.3		gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	26.800	6.300	5.600		lbs/yr

7/20/2022

Current Parameters				
kgen	0.25			
ThetaGen	1.06			
KDO	0.05			
KSO4	10			
kanox	0.006			
ThetaOx	1.05			
m	1			
n	0.2			
MLVSS	272.2			
O <sub>2</sub> Transfer Coeff.	2			
alpha 1	0.83			
alpha 2	0.6			

Percent Inlet Sulfide Removed -54.1%

## NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Company Name			New-Indy
Facility Na	Facility Name		
Basin Name			ASB
Data Type 2. Model 2	Zone Info	ormation	
Number of Zones	3	-	
Zone Location of Hardpipe	1	-	
Type of Basin	ASB	-	
Data Type 3. Load Ch	aracteris	stics	
Loadina	Mair		- 1 - P.

Characteristics	Influent	Hardpipe	Units
Flow	19.93	0.19	MGD •
Total Sulfide	0.094	0.625	mg/L 🔻
Sulfate	390	390	mg/L 👻

Data Ty	pe 4. Atmospheric Conditions	
---------	------------------------------	--

Data Type 1. Site Identification

Windspeed	3.55	mph	•
Ambient Temperature	79	F	•

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units	N
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L	
Temperature	94.76	90.42	87.08		F 💌	
рН	7.1	7.19	7.35	Editor	s.u.	
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌		_
Length	968	1208	1235	1	feet 🗸	
Width	968	604	617		feet 👻	
Depth	4.5	3.2	3	3.37	feet 🔹	
Mixing	Moderat 🔻	Moderat -	Moderat -			
Number of Aerators	31	15	6	Page 1 and	100	-
Total Horsepower	2325	1125	450		НР	
Impellor Size	1.625	1.625	1.625		feet 🝷	
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms 👻	
Weir Height	0	0	0	100	feet 🝷	

Iodel Contro	rol
Run H2SSI	SIN
View	-
Parameters	s
Clear Input	
Sheet	

### 7/21/2022

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.111	gms/s
Total Emissions (H <sub>2</sub> S)	7700.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	3.9	tons/yr
Total Emissions (H <sub>2</sub> S)	3.5	tonnes/yr
Emission Flux (H <sub>2</sub> S)	15.5	gms/m² yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.06	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4305.7	1814.2	1580.9	11	lbs/yr
Emission Flux (H <sub>2</sub> S)	22.4	12.1	10.1		gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	21.300	5.000	4.400	-	lbs/yr

**Current Parameters** kgen 0.25 ThetaGen 1.06 KDO 0.05 KSO4 10 0.006 kanox ThetaOx 1.05 1 m 0.2 n MLVSS 272.2

2

0.83

0.6

O<sub>2</sub> Transfer Coeff.

alpha 1

alpha 2

Percent Inlet Sulfide Removed -27.1%

## 7/21/2022

## WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION PROJECTED ACTUAL EMISSIONS
## New Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
No Hardpipe flow (foul or stripped)	N/A	N/A	N/A	N/A
ASB Influent (Wastewater)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.25	0.09	0.20	2.60E-03
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.03	0.15	2.13E-03
ASB Zone 2	0.03	5.03E-04	3.19E-03	3.77E-05
ASB Zone 3	0.02	9.42E-06	1.11E-04	1.22E-06
Total ASB	0.12	0.03	0.16	2.17E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, lb/ODTP
Total ASB	1.03E-02	2.81E-03	1.36E-02	1.88E-04

Hardpipe Flow (Foul or Stripped Condensate)		0	MGD
Post-Project ASB Influent Flow:		25.48	MGD
Total ASB Flow:		25.48	MGD
Total ASB Flow:		1116.47	L/s
Pulp Production		2200	ODTP/day
			MW
	H2S		34
	DMDS		94
	DMS		62
	MMC		48

Type of unit is 1 Total water added at the unit (1/s) 50 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 13 friction factor liquid 14 friction factor gas 15 radius of underflow conduit (cm) 16 Underflow T (C) 17 oscillation cycle time (min)	$\begin{array}{c} 0 \\ 50 \\ 5 \\ 61 \\ 40 \\ 25 \\ 84 \\ 128 \\ 66 \\ 447 \\ 500 \\ 015 \\ 016 \\ 006 \\ 12 \\ 25 \\ 5 \end{array}$
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
The second se	
Type of unit is 8 HL partition flag=1, adjust for sorption 9 unit recycle convergence number 10 oil molecular weight	0 200 0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equif 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm	
DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment	
	WWTP\PAE\New
Stripper Scenario\ASB New Stripper V5 3/14/2 COMPOUND: DIMETHYL DISULFIDE	2023 1:52:24 PM 19:27;50
Type of unit is aerated biotreatment	
<pre>1 Description of unit 11 2 Wastewater temperature (C) 3 length of aeration unit (m) 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 17 If covered, then enter 1 18 special input 19 pH (enter 0 for no pH adjustment)</pre>	ASB Zone 1 34.08 295 295 1.4 135 31 75 49.53 1200 0.83 0 19 0 0.3 0 0 7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

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```
hl= 0.001714 atm-m3/mol vp= 45.945 mmHg (0.88868 psia)
       95.2 v/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr d1= 1.041e-05 cm2/s dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.087838 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
   Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
                                           0.11781
  KG aerated (m/s)
   KL aerated (m/s)
                                           0.017486
  KL OVERALL AERATED (m/s)
                                          0.005609
                                          0.005703
  KG quiescent (m/s)
                                          5.971e-06
  KL quiescent (m/s)
  KL OVERALL QUIESCENT (m/s)
                                           5.883e-06
  KL OVERALL (m/s)
                                          2.753e-04
 air stripping time constant (min) 84.752
  FRACTION SURFACE VOLATILIZED
                                          0.36393
                                      0.36393
0.
0.36393
0.61912
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
   FRACTION BIOLOGICALLY REMOVED
                                          0.
  FRACTION ABSORBED
  TOTAL AIR EMISSIONS (g/s)
                                          0.031967
                    (Mg/year)
                                          1.00811
   UNIT EXIT CONCENTRATION (ppmw)
   EMISSION FACTOR (g/cm2-s)
                                          3.673e-11
                                           0.001334
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                   WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50
COMPOUND: DIMETHYL DISULFIDE
Type of unit is system exit stream
1 Description of unit
                                          12
                                                def.system exit st
```

TOTAL AIR EMISSIONS (g/s)

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0.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)3.673e-11UNIT EXIT CONCENTRATION (ppmw)2.231e-06DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50COMPOUND: DIMETHYL DISULFIDEType of unit is open hub drain1 Description of unit13 default open hub d2 Underflow T (C)43.893 Total water added at the unit (1/s)04 Area of openings at unit (cm2)505 Radius of drop pipe (cm)56 Drop length to conduit (cm)617 Open surface=118 Subsurface entrance=109 subsurface exit =1010 radius of underflow conduit (cm)1211 distance to next unit (cm)50012 slope of underflow conduit0.01516 velocity air at drain opening (ft/min)8417 municipal waste in conduit =1018 Assume equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)1

Instance equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)8.9Equilibrium partitioning in drain drop hub is assumed.<br/>Total drain flow is 1116 1/s.<br/>Weight fraction down is 8.680001E-08<br/>Gas concentration in 0 mol fraction.<br/>Gas flow 1116 L/sWeight fraction out at base of drop is 7.87078550837274E-08<br/>fraction transferred in the drain drop from hub is .093228<br/>fraction loss in wastel drop to hubfraction loss in wastel drop to hub0.<br/>fraction loss in wastel drop to hubfraction loss in wastel drop to hub0.<br/>fraction loss in wastel drop to hubfraction loss in wastel drop to hub0.<br/>fraction loss in unitcomponent upstream of unit, g/s0.<br/>mol fract. headspace upstream (y)mol fract. headspace upstream (y)0.<br/>headspace flow down line (cc/s)fraction fract (m/s)1.116e+06<br/>fraction hub (1/s)kG surface (m/s)0.9228<br/>fractial component into unit, g/smol fract. headspace vent base2.233e-06<br/>fraction headspace flow down line (cc/s)flow of waste down hub (1/s)0.<br/>component flow in waste into unit (g/s)component flow in waste into unit (g/s)0.096869<br/>for 0.09031<br/>(Mg/year)minsion FACTOR (g/cm2-s)3.673e-11<br/>0.078708DETAILED CALCULATIONS at Unit 17 ASB Zone 3<br/>Type: aerated biotreatment

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

WWTP\PAE\New

WWTP\PAE\New

```
30.01
 2 Wastewater temperature (C)
                                                 376
 3 length of aeration unit (m)
                                                 188
 4 width of aeration unit (m)
                                                  0.91
 5 depth of aeration unit (m)
 6 Area of agitation (each aerator,m2)
                                               135
 7 Total number of agitators in the unit
                                                 6
 8 Power of agitation (each aerator, HP)
                                                 75
                                                 49.53
 9 Impeller diameter (cm)
                                                 1200
10 Impeller rotation (RPM)
                                                0.83
 11 Agitator mechanical efficiency
                                                0.83
 12 aerator effectiveness, alpha
 13 if there is plug flow, enter 1
                                                 0
                                                 19
 14 Overall biorate (mg/g bio-hr)
                                               0
15 Aeration air flow (m3/s)
                                                 0.3
 16 active biomass, aeration (g/1)
                                                 0
 17 If covered, then enter 1
                                                 0
18 special input
 19 pH (enter 0 for no pH adjustment)
                                                 7.42
 Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
    hl= 0,00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia)
        78.352 y/x
        0.056726 g/L gas per g/L liquid
    Temperature adjustment factor = 1.046 ^(T-25), deg. C
     k1= 0. L/g-hr d1= 1.027e-05 cm2/s dv= 0.085991 cm2/s
 Compound flow rate from inlet water is 5.19e-05 g/s.
 Compound flow rate from inlet vent is 0. g/s.
 Compound flow rate from inlet duct is 0. g/s.
 Submerged aeration rate from inlet vent is 0. m3/s.
 Total submerged aeration is 0. m3/s.
 The residence time in the unit is 16.011 hr,
     Biomass production
     The biomass production rate is 0.mg/hr. (0. mg/L)
     The fraction dissolved solids converted is 0. .
     The estimated biomass exit concentration is 0. mg/L.
         Quiescent wind shear surface Springer
 The fetch to depth ratio is 329.675.
 kl is estimated as 5.918e-06 m/s.
 kg is estimated as 0.005575 m/s. Model: 2
 kg is estimated as 0.005575 m/s. Model: 2
 The Schmidt number is 1.74436.
 The friction velocity is 37.398 m/s
 kg is estimated as 0.012742 m/s. Model: 3
         Agitated surface
 The rotation speed is 125.654 radians per second.
 The rotation factor NRW is 2.052e+06.
 The power number NPR is 7.881e-04.
 The rotation factor NFR is 797.027.
 kg (agitated) is estimated as 0.1143 m/s.
 kl (agitated) is estimated as 0.015772 m/s.
     The specified and growth biomass is 0.3 g/L.
  The effective KL (surface + diffused air) is 5.972e-05 m/s.
  The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
  hrs.)
  The pump mixing time is 5 x the pumping recirculaion time, 0. min.
  The ratio of the mixing to the striping (surface + diffused air) is 0.
  The mean residence time is 960.664 min. (16.011 hr.)
  The ratio of the pump mixing to the residence time is 0.
    KG aerated (m/s)
                                             0.11644
     KL aerated (m/s)
                                             0.015772
    KL OVERALL AERATED (m/s)
                                             0.004711
    KG quiescent (m/s)
                                             0.005679
                                            5.918e-06
     KL quiescent (m/s)
    KL OVERALL QUIESCENT (m/s)
                                            5.813e-06
    KL OVERALL (m/s)
                                            5.972e-05
                                            253.944
    air stripping time constant (min)
```

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0.18149 FRACTION SURFACE VOLATILIZED FRACTION SUBMERGED VOLATILIZED Ο. TOTAL FRACTION VOLATILIZED 0.18149 0.77054 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s)0.(Mg/year)9.419e-06(Mg/year)2.97e-04EMISSION FACTOR (g/cm2-s)1.332e-14UNIT EXIT CONCENTRATION (ppmw)2.231e-06 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment

WWTP\PAE\New

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment 18 ASB Zone 2 1 Description of unit 101 2 Wastewater temperature (C) 32.08 368 3 length of aeration unit (m) 184 4 width of aeration unit (m) 0.97 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 135 15 75 49.53 9 Impeller diameter (cm) 0.83 0.83 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 14 Overall biorate (mg/g bio-hr) 19 0 0.3 0 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/1)17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 86.579 v/x 0.062258 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C kl= 0. L/q-hr dl= 1.034e-05 cm2/s dv= 0.087022 cm2/s Compound flow rate from inlet water is 0.001489 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface \_\_\_\_ Springer\_\_\_\_ The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. R-63

```
kg (agitated) is estimated as 0.11498 m/s.
kl (agitated) is estimated as 0.016622 m/s.
   The specified and growth biomass is 0.3 \text{ g/L}.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes.
(1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 980.894 min. (16,348 hr.)
The ratio of the pump mixing to the residence time is 0.
                                        0.11714
  KG aerated (m/s)
                                            0.016622
  KL aerated (m/s)
                                            0.005152
 KL OVERALL AERATED (m/s)
  KG quiescent (m/s)
                                            0.005738
  KL quiescent (m/s)
                                            5.945e-06
  KL OVERALL QUIESCENT (m/s)
                                            5.85e-06
                                            1.598e-04
 KL OVERALL (m/s)
  air stripping time constant (min)
                                           101.198
                                        0.33782
0.
0.33782
  FRACTION SURFACE VOLATILIZED
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
                                        0.33782
0.62732
0.
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                        5.03e-04
0.015863
7.429e-13
  TOTAL AIR EMISSIONS (g/s)
                    (Mg/year)
  EMISSION FACTOR (g/cm2-s)
                                           7.429e-13
  EMISSION FACTOR (g/cm2-s)7.429e-1UNIT EXIT CONCENTRATION (ppmw)4.65e-05
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Type of unit is 1 Total water added at the unit (1/s) 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 13 friction factor liquid 14 friction factor gas 15 radius of underflow conduit (cm) 16 Underflow T (C) 17 oscillation cycle time (min) 18 design collection velocities (ft/s) 19 design branch line fraction full	50	0 50 5 61 40 25 84 128 66 447 500 .015 .016 .006 12 25 5 2 .4		
Type of unit is 8 HL partition flag=1, adjust for sorptic 9 unit recycle convergence number 10 oil molecular weight 11 oil density (g/cc) 12 NaUT 1=municipal 2=industrial 3=turb. 13 NaUT 1=mass tr. 2=equil 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone Type: aerated biotreatment	n 1 2 1	0 200 0 0 0		
Stripper Scenario\ASB New Stripper V5 3 COMPOUND: DIMETHYL SULFIDE (DMS)	3/14/202	23 1:52:24	PM	WWTP\PAE\New 19:28:26
Type of unit is aerated biotreatment 1 Description of unit 2 Wastewater temperature (C) 3 length of aeration unit (m) 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 17 If covered, then enter 1 18 special input 19 pH (enter 0 for no pH adjustment)	11	ASB Zone 34.08 295 295 1.4 135 31 75 49.53 1200 0.83 0.83 0 19 0 0.3 0 0 7.04	1	

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

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```
hl= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia)
      162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.19163 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
   Biomass production
   The biomass production rate is 0.mg/hr. (0. mg/L)
   The fraction dissolved solids converted is 0. .
   The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s. Model: 2
kg is estimated as 0.007917 m/s. Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14978 m/s.
kl (agitated) is estimated as 0.021024 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 4.77e-04 m/s.
The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1819.519 min. (30.325 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                          0.15258
  KL aerated (m/s)
                                           0.021024
  KL OVERALL AERATED (m/s)
                                           0.009769
 KG quiescent (m/s)
                                           0.008066
                                           7.634e-06
  KL quiescent (m/s)
 KL OVERALL QUIESCENT (m/s)
                                          7.574e-06
 KL OVERALL (m/s)
                                          4.77e-04
 air stripping time constant (min)
                                          48.915
 FRACTION SURFACE VOLATILIZED
                                         0.80146
                                        Ο.
  FRACTION SUBMERGED VOLATILIZED
                                          0.80146
  TOTAL FRACTION VOLATILIZED
  FRACTION BIOLOGICALLY REMOVED
                                          0.17699
  FRACTION ABSORBED
                                          0.
  TOTAL AIR EMISSIONS (g/s)
                                         0.15358
                   (Mg/year)
                                          4.84331
  EMISSION FACTOR (g/cm2-s)
                                          1.765e-10
  UNIT EXIT CONCENTRATION (ppmw)
                                         0.0037
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                  WWTP\PAE\New
 Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26
COMPOUND: DIMETHYL SULFIDE (DMS)
Type of unit is system exit stream.
1 Description of unit
                                          12 def.system exit st
```

TOTAL AIR EMISSIONS (g/s)

Ο.

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(Mg/year)0.EMISSION FACTOR (g/cm2-s)1.765e-10UNIT EXIT CONCENTRATION (ppmw)1.485e-05DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

COMPOUND: DIMETHYL SULFIDE (DMS)

WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26

Type of unit is open hub drain 13 default open hub d 1 Description of unit 2 Underflow T (C) 2 Underflow T (C)43.893 Total water added at the unit (1/s)04 Area of openings at unit (cm2)505 Radius of drop pipe (cm)56 Drop length to conduit (cm)617 Open surface=11 7 Open surface=1 8 Subsurface entrance=1 9 subsurface exit =1 0 9 subsurface exit =1 0 9 subsurface exit =1010 radius of underflow conduit (cm)1211 distance to next unit (cm)50012 slope of underflow conduit0.01516 velocity air at drain opening (ft/min)8417 municipal waste in conduit =1018 Assume equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1116 1/s. Weight fraction down is 1.989E-07 Gas concentration in 0 mol fraction. Gas flow 1116 L/s Weight fraction out at base of drop is 1.71707119336225E-07 fraction transferred in the drain drop from hub is .136716 fraction loss in wastel drop to hub0.fraction loss in collection hub drop0.13672fraction loss in unit0. traction loss in collection hub drop0.13672fraction loss in unit0.fraction loss in line run0.component upstream of unit, g/s0.mol fract. headspace upstream (y)0.headspace at conduit discharge, y0.headspace end of conduit (y)4.229e-19mol fract. headspace vent base1.138e-05headspace flow out vent (cc/s)-1.116e+06headspace flow down line (cc/s)1.116e+06KG surface (m/s)2728.591KL surface (m/s)8.51e-09flow of waste down hub (1/s)0.component flow in waste into unit (g/s)0.22197 component flow in waste into unit (g/s) 0.22197 total component into unit, g/s0.19163TOTAL AIR EMISSIONS (g/s)0.030347(Mg/year)0.95703EMISSION FACTOR (g/cm2-s)1.765e-10UNIT EXIT CONCENTRATION (ppmw)0.17171

UNIT EXIT CONCENTRATION (ppmw) 0. DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

WWTP\PAE\New

```
30.01
 2 Wastewater temperature (C)
 3 length of aeration unit (m)
                                                  376
 4 width of aeration unit (m)
                                                  188
 5 depth of aeration unit (m)
                                                  0.91
 6 Area of agitation (each aerator,m2)
                                                 135
 7 Total number of agitators in the unit
                                                6
 8 Power of agitation (each aerator, HP)
                                                 75
 9 Impeller diameter (cm)
                                                  49.53
 10 Impeller rotation (RPM)
                                                 1200
 11 Agitator mechanical efficiency
                                                0.83
                                               0.83
 12 aerator effectiveness, alpha
 13 if there is plug flow, enter 1
                                                 0
 14 Overall biorate (mg/g bio-hr)
                                                 19
 15 Aeration air flow (m3/s)
                                                  0
 16 active biomass, aeration (g/l)
                                                 0.3
 17 If covered, then enter 1
                                                 0
18 special input
                                                 0
 19 pH (enter 0 for no pH adjustment)
                                                  7.42
 Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
    hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia)
        139.945 y/x
        0.10132 g/L gas per g/L liquid
    Temperature adjustment factor = 1.046 ^(T-25), deg. C
    kl= 0. L/g-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s
 Compound flow rate from inlet water is 1.869e-04 g/s.
 Compound flow rate from inlet vent is 0. g/s.
 Compound flow rate from inlet duct is 0. g/s.
 Submerged aeration rate from inlet vent is 0. m3/s.
 Total submerged aeration is 0. m3/s.
 The residence time in the unit is 16.011 hr.
     Biomass production
     The biomass production rate is 0.mg/hr. (0. mg/L)
     The fraction dissolved solids converted is 0. .
     The estimated biomass exit concentration is 0. mg/L.
         Quiescent wind shear surface Springer
 The fetch to depth ratio is 329.675.
 kl is estimated as 7.566e-06 m/s.
 kg is estimated as 0.007884 m/s. Model: 2
 kg is estimated as 0.007884 m/s. Model: 2
 The Schmidt number is 1.03989.
 The friction velocity is 37.398 m/s
 kg is estimated as 0.017611 m/s. Model: 3
         Agitated surface
 The rotation speed is 125.654 radians per second.
 The rotation factor NRW is 2.052e+06.
 The power number NPR is 7.881e-04.
 The rotation factor NFR is 797.027.
 kg (agitated) is estimated as 0.14804 m/s.
 kl (agitated) is estimated as 0.018962 m/s.
     The specified and growth biomass is 0.3 g/L.
  The effective KL (surface + diffused air) is 1.053e-04 m/s.
  The effective stripping time (surface + diffused air) is 144.073 minutes.
  (2.40122 hrs.)
  The pump mixing time is 5 x the pumping recirculaion time, 0. min.
  The ratio of the mixing to the striping (surface + diffused air) is 0.
  The mean residence time is 960.664 min. (16.011 hr.)
  The ratio of the pump mixing to the residence time is 0.
    KG aerated (m/s)
                                             0.15081
    KL aerated (m/s)
                                             0.018962
    KL OVERALL AERATED (m/s)
                                          0.00854
    KG quiescent (m/s)
                                            0.008032
    KL quiescent (m/s)
                                            7.566e-06
    KL OVERALL QUIESCENT (m/s)
                                            7.497e-06
    KL OVERALL (m/s)
                                             1.053e-04
    air stripping time constant (min).
                                            144.073
```

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FRACTION SURFACE VOLATILIZED0.59112FRACTION SUBMERGED VOLATILIZED0.TOTAL FRACTION VOLATILIZED0.59112FRACTION BIOLOGICALLY REMOVED0.32022FRACTION ABSORBED0.TOTAL AIR EMISSIONS (g/s)1.105e-04(Mg/year)0.003484EMISSION FACTOR (g/cm2-s)1.563e-13UNIT EXIT CONCENTRATION (ppmw)1.485e-05DETAILED CALCULATIONS at Unit 18 ASB Zone 2Type: aerated biotreatment

WWTP\PAE\New

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 1 Description of unit 2 Wastewater temperature (C) 18 ASB Zone 2 32.08 368 3 length of aeration unit (m) 4 width of aeration unit (m) 184 5 depth of aeration unit (m) 0.97 6 Area of agitation (each aerator,m2)1357 Total number of agitators in the unit158 Power of agitation (each aerator,HP)759 Impeller diameter (cm)49.53 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 0 19 0 16 active biomass, aeration (g/1) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1= 0. L/g-hr d1= 1.495e-05 cm2/s dv= 0.14597 cm2/s Compound flow rate from inlet water is 0.004129 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. \_\_\_\_Quiescent wind shear surface\_\_\_Springer\_ The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1,02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

kg (agitated) is estimated as 0.14892 m/s. kl (agitated) is estimated as 0.019984 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 2.809e-04 m/s. The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 980.894 min. (16.348 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15171 KL aerated (m/s) 0.019984 KL OVERALL AERATED (m/s) 0.009148 0.008115 KG quiescent (m/s) KL quiescent (m/s) 7.6e-06 KL OVERALL QUIESCENT (m/s) 7.537e-06 KL OVERALL (m/s) 2.809e-04 air stripping time constant (min) 57.552 0.7715 FRACTION SURFACE VOLATILIZED 0. FRACTION SUBMERGED VOLATILIZED 0.7715 TOTAL FRACTION VOLATILIZED 0.18324 0. FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0.003185 TOTAL AIR EMISSIONS (g/s) 0.10045 (Mg/year) EMISSION FACTOR (g/cm2-s) 4.704e-12 UNIT EXIT CONCENTRATION (ppmw) 1.675e-04

Type of unit is 1 Total water added at the unit (1/s) 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 13 friction factor liquid 14 friction factor gas 15 radius of underflow conduit (cm) 16 Underflow T (C) 17 oscillation cycle time (min) 18 design collection velocities (ft/s) 19 design branch line fraction full	50	0 50 5 61 40 25 84 128 66 447 500 .015 .016 .006 12 25 5 2 .4	
Type of unit is 8 HL partition flag=1, adjust for sorption 9 unit recycle convergence number 10 oil molecular weight 11 oil density (g/cc) 12 NaUT 1=municipal 2=industrial 3=turb. 13 NaUT 1=mass tr. 2=equil 14 parts biomass per 1000 parts COD 15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1 19 biogrowth Monod half concentration ppm DETAILED CALCULATIONS at Unit 11 ASB Zone	1	0 200 0 0 0	
Type: aerated biotreatment Stripper Scenario\ASB New Stripper V5 3/	/14/202	3 1:52:24 PM 19	WWTP\PAE\New 9:28:58
Type of unit is aerated biotreatment 1 Description of unit 2 Wastewater temperature (C) 3 length of aeration unit (m) 4 width of aeration unit (m) 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator,HP) 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 17 If covered, then enter 1	11	ASB Zone 1 34.08 295 295 1.4 135 31 75 49.53 1200 0.83 0.83 0 19 0 0.3 0	

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia)
       230.99 v/x
        0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   kl= 0. L/g-hr dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
 Compound flow rate from inlet water is 0.002397 g/s.
 Compound flow rate from inlet vent is 0. g/s.
 Compound flow rate from inlet duct is 0. g/s.
 Submerged aeration rate from inlet vent is 0. m3/s.
 Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
 The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
 kg is estimated as 0.010871 m/s. Model: 2
 kg is estimated as 0.010871 m/s. Model: 2
 The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
 kg is estimated as 0.024173 m/s. Model: 3
        Agitated surface
 The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18977 m/s.
kl (agitated) is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)
                                           0.19332
   KL aerated (m/s)
                                           0.021167
                                           0.012876
  KL OVERALL AERATED (m/s)
  KG quiescent (m/s)
                                           0.011075
   KL quiescent (m/s)
                                           7.703e-06
   KL OVERALL QUIESCENT (m/s)
                                           7.672e-06
                                           6.265e-04
   KL OVERALL (m/s)
                                        37.242
0.88816
   air stripping time constant (min)
   FRACTION SURFACE VOLATILIZED
                                        Ο.
   FRACTION SUBMERGED VOLATILIZED
   TOTAL FRACTION VOLATILIZED
                                           0.88816
                                        0.09366
   FRACTION BIOLOGICALLY REMOVED
   FRACTION ABSORBED
                                           0.
   TOTAL AIR EMISSIONS (g/s)
                                          0.002129
                    (Mg/year)
                                           0.06713
                                           2.446e-12
   EMISSION FACTOR (g/cm2-s)
   UNIT EXIT CONCENTRATION (ppmw)
                                           3.904e-05
 DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                   WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)
Type of unit is system exit stream
1 Description of unit
                                         12 def.system exit st
```

TOTAL AIR EMISSIONS (g/s)

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0.

0. (Mg/year) (Mg/year) 0. EMISSION FACTOR (g/cm2-s) 2.446e-12 EMISSION FACTOR (g/cm2-s)2.446e-1UNIT EXIT CONCENTRATION (ppmw)1.24e-07 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential New Stripper Permitting Emissions WWTP PAE New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan) Type of unit is open hub drain 13 default open hub d 1 Description of unit 2 Underflow T (C) 3 Total water added at the unit (l/s) 4 Area of openings at unit (cm2) 0 50 5 Radius of drop pipe (cm) 5 6 Drop length to conduit (cm) 61 7 Open surface=1 1 7 Open Surface=1 8 Subsurface entrance=1 9 subsurface exit =1 0 9 subsurface exit =1 0 10 radius of underflow conduit (cm)50011 distance to next unit (cm)50012 slope of underflow conduit0.01516 velocity air at drain opening (ft/min)8400 10 radius of underflow conduit (cm) 12 17 municipal waste in conduit =1018 Assume equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1116 1/s. Weight fraction down is 2.6E-09 Gas concentration in 0 mol fraction. Gas flow 1116 L/s Weight fraction out at base of drop is 2.14759568570224E-09 fraction transferred in the drain drop from hub is .174002 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.174 Iraction loss in collection hub drop0.174fraction loss in unit0.fraction loss in line run0.component upstream of unit, g/s0.mol fract. headspace upstream (y)0.headspace at conduit discharge, y0.headspace end of conduit (y)6.896e-21mol fract. headspace vent base2.445e-07headspace flow out vent (cc/s)-1.116e+06headspace flow down line (cc/s)1.116e+06KG surface (m/s)3741.46KL surface (m/s)0.component flow in waste into unit (g/s)0.002902 component flow in waste into unit (g/s) 0.002902 total component into unit, g/s0.002397TOTAL AIR EMISSIONS (g/s)5.049e-04(Mg/year)0.015922EMISSION FACTOR (g/cm2-s)2.446e-12UNIT EXIT CONCENTRATION (ppmw)0.002148 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

WWTP\PAE\New

```
30.01
2 Wastewater temperature (C)
                                                 376
3 length of aeration unit (m)
                                                188
4 width of aeration unit (m)
                                                0.91
5 depth of aeration unit (m)
6 Area of agitation (each aerator,m2)
7 Total number of agitators in the unit
8 Power of agitation (each aerator,HP)
0 Immellian diameter (am)
                                             135
6
                                                75
                                                49.53
9 Impeller diameter (cm)
                                                1200
10 Impeller rotation (RPM)
                                       0.83
11 Agitator mechanical efficiency
12 aerator effectiveness, alpha
                                                0
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
                                                19
                                                0
15 Aeration air flow (m3/s)
                                                0.3
16 active biomass, aeration (g/l)
                                                0
17 If covered, then enter 1
                                                0
18 special input
19 pH (enter 0 for no pH adjustment)
                                                 7.42
Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
  hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
       204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s
Compound flow rate from inlet water is 1.671e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.011 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
     Quiescent wind shear surface Springer
The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s. Model: 2
kg is estimated as 0.010826 m/s. Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18756 m/s.
kl (agitated) is estimated as 0.019092 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.391e-04 m/s.
 The effective stripping time (surface + diffused air) is 109.038 minutes.
 (1.81731 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 960.664 min. (16.011 hr.)
 The ratio of the pump mixing to the residence time is 0.
                          0.19108
   KG aerated (m/s)
   KL aerated (m/s)
                                            0.019092
   KL OVERALL AERATED (m/s)
                                           0.011483
                                           0.011029
   KG quiescent (m/s)
                                           7.635e-06
   KL quiescent (m/s)
   KL OVERALL QUIESCENT (m/s)
                                           7.6e-06
                                            1.391e-04
   KL OVERALL (m/s)
   air stripping time constant (min)
                                            109.038
```

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FRACTION SURFACE VOLATILIZED	0.7296
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.7296
FRACTION BIOLOGICALLY REMOVED	0.18759
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	1.219e-06
(Mg/year)	3.844e-05
EMISSION FACTOR (g/cm2-s)	1.724e-15
UNIT EXIT CONCENTRATION (ppmw)	1.24e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment	

WWTP\PAE\New

Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 18 ASB Zone 2 1 Description of unit 32.08 2 Wastewater temperature (C)368 3 length of aeration unit (m) 184 4 width of aeration unit (m) 0.97 5 depth of aeration unit (m) 6 Area of agitation (each aerator, m2) 135 7 Total number of agitators in the unit 15 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 1200 10 Impeller rotation (RPM) 0.83 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0 13 if there is plug flow, enter 1 19 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 0 0.3 16 active biomass, aeration (g/l) 0 17 If covered, then enter 1 18 special input 0 7.24 19 pH (enter 0 for no pH adjustment) Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 217.838 v/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor =  $1.046 \wedge (T-25)$ , deg. C k1=0. L/g-hrdl= 1.515e-05 cm2/s dv= 0.23433 cm2/s Compound flow rate from inlet water is 4.357e-05 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 16.348 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. \_Quiescent wind shear surface \_\_\_\_ Springer\_\_\_ The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. kg is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0,010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. B-75

kg (agitated) is estimated as 0.18868 m/s. kl (agitated) is estimated as 0.020121 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 3.715e-04 m/s. The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 980.894 min. (16.348 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.19222 0.020121 KL aerated (m/s) 0.012174 KL OVERALL AERATED (m/s) 0.011143 KG quiescent (m/s) KL quiescent (m/s) 7.67e-06 KL OVERALL QUIESCENT (m/s) 7.637e-06 KL OVERALL (m/s) 3.715e-04 air stripping time constant (min) 43.518 0.86431 FRACTION SURFACE VOLATILIZED 0. FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED 0.86431 0.097342 FRACTION BIOLOGICALLY REMOVED 0. FRACTION ABSORBED TOTAL AIR EMISSIONS (g/s) 3.766e-05 0.001188 (Mg/year) 5.562e-14 EMISSION FACTOR (g/cm2-s) 1.497e-06 UNIT EXIT CONCENTRATION (ppmw)

## Backup Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings to Backup Stripper	147	15.00	17.00	16.00
Backup Stripper TRS Removal Efficiency	0.98	0.98	0.98	0.98
Stripped Condensate to Hardpipe	2.93	0.30	0.34	0.32
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.38	0.10	0.21	0.02
WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.04	0.17	0.01
ASB Zone 2	0.03	6.14E-04	3.60E-03	2.73E-04
ASB Zone 3	0.02	1.20E-05	1.31E-04	9.23E-06
Total ASB	0.13	0.04	0.17	0.02
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.09E-02	3.28E-03	1.47E-02	1.30E-03

Post-Project Stripped Condensate Flow: Post-Project Stripped Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: Pulp Production 850 gpm 1.22 MGD 25.48 MGD 26.71 MGD 1170 L/s 2200 ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

muun vé vult in	
Type of unit is	0
2 Area of openings at unit (cm2)	50
3 Radius of dron nine (cm)	50
4 Drop length to conduit (cm)	5 61
5 Humidity of inlet air (%)	40
6 Tomporature of air (C)	25
7 Drain air valacity (fr(min)	2.5
/ Didin dir velocity (it/min)	04
8 mannole air velocity (it/min)	128
9 Conduit air velocity (it/min)	
10 Wind speed (CM/S at 10 m)	447
11 distance to next unit (om)	500
12 Stope of underliew conduit	.015
14 fairting factor liquid	.016
14 Inician factor gas	.006
15 radius of underflow conduit (cm)	12
16 Underflow T (C)	25
17 oscillation cycle time (min)	5
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
Type of unit is	
8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density $(a/cc)$	Ő
12 NaUT l=municipal 2=industrial 3=turb	0
13 NaUT 1=mass tr 2=equil	õ
14 parts biomass per 1000 parts COD	0
15 oil water partition method 0=ownc	
16 use UNITAC aqueous data base =1	
17 specify mass transfer for unit =1	
18 Use biomass for unit option =1	
19 biogrowth Monod half concentration ppm	
DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment	
Stripper Scepario\ASB Old Stripper V7 3/16/20	WWTP\PAE\OId 023 1.51.43 DM 11.39.37
COMPOUND: DIMETHYL DISULFIDE	023 1.31.45 FM 11.39.37
Type of unit is aerated biotreatment	
1 Description of unit 11	ASB Zone 1
2 Wastewater temperature (C)	34.08
3 length of aeration unit (m)	295
4 width of aeration unit (m)	295
5 depth of aeration unit (m)	1.4
6 Area of agitation (each aerator,m2)	135
7 Total number of agitators in the unit	31
8 Power of agitation (each aerator, HP)	75
9 Impeller diameter (cm)	49.53
10 Impeller rotation (RPM)	1200
11 Agitator mechanical efficiency	0.83
12 aerator effectiveness, alpha	0.83
13 if there is plug flow, enter 1	0
14 Overall biorate (mg/g bio-hr)	19
15 Aeration air flow (m3/s)	0
16 active biomass, aeration (g/l)	0.3
17 If covered, then enter 1	0
18 special input	0
19 pH (enter 0 for no pH adjustment)	7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
hl= 0.001714 atm-m3/mol vp= 45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   kl= 0. L/g-hr dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.10249 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
   The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                    0.11781
  KL aerated (m/s)
                                         0.017486
 KL OVERALL AERATED (m/s)
                                         0.005609
  KG quiescent (m/s)
                                          0.005703
  KL quiescent (m/s)
                                          5.971e-06
  KL OVERALL QUIESCENT (m/s)
                                          5.883e-06
  KL OVERALL (m/s)
                                          2.753e-04
                                       84.752
0.36364
  air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                       Ο.
   FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
                                          0.36364
                                      0.6186
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                          0.
  TOTAL AIR EMISSIONS (g/s)
                                         0.037268
                   (Mg/year)
                                          1.17529
  EMISSION FACTOR (g/cm2-s)
                                          4.282e-11
  UNIT EXIT CONCENTRATION (ppmw) 0.001555
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                  WWTP\PAE\01d
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37
COMPOUND: DIMETHYL DISULFIDE
Type of unit is system exit stream
                                         12 def.system exit st
1 Description of unit
```

TOTAL AIR EMISSIONS (g/s)

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0.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)4.282e-11UNIT EXIT CONCENTRATION (ppmw)2.847e-06DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain					
1 Description of unit	13	default	open	hub	d
2 Underflow T (C)		43.89			
3 Total water added at the unit $(1/s)$		0			
4 Area of openings at unit (cm2)		50			
5 Radius of drop pipe (cm)		5			
6 Drop length to conduit (cm)		61			
7 Open surface=1		1			
8 Subsurface entrance=1		0			
9 subsurface exit =1		0			
10 radius of underflow conduit (cm)		12			
11 distance to next unit (cm)		500			
12 slope of underflow conduit		0.015			
16 velocity air at drain opening (ft/min)		84			
17 municipal waste in conduit =1		0			
18 Assume equilibrium in unit, =1		0			
19 pH (enter 0 for no pH adjustment)		8.9			
Total drain flow is 11/0 1/s. Weight fraction down is 9.66E-08 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is fraction transferred in the drain drop fraction loss in wastel drop to hub fraction loss in waste2 drop to hub fraction loss in waste3 drop to hub fraction loss in collection hub drop fraction loss in unit fraction loss in line run component upstream of unit, g/s mol fract. headspace upstream (y) headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base headspace flow out vent (cc/s)	8.759 from h 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	421435509 ub is .09 3228 7e-08 2e-19 6e-06 7e-06	91E-08 93228	3	
Readspace from down fine (cc/s) KG surface (m/s)	2007	.233 .200			
KL SUTIACE (M/S)	6.18	/e-09			

WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39;37 COMPOUND: DIMETHYL DISULFIDE

Õ.

0.010537

0.33229

4.282e-11

Type of unit is aerated biotreatment 1 Description of unit

TOTAL AIR EMISSIONS (g/s)

EMISSION FACTOR (g/cm2-s)

Type: aerated biotreatment

flow of waste down hub (1/s)

DETAILED CALCULATIONS at Unit 17 ASB Zone 3

component flow in waste into unit (g/s) 0.11302 total component into unit, g/s 0.10249

UNIT EXIT CONCENTRATION (ppmw) 0.087594

(Mg/year)

17 ASB Zone 3

30.01 2 Wastewater temperature (C) 376 3 length of aeration unit (m) 188 4 width of aeration unit (m) 0.91 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 0.83 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0 13 if there is plug flow, enter 1 19 14 Overall biorate (mg/g bio-hr) 0 15 Aeration air flow (m3/s) 0.3 16 active biomass, aeration (g/1) 0 17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F) hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia) 78.352 y/x 0.056726 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s Compound flow rate from inlet water is 6.639e-05 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 5.918e-06 m/s. kg is estimated as 0.005575 m/s. Model: 2 kg is estimated as 0.005575 m/s. Model: 2 The Schmidt number is 1.74436. The friction velocity is 37.398 m/s kg is estimated as 0.012742 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.1143 m/s. kl (agitated) is estimated as 0.015772 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 5.972e-05 m/s. The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.11644 0.015772 KL aerated (m/s) KL OVERALL AERATED (m/s) 0.004711 KG quiescent (m/s) 0.005679 5.918e-06 KL quiescent (m/s) KL OVERALL QUIESCENT (m/s) 5.813e-06 KL OVERALL (m/s) 5.972e-05 air stripping time constant (min) 253.944

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FRACTION SURFACE VOLATILIZED 0.18107 FRACTION SUBMERGED VOLATILIZED 0. 0.18107 TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED 0.76875 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 1.202e-05 (Mg/year) EMISSION FACTOR (g/cm2-s) 3.791e-04 1.7e-14 UNIT EXIT CONCENTRATION (ppmw) 2.847e-06 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment

WWTP\PAE\01d

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment		
1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.08
3 length of aeration unit (m)		368
4 width of aeration unit (m)		184
5 depth of aeration unit (m)		0.97
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		15
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration $(g/1)$		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.24
Temperature adjustment factor = 1.046 ' kl= 0. L/g-hr dl= 1.034e-05 cm Compound flow rate from inlet water is 0.0 Compound flow rate from inlet vent is 0. c Compound flow rate from inlet duct is 0. c Submerged aeration rate from inlet vent is Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 k	`(T-25) n2/s d 00182 g g/s. g/s. s 0. m3 nr.	, deg. C lv= 0.087022 cm2/s //s.
Blomass production	10	marIT
The fraction dissolved solids converte	d is $0$	lug/μ)
The estimated biomass exit concentrati	onis	0 mg/T
Oujescent wind shear surface Spr	inger	5. mg/ 1.
The fetch to depth ratio is 302.703.		
kl is estimated as 5.945e-06 m/s.		
kg is estimated as 0.005633 m/s. Model: 2	2	
kg is estimated as 0.005633 m/s. Model: 2	2	
The Schmidt number is 1.72371.		
The friction velocity is 37.398 m/s		
kg is estimated as 0.012836 m/s. Model: 3	3	
Agitated surface		
The rotation speed is 125.654 radians per	second	
The rotation factor NRW is 2.052e+06.		
The power number NPR is 7.881e-04.		
The rotation factor NFR is 797.027.		

```
kg (agitated) is estimated as 0.11498 m/s.
kl (agitated) is estimated as 0.016622 m/s.
    The specified and growth biomass is 0.3 \text{ g/L}.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes.
(1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.
                                          0.11714
  KG aerated (m/s)
                                          0.016622
  KL aerated (m/s)
                                          0.005152
  KL OVERALL AERATED (m/s)
                                          0.005738
  KG quiescent (m/s)
                                          5.945e-06
  KL quiescent (m/s)
  KL OVERALL QUIESCENT (m/s)
                                          5.85e-06
 KL OVERALL (m/s)
                                          1.598e-04
  air stripping time constant (min)
                                         101.198
                                        0.33725
  FRACTION SURFACE VOLATILIZED
                                        0.
  FRACTION SUBMERGED VOLATILIZED
                                        0.33725
  TOTAL FRACTION VOLATILIZED
                                       0.62627
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                        0.
  TOTAL AIR EMISSIONS (q/s)
                                         6.138e-04
                                       0.019356
                   (Mg/year)
 EMISSION FACTOR (g/cm2-s)
                                          9.065e-13
                                      5.674e-05
  UNIT EXIT CONCENTRATION (ppmw)
```

Type of unit is 1 Total water added at the unit (1/s) 2 Area of openings at unit (cm2) 3 Radius of drop pipe (cm) 4 Drop length to conduit (cm) 5 Humidity of inlet air (%) 6 Temperature of air (C) 7 Drain air velocity (ft/min) 8 manhole air velocity (ft/min) 9 Conduit air velocity (ft/min) 10 Wind speed (cm/s at 10 m) 11 distance to next unit (cm) 12 slope of underflow conduit 13 friction factor liquid 14 friction factor gas 15 radius of underflow conduit (cm) 16 Underflow T (C)	50	0 50 5 61 40 25 84 128 66 447 500 .015 .016 .006 12 25		
17 oscillation cycle time (min)		5		
18 design collection velocities (ft/s)		2		
19 design branch line fraction full		. 4		
Type of unit is		0		
8 HL partition flag=1, adjust for sorptio	n	200		
10 oil molecular weight		0		
11 oil density (g/cc)		0		
12 NaUT 1=municipal 2=industrial 3=turb.		0		
13 NaUT 1=mass tr. 2=equil		0		
14 parts biomass per 1000 parts COD				
15 oil water partition method 0=owpc				
16 use UNIFAC aqueous data base =1				
17 specify mass transfer for unit, =1				
19 biogrowth Monod half concentration ppm				
DETAILED CALCULATIONS at Unit 11 ASB Zone	1			
Type: aerated biotreatment				
Strippor Cooperio\ASD Old Strippor V7 3	/16/201	2 1.51.42	DM	WWTP\PAE\OId
COMPOUND: DIMETHYL SULFIDE (DMS)	/10/202	1.01.40	LEI	19.24.10
Type of unit is aerated biotreatment				
1 Description of unit	11	ASB Zone	1	
2 Wastewater temperature (C)		34.08		
3 length of aeration unit (m)		295		
4 width of aeration unit (m)		295		
5 depth of aeration unit (m)		1.4		
6 Area of agitation (each aerator, m2)		135		
9 Power of agitation (each agrator HP)		75		
9 Impeller diameter (cm)		49.53		
10 Impeller rotation (RPM)		1200		
11 Agitator mechanical efficiency		0.83		
12 aerator effectiveness, alpha		0.83		
13 if there is plug flow, enter 1		0		
14 Overall biorate (mg/g bio-hr)		19		
15 Aeration air flow (m3/s)		0		
16 active biomass, aeration (g/l)		0.3		
1/ It covered, then enter 1		0		
10 pH (optor 0 for no pH adjustment)		7 04		
to bu (encer o tot no bu adjustment)		/.04		

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

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```
hl= 0.002924 atm-m3/mo1 vp= 704.653 mmHg (13.629 psia)
      162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.20746 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s. Model: 2
kg is estimated as 0.007917 m/s. Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14978 m/s.
kl (agitated) is estimated as 0.021024 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 4.77e-04 m/s.
The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1735.541 min. (28.926 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.15258
  KL aerated (m/s)
                                           0.021024
  KL OVERALL AERATED (m/s)
                                          0.009769
                                          0.008066
 KG quiescent (m/s)
 KL quiescent (m/s)
                                          7.634e-06
KL OVERALL QUIESCENT (m/s)
                                         7.574e-06
  KL OVERALL (m/s)
                                          4.77e-04
  air stripping time constant (min)
                                          48.915
 FRACTION SURFACE VOLATILIZED
                                         0.80063
                                        0.
0.80063
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
  FRACTION BIOLOGICALLY REMOVED
                                          0.17681
  FRACTION ABSORBED
                                           0.
  TOTAL AIR EMISSIONS (g/s)
                                          0.1661
                                          5.23815
                   (Mg/year)
                                          1.909e-10
  EMISSION FACTOR (g/cm2-s)
  UNIT EXIT CONCENTRATION (ppmw)
                                           0.004001
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                   WWTP\PAE\01d
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18
COMPOUND: DIMETHYL SULFIDE (DMS)
Type of unit is system exit stream
1 Description of unit
                                         12
                                               def.system exit st
```

TOTAL AIR EMISSIONS (g/s)

Ο.

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 (Mg/year)
 0.

 EMISSION FACTOR (g/cm2-s)
 1.909e-10

 UNIT EXIT CONCENTRATION (ppmw)
 1.753e-05
 DETAILED CALCULATIONS at Unit 13 default open hub d Type: open hub drain WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS) Type of unit is open hub drain 1 Description of unit13default open hub d2 Underflow T (C)43.89 43.89 2 Underflow T (C) 2 Underflow T (C)433 Total water added at the unit (1/s)04 Area of openings at unit (cm2)505 Radius of drop pipe (cm)56 Drop length to conduit (cm)617 Open surface=118 Subsurface entrance=109 subsurface exit =10 9 subsurface exit =1010 radius of underflow conduit (cm)1211 distance to next unit (cm)50012 slope of underflow conduit0.01516 velocity air at drain opening (ft/min)8417 municipal waste in conduit =1018 Assume equilibrium in unit, =1019 pH (enter 0 for no pH adjustment)8.9 Equilibrium partitioning in drain drop hub is assumed. Total drain flow is 1170 l/s. Weight fraction down is 2.054E-07 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is 1.77318497496617E-07 fraction transferred in the drain drop from hub is .136716 fraction loss in wastel drop to hub 0. fraction loss in waste2 drop to hub 0. fraction loss in waste3 drop to hub 0. fraction loss in collection hub drop 0.13672 fraction loss in collection hub drop0.13672fraction loss in unit0.fraction loss in line run0.component upstream of unit, g/s0.mol fract. headspace upstream (y)0.headspace at conduit discharge, y0.headspace end of conduit (y)4.299e-19mol fract. headspace vent base1.175e-05headspace flow out vent (cc/s)-1.17e+06headspace flow down line (cc/s)1.17e+06KG surface (m/s)2834.248KL surface (m/s)8.784e-09flow of waste down hub (1/s)0.component flow in waste into unit (g/s)0.24032 component flow in waste into unit (g/s) 0.24032 total component into unit, g/s0.20746TOTAL AIR EMISSIONS (g/s)0.032855(Mg/year)1.03613EMISSION FACTOR (g/cm2-s)1.909e-10UNIT EXIT CONCENTRATION (ppmw)0.17732 DETAILED CALCULATIONS at Unit 17 ASB Zone 3 Type: aerated biotreatment

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

WWTP\PAE\01d

```
2 Wastewater temperature (C)
                                                30.01
3 length of aeration unit (m)
                                                376
4 width of aeration unit (m)
                                                188
5 depth of aeration unit (m)
                                               0.91
6 Area of agitation (each aerator,m2)
                                               135
7 Total number of agitators in the unit
                                               6
                                               75
8 Power of agitation (each aerator, HP)
9 Impeller diameter (cm)
                                               49.53
10 Impeller rotation (RPM)
                                                1200
                                              0.83
11 Agitator mechanical efficiency
                                             0.83
12 aerator effectiveness, alpha
                                             0
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
                                               19
15 Aeration air flow (m3/s)
                                                0
16 active biomass, aeration (g/l)
                                                0.3
17 If covered, then enter 1
                                               0
18 special input
                                                0
19 pH (enter 0 for no pH adjustment)
                                                7.42
Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F)
   hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia)
       139.945 y/x
       0.10132 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr d1= 1.485e-05 cm2/s dv= 0.14425 cm2/s
Compound flow rate from inlet water is 2.217e-04 g/s.
Compound flow rate from inlet vent is 0. q/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 329.675.
kl is estimated as 7.566e-06 m/s.
kg is estimated as 0.007884 m/s. Model: 2
kg is estimated as 0.007884 m/s. Model: 2
The Schmidt number is 1.03989.
The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s. Model: 3
        Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14804 m/s.
kl (agitated) is estimated as 0.018962 m/s.
    The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 1.053e-04 m/s.
 The effective stripping time (surface + diffused air) is 144.073 minutes.
 (2.40122 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                  0.15081
                                     0.018962
  KL aerated (m/s)
                                        0.00854
  KL OVERALL AERATED (m/s)
  KG quiescent (m/s)
                                          0.008032
  KL quiescent (m/s)
                                          7.566e-06
   KL OVERALL QUIESCENT (m/s)
                                          7.497e-06
   KL OVERALL (m/s)
                                          1.053e-04
   air stripping time constant (min)
                                           144.073
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FRACTION SURFACE VOLATILIZED 0.5886 FRACTION SUBMERGED VOLATILIZED 0. 0.5886 TOTAL FRACTION VOLATILIZED 0.31886 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 1.305e-04 (Mg/year) 0.004115 EMISSION FACTOR (g/cm2-s) 1.846e-13 UNIT EXIT CONCENTRATION (ppmw) 1.753e-05 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment

WWTP\PAE\Old

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 1 Description of unit 18 ASB Zone 2 2 Wastewater temperature (C) 32.08 368 3 length of aeration unit (m) 4 width of aeration unit (m) 184 0.97 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 15 75 8 Power of agitation (each aerator, HP) 49.53 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 19 14 Overall biorate (mg/g bio-hr) 0 15 Aeration air flow (m3/s) 0.3 0 16 active biomass, aeration (g/l) 17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL SULFIDE (DMS) at 32.1 deg.C (89.7 deg.F) hl= 0.002719 atm-m3/mol vp= 655.201 mmHg (12.673 psia) 151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr d1= 1.495e-05 cm2/s dv= 0.14597 cm2/s Compound flow rate from inlet water is 0.004681 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.6e-06 m/s. kg is estimated as 0.007966 m/s. Model: 2 kg is estimated as 0.007966 m/s. Model: 2 The Schmidt number is 1.02758. The friction velocity is 37.398 m/s kg is estimated as 0.017744 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

kg (agitated) is estimated as 0.14892 m/s. kl (agitated)is estimated as 0.019984 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 2.809e-04 m/s. The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15171 KL aerated (m/s) 0.019984 KL OVERALL AERATED (m/s) 0.009148 KG quiescent (m/s) 0.008115 KL quiescent (m/s) 7.6e-06 KL OVERALL QUIESCENT (m/s) 7.537e-06 2.809e-04 KL OVERALL (m/s) air stripping time constant (min) 57.552 0.76981 FRACTION SURFACE VOLATILIZED 0. 0.76981 FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED 0.18284 0. FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0.003604 0.11365 TOTAL AIR EMISSIONS (g/s) (Mg/year) 5.322e-12 EMISSION FACTOR (g/cm2-s) 1.895e-04 UNIT EXIT CONCENTRATION (ppmw)

Type of unit is			
1 Total water added at the unit (1/s)	50	0	
2 Area of openings at unit (cm2)		50	
3 Radius of drop pipe (cm)		5	
4 Drop length to conduit (cm)		61	
5 Humidity of inlet air (%)		40	
6 Temperature of air (C)		25	
7 Drain air velocity (ft/min)		84	
8 manhole air velocity (ft/min)		128	
9 Conduit air velocity (ft/min)		66	
10 Wind speed (cm/s at 10 m)		447	
11 distance to next unit (cm)		500	
12 slope of underflow conduit		.015	
13 friction factor liquid		.016	
14 friction factor gas		.006	
15 radius of underflow conduit (cm)		12	
16 Underflow T (C)		25	
17 oscillation cycle time (min)		5	
18 design collection velocities (ft/s)		2	
19 design branch line fraction full		. 4	
Type of unit is			
8 HL partition flag=1, adjust for sorption	1	0	
9 unit recycle convergence number		200	
10 oil molecular weight		0	
11 oil density (g/cc)		0	
12 NaUT 1=municipal 2=industrial 3=turb.		0	
13 NaUT 1=mass tr. 2=equil		0	
14 parts biomass per 1000 parts COD			
15 oil water partition method 0=owpc			
16 use UNIFAC aqueous data base =1			
17 specify mass transfer for unit, =1			
18 Use biomass for unit option, =1			
19 biogrowth Monod half concentration ppm			
DETAILED CALCULATIONS at Unit 11 ASB Zone	1		
Type: aerated biotreatment			
			WWTP\PAE\01d
Stripper Scenario\ASB Old Stripper V7 3/	16/202	23 1:51:43 P	M 19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)			
Type of unit is aerated biotreatment			
1 Description of unit	11	ASB Zone 1	
2 Wastewater temperature (C)	++	34_08	
3 length of peration unit (m)		295	
A width of aeration unit (m)		295	
5 depth of aeration unit (m)		1 4	
6 Area of agitation (orch aprator m2)		135	
7 Total number of agitators in the unit		21	
8 Power of agitation (each agrator HP)		J1 75	
9 Impoller diameter (cm)		10 52	
10 Impollor retation (RPM)		49.00	
11 Agitator mechanical officiency		1200	
12 agrator affectiveness alpha		0.03	
13 if there is plug flow optor 1		0.05	
14 Overall biorate (ma/a bio ba)		10	
15 Deration air flow (m3/a)		19	
16 active biomage acception (a/1)		0.2	
17 If covered then enter 1		0.3	
19 special input		0	
10 pu (optor 0 for no pu odiustmont)		7 04	
TY PH (ENCET V TOT NO PH adjustment)		1.04	

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
hl= 0.004158 atm-m3/mol vp= 2272.142 mmHg (43.948 psia)
       230.99 v/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.016622 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s. Model: 2
kg is estimated as 0.010871 m/s. Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s. Model: 3
      Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18977 m/s.
kl (agitated) is estimated as 0.021167 m/s.
   The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.19332
  KL aerated (m/s)
                                           0.021167
  KL OVERALL AERATED (m/s)
                                          0.012876
                                          0.011075
  KG quiescent (m/s)
                                         7.703e-06
  KL quiescent (m/s)
  KL OVERALL QUIESCENT (m/s)
                                           7.672e-06
                                        6.265e-04
  KL OVERALL (m/s)
                                       37.242
0.88738
  air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                        0.
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
                                           0.88738
  FRACTION BIOLOGICALLY REMOVED
                                          0.093577
  FRACTION ABSORBED
                                          0.
                                         0.01475
  TOTAL AIR EMISSIONS (g/s)
                                         0.46517
                   (Mg/year)
                                         1.695e-11
   EMISSION FACTOR (g/cm2-s)
  UNIT EXIT CONCENTRATION (ppmw) 2.705e-04
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
                                                                   WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)
Type of unit is system exit stream
1 Description of unit
                                          12 def.system exit st
```

TOTAL AIR EMISSIONS (g/s)

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0.

(Mg/year)0.EMISSION FACTOR (g/cm2-s)1.695e-11UNIT EXIT CONCENTRATION (ppmw)9.387e-07DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\PAE\Old

WWTP\PAE\01d

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain		
1 Description of unit	13 default open hub d	
2 Underflow T (C)	43.89	
3 Total water added at the unit $(1/s)$	0	
4 Area of openings at unit (cm2)	50	
5 Radius of drop pipe (cm)	5	
6 Drop length to conduit (cm)	61	
7 Open surface=1	1	
8 Subsurface entrance=1	0	
9 subsurface exit =1	0	
10 radius of underflow conduit (cm)	12	
11 distance to next unit (cm)	500	
12 slope of underflow conduit	0.015	
16 velocity air at drain opening (ft/min)	84	
17 municipal waste in conduit =1	0	
18 Assume equilibrium in unit, =1	0	
19 pH (enter 0 for no pH adjustment)	8.9	
Total drain flow is 1170 l/s. Weight fraction down is 1.72E-08 Gas concentration in 0 mol fraction.	5 15 d55 diled.	
Gas flow 1170 L/s		
Weight fraction out at base of drop is	1.42071711698917E-08	
fraction transferred in the drain drop :	from hub is .174002	
fraction loss in wastel drop to hub	0.	
fraction loss in waste2 drop to hub	0.	
fraction loss in waste3 drop to hub	0.	
fraction loss in collection hub drop	0.174	
fraction loss in unit	0.	
fraction loss in line run	Ο.	
component upstream of unit, g/s	0.	
mol fract. headspace upstream (y)	0.	
headspace at conduit discharge, y	0.	
headspace end of conduit (y)	4.491e-20	
mol fract. headspace vent base	1.618e-06	
headspace flow out vent (cc/s)	-1.17e+06	
headspace flow down line (cc/s)	1.17e+06	
KG surface (m/s)	3886.338	
KL surface (m/s)	8.868e-09	
flow of waste down hub (1/s)	0.	
component flow in waste into unit (g/s)	0.020124	
total component into unit. g/s	0.016622	
TOTAL AIR EMISSIONS (d/s)	0.003502	
(Mg/vear)	0.11043	
EMISSION FACTOR (a/cm2-s)	1.695e-11	
UNIT EXIT CONCENTRATION (DDmw)	0.014207	
DETAILED CALCULATIONS at Unit 17 ASR Zone	3	
Type: aerated biotreatment		
The detailed procreatments		

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 1 Description of unit

17 ASB Zone 3

```
30.01
 2 Wastewater temperature (C)
 3 length of aeration unit (m)
                                                376
 4 width of aeration unit (m)
                                                188
                                               0.91
 5 depth of aeration unit (m)
 6 Area of agitation (each aerator,m2)
                                               135
                                             6
75
 7 Total number of agitators in the unit
 8 Power of agitation (each aerator, HP)
 9 Impeller diameter (cm)
                                               49.53
                                                1200
 10 Impeller rotation (RPM)
                                               0.83
 11 Agitator mechanical efficiency
                                             0.83
0
19
0
 12 aerator effectiveness, alpha
13 if there is plug flow, enter 1
13 if there is plug flow, enter 1
14 Overall biorate (mg/g bio-hr)
15 Aeration air flow (m3/s)
16 active biomass, aeration (g/l)
                                                0.3
                                               0
 17 If covered, then enter 1
 18 special input
                                                0
19 pH (enter 0 for no pH adjustment)
                                                7.42
 Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
    hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia)
        204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   k1= 0. L/g-hr d1= 1.505e-05 cm2/s dv= 0.23155 cm2/s
 Compound flow rate from inlet water is 1.27e-05 g/s.
 Compound flow rate from inlet vent is 0. g/s.
 Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
     Biomass production
     The biomass production rate is 0.mg/hr. (0. mg/L)
     The fraction dissolved solids converted is 0. .
     The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
 The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s. Model: 2
kg is estimated as 0.010826 m/s. Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s. Model: 3
       Agitated surface
The rotation speed is 125.654 radians per second.
 The rotation factor NRW is 2.052e+06.
 The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
 kg (agitated) is estimated as 0.18756 m/s.
kl (agitated) is estimated as 0.019092 m/s.
     The specified and growth biomass is 0.3 g/L.
  The effective KL (surface + diffused air) is 1.391e-04 m/s.
  The effective stripping time (surface + diffused air) is 109.038 minutes.
  (1.81731 hrs.)
  The pump mixing time is 5 x the pumping recirculaion time, 0. min.
  The ratio of the mixing to the striping (surface + diffused air) is 0.
  The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
                                0.19108
   KG aerated (m/s)
   KL aerated (m/s)
                                           0.019092
                                         0.011483
   KL OVERALL AERATED (m/s)
   KG quiescent (m/s)
                                         0.011029
   KL quiescent (m/s)
                                           7.635e-06
   KL OVERALL QUIESCENT (m/s)
                                           7.6e-06
   KL OVERALL (m/s)
                                           1.391e-04
   air stripping time constant (min)
                                           109.038
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0.72669 FRACTION SURFACE VOLATILIZED 0. FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED 0.72669 0.18684 FRACTION ABSORBED 0. TOTAL AIR EMISSIONS (g/s) 9.23e-06 (Mg/year) 2.911e-04 EMISSION FACTOR (g/cm2-s) 1.306e-14 UNIT EXIT CONCENTRATION (ppmw) 9.387e-07 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment

WWTP\PAE\Old

Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment (C) 18 ASB Zone 2 1 Description of unit 32.08 2 Wastewater temperature (C) 3 length of aeration unit (m) 368 184 4 width of aeration unit (m) 0.97 5 depth of aeration unit (m) 135 15 75 6 Area of agitation (each aerator,m2) 7 Total number of agitators in the unit 8 Power of agitation (each aerator, HP) 49.53 9 Impeller diameter (cm) 1200 0.83 10 Impeller rotation (RPM) 11 Agitator mechanical efficiency 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 14 Overall biorate (mg/g bio-hr) 0 19 0 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of METHANETHIOL (methyl mercaptan) at 32.1 deg.C (89.7 deg.F) hl= 0.003921 atm-m3/mol vp= 2142.771 mmHg (41.446 psia) 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr d1= 1.515e-05 cm2/s dv= 0.23433 cm2/s Compound flow rate from inlet water is 3.165e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 302.703. kl is estimated as 7.67e-06 m/s. kq is estimated as 0.010938 m/s. Model: 2 kg is estimated as 0.010938 m/s. Model: 2 The Schmidt number is 0.64013. The friction velocity is 37.398 m/s kg is estimated as 0.023996 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027.

kg (agitated) is estimated as 0.18868 m/s. kl (agitated) is estimated as 0.020121 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 3.715e-04 m/s. The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 935.622 min. (15.594 hr.) The ratio of the pump mixing to the residence time is 0. 0.19222 KG aerated (m/s) 0.020121 KL aerated (m/s) 0.012174 KL OVERALL AERATED (m/s) 0.011143 KG quiescent (m/s) 7.67e-06 KL quiescent (m/s) 7.637e-06 KL OVERALL QUIESCENT (m/s) 3.715e-04 KL OVERALL (m/s) 43.518 air stripping time constant (min) 0.86271 FRACTION SURFACE VOLATILIZED 0. 0.86271 FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED 0.097161 FRACTION BIOLOGICALLY REMOVED FRACTION ABSORBED 0. 2.731e-04 0.008611 TOTAL AIR EMISSIONS (g/s) (Mg/year) EMISSION FACTOR (g/cm2-s) 4.033e-13 1.086e-05 UNIT EXIT CONCENTRATION (ppmw)

## No Stripper Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings (prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.31	1.48	0.27	9.82E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.08	0.57	0.22	8.40E-03
ASB Zone 2	0.03	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	0.02	1.85E-04	1.70E-04	5.26E-06
Total ASB	0.12	0.58	0.22	8.56E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.06E-02	5.04E-02	1.92E-02	7.42E-04

Post-Project Foul Condensate Flow: Post-Project Foul Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: Pulp Production 850 gpm 1.22 MGD 25.48 MGD 26.71 MGD 1170 L/s 2200 ODTP/day MW

H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is	
1 Total water added at the unit (1/s) 50	0
2 Area of openings at unit (cm2)	50
3 Radius of drop pipe (cm)	5
4 Drop length to conduit (cm)	61
5 Humidity of inlet air (%)	40
6 Temperature of air (C)	25
7 Drain air velocity (ft/min)	84
8 manhole air velocity (ft/min)	128
9 Conduit air velocity (ft/min)	66
10 Wind speed (cm/s at 10 m)	447
11 distance to next unit (cm)	500
12 slope of underflow conduit	.015
13 friction factor liquid	.016
14 friction factor gas	.006
15 radius of underflow conduit (cm)	12
16 Underflow T (C)	25
17 oscillation cycle time (min)	5
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
Type of unit is	
8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	O
14 parts biomass per 1000 parts COD	

15 oil water partition method 0=owpc 16 use UNIFAC aqueous data base =1 17 specify mass transfer for unit, =1 18 Use biomass for unit option, =1

Type: aerated biotreatment

19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment		
1 Description of unit	11	ASB Zone 1
2 Wastewater temperature (C)		34.08
3 length of aeration unit (m)		295
4 width of aeration unit (m)		295
5 depth of aeration unit (m)		1.4
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		31
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		Q
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/1)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.04

```
Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)
  hl= 0.001714 atm-m3/mol vp= 45.945 mmHg (0.88868 psia)
       95.2 V/X
      0.068011 g/L gas per g/L liquid
  Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr dl= 1.041e-05 cm2/s dv= 0.088022 cm2/s
Compound flow rate from inlet water is 1.57133 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
   Biomass production
   The biomass production rate is 0.mg/hr. (0. mg/L)
   The fraction dissolved solids converted is 0. .
   The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s. Model: 2
kg is estimated as 0.005598 m/s. Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s. Model: 3
       Agitated surface
The rotation speed is 125,654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11564 m/s.
kl (agitated) is estimated as 0.017486 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.753e-04 m/s.
The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1735.541 min. (28.926 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                     0.11781
  KL aerated (m/s)
                                          0.017486
  KL OVERALL AERATED (m/s)
                                           0.005609
 KG quiescent (m/s)
                                           0.005703
  KL quiescent (m/s)
                                           5.971e-06
  KL OVERALL QUIESCENT (m/s)
                                           5.883e-06
                                           2.753e-04
  KL OVERALL (m/s)
                                       84.752
 air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                          0.36452
                                       0.
0.36452
51768
  FRACTION SUBMERGED VOLATILIZED
  TOTAL FRACTION VOLATILIZED
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                           0.
  TOTAL AIR EMISSIONS (g/s)
                                          0.57278
                   (Mg/year)
                                          18.063
  EMISSION FACTOR (g/cm2-s)
                                          6.582e-10
  LETISSION FACTOR (g/cmz-s)6.582e-1UNIT EXIT CONCENTRATION (ppmw)0.023907
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
```

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE

Type of unit is system exit stream 1 Description of unit 12 d

12 def.system exit st

TOTAL AIR EMISSIONS (g/s)0.(Mg/year)0.EMISSION FACTOR (g/cm2-s)6.582e-10UNIT EXIT CONCENTRATION (ppmw)4.376e-05DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE

Two of unit is open hub drain				
1 Description of unit	13	default	nego	hub d
2 Underflow T (C)	122	43.89	10 IS - 200	1000 C
3 Total water added at the unit $(1/s)$		0		
4 Area of openings at unit (cm2)		50		
5 Badius of drop pipe (cm)		5		
6 Drop length to conduit (cm)		61		
7 Open surface=1		1		
<pre>% Subsurface entrance=1</pre>		Ô		
0 subsurface entrance-r		0		
10 radius of underflow conduit (cm)		12		
11 distance to post unit (cm)		500		
12 alona of underflow conduit		0 015		
12 Slope of underline conduit		81		
18 verocity air at drain opening (it/min)		0.4		
10 Desume emullibrium in unit =1		0		
18 Assume equilibrium in unit, =1		0		
19 pH (enter 0 for no pH adjustment)		0.9		
Total drain flow is 11/0 1/s. Weight fraction down is 1.4811E-06 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is fraction transferred in the drain drop fraction loss in wastel drop to hub fraction loss in waste2 drop to hub fraction loss in waste3 drop to hub fraction loss in collection hub drop fraction loss in unit fraction loss in line run component upstream of unit, g/s mol fract. headspace upstream (y) headspace at conduit discharge, y headspace end of conduit (y) mol fract. headspace vent base	1.343 from h 0. 0. 0.09 0. 0. 0. 0. 0. 0. 0. 1.65 3.81	020339909 ub is .09 03228 09e-18 1e-05 70406	53E-00 93228	5
headspace flow out vent (cc/s)	-1.1	/e+06		
headspace flow down line (cc/s)	1.17	e+06		
KG surface (m/s)	2007	.233		
KL surface (m/s)	6.78	/e-09		
flow of waste down hub (1/s)	0.			
component flow in waste into unit (g/s)	) 1./3	289		
total component into unit, g/s	1.57	133		
TOTAL AIR EMISSIONS (g/s)	0.16	155		
(Mg/year)	5.09	474		
EMISSION FACTOR (g/cm2-s)	6.58	2e-10		
UNIT EXIT CONCENTRATION (ppmw)	1.34	302		
DETAILED CALCULATIONS at Unit 17 ASB Zone	3 -			
Type: aerated biotreatment				

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20

#### COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment 17 ASB Zone 3 1 Description of unit 2 Wastewater temperature (C) 30.01 376 3 length of aeration unit (m) 188 4 width of aeration unit (m) 0.91 5 depth of aeration unit (m) 135 6 Area of agitation (each aerator, m2) 7 Total number of agitators in the unit 6 8 Power of agitation (each aerator, HP) 75 9 Impeller diameter (cm) 49.53 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 19 14 Overall biorate (mg/g bio-hr) 15 Aeration air flow (m3/s) 0 0.3 16 active biomass, aeration (g/l) 0 17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F) hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia) 78.352 y/x 0.056726 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/q-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s Compound flow rate from inlet water is 0.00102 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0, m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 5.918e-06 m/s. kg is estimated as 0.005575 m/s. Model: 2 kg is estimated as 0.005575 m/s. Model: 2 The Schmidt number is 1.74436. The friction velocity is 37.398 m/s kg is estimated as 0.012742 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7,881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.1143 m/s. kl (agitated) is estimated as 0.015772 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 5.972e-05 m/s. The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.11644 KL aerated (m/s) 0.015772 KL OVERALL AERATED (m/s) 0.004711 KG quiescent (m/s) 0.005679

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R-100
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 KL OVERALL QUIESCENT (m/s)
 5.918e-06

 KL OVERALL (m/s)
 5.813e-06

 KL OVERALL (m/s)
 5.813e-06

 air stripping time constant (min) 253.944 air stripping time constant (min) FRACTION SURFACE VOLATILIZED FRACTION SUBMERGED VOLATILIZED TOTAL FRACTION VOLATILIZED FRACTION BIOLOGICALLY REMOVED 0.18107 0. 0.18107 0.76875 0. 1.848e-0 FRACTION ABSORBED 
 TOTAL AIR EMISSIONS (g/s)
 1.848e-04

 (Mg/year)
 0.005827

 EMISSION FACTOR (g/cm2-s)
 2.614e-12
 1.848e-04 2.614e-13 UNIT EXIT CONCENTRATION (ppmw) 4.376e-05 DETAILED CALCULATIONS at Unit 18 ASB Zone 2 Type: aerated biotreatment WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20 COMPOUND: DIMETHYL DISULFIDE Type of unit is aerated biotreatment1 Description of unit182 Wastewater temperature(C)3 longth of aeration unit (m)368 3 length of aeration unit (m)3684 width of aeration unit (m)1845 depth of aeration unit (m)0.976 Area of agitation (each aerator,m2)1357 Total number of agitators in the unit158 Power of agitation (each aerator,HP)759 Impeller diameter (cm)49.5310 Impeller rotation (RPM)120011 Agitator mechanical efficiency2.22 3 length of aeration unit (m) 10 Impeller rotation (RPM)120011 Agitator mechanical efficiency0.8312 aerator effectiveness, alpha0.8313 if there is plug flow, enter 1014 Overall biorate (mg/g bio-hr)1915 Aeration air flow (m3/s)0 16 active biomass, aeration (g/l) 17 If covered, then enter 1 0.3 0 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.24 Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F) hl= 0.001558 atm-m3/mol vp= 41.785 mmHg (0.80821 psia) 86.579 y/x 0.062258 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr d1= 1.034e-05 cm2/s dv= 0.087022 cm2/s Compound flow rate from inlet water is 0.027971 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. \_\_\_\_Quiescent wind shear surface \_\_\_\_Springer\_\_\_ The fetch to depth ratio is 302.703. kl is estimated as 5.945e-06 m/s. kg is estimated as 0.005633 m/s. Model: 2 kg is estimated as 0.005633 m/s. Model: 2 The Schmidt number is 1.72371. The friction velocity is 37.398 m/s kg is estimated as 0.012836 m/s. Model: 3

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Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.11498 m/s.
k1 (agitated) is estimated as 0.016622 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes.
 (1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.11714
  KL aerated (m/s)
                                           0.016622
  KL OVERALL AERATED (m/s)
                                           0.005152
  KG quiescent (m/s)
                                           0.005738
                                           5.945e-06
  KL quiescent (m/s)
  KL OVERALL QUIESCENT (m/s)
                                           5.85e-06
                                           1.598e-04
 KL OVERALL (m/s)
                                          101.198
  air stripping time constant (min)
  FRACTION SURFACE VOLATILIZED
                                          0.33728
                                       0.
  FRACTION SUBMERGED VOLATILIZED
                                          0.33728
  TOTAL FRACTION VOLATILIZED
                                       0.62623
  FRACTION BIOLOGICALLY REMOVED
  FRACTION ABSORBED
                                          0.
  TOTAL AIR EMISSIONS (g/s)
                                         0.009434
                   (Mg/year)
                                         0.29751
  EMISSION FACTOR (g/cm2-s)
                                          1.393e-11
                                      8.721e-04
  UNIT EXIT CONCENTRATION (ppmw)
```

Type of unit is	
1 Total water added at the unit (1/s) 50	0
2 Area of openings at unit (cm2)	50
3 Radius of drop pipe (cm)	5
4 Drop length to conduit (cm)	61
5 Humidity of inlet air (%)	40
6 Temperature of air (C)	25
7 Drain air velocity (ft/min)	84
8 manhole air velocity (ft/min)	128
9 Conduit air velocity (ft/min)	66
10 Wind speed (cm/s at 10 m)	447
11 distance to next unit (cm)	500
12 slope of underflow conduit	.015
13 friction factor liquid	.016
14 friction factor gas	.006
15 radius of underflow conduit (cm)	12
16 Underflow T (C)	25
17 oscillation cycle time (min)	5
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
Time of unit is	
9 WI partition flag=1 adjust for contion	0
0 mi partition frag-i, adjust for sorption	200
10 oil molocular weight	0
11 oil density $(a/cc)$	0
12 NaUT 1-municipal 2-industrial 3=turb	0
13 NaUT 1=mass tr 2=pquil	0
14 parts biomass per 1000 parts COD	0
15 oil water partition method 0=ownc	
16 use UNIFAC aqueous data base =1	
17 specify mass transfer for unit. =1	
18 Use biomass for unit option, =1	
19 biogrowth Monod half concentration ppm	
To stadional normal name according and the	

DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment			
1 Description of unit	11	ASB Zone	1
2 Wastewater temperature (C)		34.08	
3 length of aeration unit (m)		295	
4 width of aeration unit (m)		295	
5 depth of aeration unit (m)		1.4	
6 Area of agitation (each aerator, m2)		135	
7 Total number of agitators in the unit		31	
8 Power of agitation (each aerator, HP)		75	
9 Impeller diameter (cm)		49.53	
10 Impeller rotation (RPM)		1200	
11 Agitator mechanical efficiency		0.83	
12 aerator effectiveness, alpha		0.83	
13 if there is plug flow, enter 1		0	
14 Overall biorate (mg/g bio-hr)		19	
15 Aeration air flow (m3/s)		0	
16 active biomass, aeration $(g/1)$		0.3	
17 If covered, then enter 1		0	
18 special input		0	
19 pH (enter 0 for no pH adjustment)		7.04	

```
Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)
  h]= 0.002924 atm-m3/mol vp= 704.653 mmHg (13.629 psia)
      162.463 y/x
      0.11606 g/L gas per g/L liquid
  Temperature adjustment factor = 1.046 \text{ }^{(T-25)}, deg. C
  k1 = 0. L/g-hr
                  dl= 1.504e-05 cm2/s dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.27039 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
   Biomass production
   The biomass production rate is 0.mg/hr. (0. mg/L)
   The fraction dissolved solids converted is 0. .
   The estimated biomass exit concentration is 0. mg/L.
       Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s. Model: 2
kg is estimated as 0.007917 m/s. Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s. Model: 3
      Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14978 m/s.
kl (agitated) is estimated as 0.021024 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 4.77e-04 m/s.
The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1735.541 min. (28.926 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                          0.15258
  KL aerated (m/s)
                                          0.021024
  KL OVERALL AERATED (m/s)
                                           0.009769
  KG quiescent (m/s)
                                          0.008066
  KL quiescent (m/s)
                                           7.634e-06
  KL OVERALL QUIESCENT (m/s)
                                           7.574e-06
  KL OVERALL (m/s)
                                          4.77e-04
  air stripping time constant (min)
                                         48.915
  FRACTION SURFACE VOLATILIZED
                                          0.80064
                                       ο.
  FRACTION SUBMERGED VOLATILIZED
                                          0.80064
  TOTAL FRACTION VOLATILIZED
                                       0.1768
  FRACTION BIOLOGICALLY REMOVED
                                          0.
  FRACTION ABSORBED
  TOTAL AIR EMISSIONS (g/s)
                                          0.21648
                                          6.82699
                    (Mg/year)
                                          2.488e-10
  EMISSION FACTOR (g/cm2-s)
  UNIT EXIT CONCENTRATION (ppmw) 0.005215
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
```

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is system exit stream 1 Description of unit 12 def.system exit st TOTAL AIR EMISSIONS (g/s)0.(Mg/year)0.EMISSION FACTOR (g/cm2-s)2.488e-10UNIT EXIT CONCENTRATION (ppmw)2.285e-05DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is open hub drain	
1 Description of unit	13 default open hub d
2 Underflow T (C)	43.89
3 Total water added at the unit $(1/s)$	Q
4 Area of openings at unit (cm2)	50
5 Radius of drop pipe (cm)	5
6 Drop length to conduit (cm)	61
7 Open surface=1	1
8 Subsurface entrance=1	0
9 subsurface exit =1	0
10 radius of underflow conduit (cm)	12
11 distance to next unit (cm)	500
12 slope of underflow conduit	0.015
16 velocity air at drain opening (ft/min)	84
17 municipal waste in conduit =1	0
18 Assume equilibrium in unit, =1	0
19 pH (enter 0 for no pH adjustment)	8.9
Total drain flow is 1170 l/s. Weight fraction down is 2.677E-07 Gas concentration in 0 mol fraction. Gas flow 1170 L/s Weight fraction out at base of drop is fraction transferred in the drain drop fraction loss in wastel drop to hub fraction loss in waste2 drop to hub fraction loss in waste3 drop to hub	2.31101058606837E-07 from hub is .136716 0. 0. 0.
fraction loss in collection hub drop	0.13672
fraction loss in unit	0.
fraction loss in line run	0.
component upstream of unit, g/s	0.
mol fract. headspace upstream (y)	0.
headspace at conduit discharge, y	0.
headspace end of conduit (y)	5.603e-19
mol fract. headspace vent base	1.532e-05
neadspace flow out vent (cc/s)	-1.1/e+06
neadspace flow down line (cc/s)	1.1/e+06
KG SUFIACE (m/s)	2834.248
AL Sufface $(m/s)$	0.7040-09
component flow in waste into unit /d/s	V 0 31321
total component into unit d/s	0.27039
TOTAL AIR EMISSIONS (g/s)	0.042821
(Mg/vear)	1.3504
EMISSION FACTOR (g/cm2-s)	2.488e-10
UNIT EXIT CONCENTRATION (pomw)	0.2311
DETAILED CALCULATIONS at Unit 17 ASB Zone	3
Type: aerated biotreatment	

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment 17 ASB Zone 3 1 Description of unit 2 Wastewater temperature (C) 30.01 376 3 length of aeration unit (m) 188 4 width of aeration unit (m) 0.91 5 depth of aeration unit (m) 6 Area of agitation (each aerator,m2) 135 6 7 Total number of agitators in the unit 75 8 Power of agitation (each aerator, HP) 49.53 9 Impeller diameter (cm) 10 Impeller rotation (RPM) 1200 11 Agitator mechanical efficiency 0.83 0.83 12 aerator effectiveness, alpha 13 if there is plug flow, enter 1 0 19 14 Overall biorate (mg/g bio-hr) 0 15 Aeration air flow (m3/s) 16 active biomass, aeration (g/l) 0.3 17 If covered, then enter 1 0 18 special input 0 7.42 19 pH (enter 0 for no pH adjustment) Properties of DIMETHYL SULFIDE (DMS) at 30. deg.C (86. deg.F) hl= 0.002519 atm-m3/mol vp= 606.985 mmHg (11.74 psia) 139.945 y/x 0.10132 g/L gas per g/L liquid Temperature adjustment factor = 1.046 (T-25), deg. C k1= 0. L/g-hr dl= 1.485e-05 cm2/s dv= 0.14425 cm2/s Compound flow rate from inlet water is 2.889e-04 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.566e-06 m/s. kg is estimated as 0.007884 m/s. Model: 2 kg is estimated as 0.007884 m/s. Model: 2 The Schmidt number is 1.03989. The friction velocity is 37.398 m/s kg is estimated as 0.017611 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.14804 m/s. kl (agitated) is estimated as 0.018962 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.053e-04 m/s. The effective stripping time (surface + diffused air) is 144.073 minutes. (2.40122 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.15081 KL aerated (m/s) 0.018962 KL OVERALL AERATED (m/s) 0.00854 KG quiescent (m/s) 0.008032

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R-106
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KL quiescent (m/s	)	7.566e-06
KL OVERALL OUIESC	ENT (m/s)	7.497e-06
KL OVERALL (m/s)	2.0.3 (0.4.6)	1.053e-04
air stripping tim	e constant (min)	144.073
FRACTION SURFACE	VOLATILIZED	0.5886
FRACTION SUBMERGE	D VOLATILIZED	0.
TOTAL FRACTION VO	LATILIZED	0.5886
FRACTION BIOLOGIC	ALLY REMOVED	0.31886
FRACTION ABSORBED		0.
TOTAL AIR EMISSIO	NS (g/s)	1.701e-04
	(Mg/year)	0.005363
EMISSION FACTOR	(g/cm2-s)	2.406e-13
UNIT EXIT CONCENT	RATION (ppmw)	2.285e-05
DETAILED CALCULATION Type: aerated biotre	S at Unit 18 ASB Zone 2 atment	

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:06 COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment		
1 Description of unit	18 A	SB Zone 2
2 Wastewater temperature (C)	3	2.08
3 length of aeration unit (m)	3	68
4 width of aeration unit (m)	1	84
5 depth of aeration unit (m)	0	.97
6 Area of agitation (each aerator.m2)	1	35
7 Total number of agitators in the unit	1	5
8 Power of agitation (each aerator, HP)	7	5
9 Impeller diameter (cm)	4	9.53
10 Impeller rotation (RPM)	1	200
11 Agitator mechanical efficiency	0	.83
12 aerator effectiveness, alpha	0	.83
13 if there is plug flow, enter 1	0	
14 Overall biorate (mg/g bio-hr)	1	9
15 Aeration air flow (m3/s)	0	
16 active biomass, aeration (g/l)	0	.3
17 If covered, then enter 1	0	
18 special input	0	
19 pH (enter 0 for no pH adjustment)	7	.24
151.062 y/x 0.10863 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^ k1= 0. L/g-hr dl= 1.495e-05 cm Compound flow rate from inlet water is 0.0 Compound flow rate from inlet vent is 0. g Compound flow rate from inlet duct is 0. g Submerged aeration rate from inlet vent is Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 h Biomass production The biomass production rate is 0.mg/hr The fraction dissolved solids converted The optimated biomass exit concentration	(T-25), 2/s dv= 06101 g/ //s. 1/	deg. C 0.14597 cm2/s s. /L)
The estimated plomass exit concentration	indor	шд/ц.
The fetch to depth ratio is 302 703	Tuder-	
kl is estimated as 7 6e-06 m/s		
kg is estimated as 0.007966 m/s. Model 2	6	
kg is estimated as 0.007966 m/s. Model: 2		
The Schmidt number is 1.02758.		
The friction velocity is 37.398 m/s		
kg is estimated as 0.017744 m/s. Model: 3		

```
Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.14892 m/s.
kl (agitated) is estimated as 0.019984 m/s.
   The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.809e-04 m/s.
The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.
  KG aerated (m/s)
                                           0.15171
                                          0.019984
  KL aerated (m/s)
  KL OVERALL AERATED (m/s)
                                          0.009148
                                          0.008115
  KG quiescent (m/s)
                                          7.6e-06
  KL quiescent (m/s)
                                           7.537e-06
  KL OVERALL QUIESCENT (m/s)
                                          2.809e-04
  KL OVERALL (m/s)
                                        57.552
  air stripping time constant (min)
 FRACTION SURFACE VOLATILIZED
                                          0.76981
                                       0.
  FRACTION SUBMERGED VOLATILIZED
                                          0.76981
  TOTAL FRACTION VOLATILIZED
                                       0.18284
  FRACTION BIOLOGICALLY REMOVED
 FRACTION ABSORBED
                                          0.
 TOTAL AIR EMISSIONS (g/s)
                                         0.004697
 (Mg/year)
EMISSION FACTOR (g/cm2-s)
                                         0.14812
                                        6.937e-12
                                      2.469e-04
  UNIT EXIT CONCENTRATION (ppmw)
```

Type of unit is	
1 Total water added at the unit (1/s) 50	0
2 Area of openings at unit (cm2)	50
3 Radius of drop pipe (cm)	5
4 Drop length to conduit (cm)	61
5 Humidity of inlet air (%)	40
6 Temperature of air (C)	25
7 Drain air velocity (ft/min)	84
8 manhole air velocity (ft/min)	128
9 Conduit air velocity (ft/min)	66
10 Wind speed (cm/s at 10 m)	447
11 distance to next unit (cm)	500
12 slope of underflow conduit	.015
13 friction factor liquid	.016
14 friction factor gas	.006
15 radius of underflow conduit (cm)	12
16 Underflow T (C)	25
17 oscillation cycle time (min)	5
18 design collection velocities (ft/s)	2
19 design branch line fraction full	. 4
Type of unit is	
8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	Q
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	0
14 parts biomass per 1000 parts COD	

15 oil water partition method 0=owpc

16 use UNIFAC aqueous data base =1

17 specify mass transfer for unit, =1

18 Use biomass for unit option, =1

19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1 Type: aerated biotreatment

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment		
1 Description of unit	11	ASB Zone 1
2 Wastewater temperature (C)		34.08
3 length of aeration unit (m)		295
4 width of aeration unit (m)		295
5 depth of aeration unit (m)		1.4
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		31
8 Power of agitation (each aerator, HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.04

```
Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)
   h1= 0.004158 atm-m3/mol vp= 2272,142 mmHg (43.948 psia)
       230.99 y/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 \wedge (T-25), deg. C
   kl = 0. L/g-hr
                        dl= 1.525e-05 cm2/s dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.009471 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
    Biomass production
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
        Quiescent wind shear surface Springer
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s. Model: 2
kg is estimated as 0.010871 m/s. Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s. Model: 3
        Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18977 m/s.
kl (agitated) is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 \text{ g/L}.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)
                                            0.19332
                                           0.021167
   KL aerated (m/s)
   KL OVERALL AERATED (m/s)
                                           0.012876
   KG quiescent (m/s)
                                           0.011075
                                            7.703e-06
   KL quiescent (m/s)
   KL OVERALL QUIESCENT (m/s)
                                           7.672e-06
   KL OVERALL (m/s)
                                           6.265e-04
                                        37.242
   air stripping time constant (min)
   FRACTION SURFACE VOLATILIZED
                                           0.88738
                                       0.88738
0.093578
   FRACTION SUBMERGED VOLATILIZED
   TOTAL FRACTION VOLATILIZED
   FRACTION BIOLOGICALLY REMOVED
                                           0.
   FRACTION ABSORBED
                                           0.008404
   TOTAL AIR EMISSIONS (g/s)
                    (Mg/year)
                                           0.26504
                                           9.657e-12
   EMISSION FACTOR (g/cm2-s)
   UNIT EXIT CONCENTRATION (ppmw) 1.541e-04
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
```

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is system exit stream 1 Description of unit

12 def.system exit st

TOTAL AIR EMISSIONS (g/s)0.(Mg/year)0.EMISSION FACTOR (g/cm2-s)9.657e-12UNIT EXIT CONCENTRATION (ppmw)5.348e-07DETAILED CALCULATIONS at Unit 13 default open hub dType: open hub drain

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan)

Tune of unit is open bub drain	
1 Description of unit	13 default open hub d
2 Underflow $T_{(C)}$	13 defadire open nab d 43.89
3 Total water added at the unit $(1/s)$	0
A Area of openings at unit (cm2)	50
5 Radius of drop pipe (am)	э ч Э э
6 Drop longth to gonduit (gm)	5
7 Open surface=1	1
2 Cubaunfana antrongo-1	- -
8 Subsurface entrance=1	0
9 subsuriace exit =1	10
10 radius of underflow conduit (cm)	12
11 distance to next unit (cm)	500
12 slope of underflow conduit	0.015
16 velocity air at drain opening (ft/min)	84
17 municipal waste in conduit =1	0
18 Assume equilibrium in unit, =1	0
19 pH (enter 0 for no pH adjustment)	8.9
Equilibrium partitioning in drain drop hul	b is assumed.
Total drain flow is 1170 1/s.	
Weight fraction down is 9.8E-09	
Gas concentration in 0 mol fraction.	
Gas flow 1170 L/s	
Weight fraction out at base of drop is	8.09478308097639E-09
fraction transferred in the drain drop	from hub is .174002
fraction loss in wastel drop to hub	0
fraction loss in waste? drop to hub	0
fraction loss in wastel drop to hub	0
fraction loss in callection bub drop	0.174
fraction loss in collection hub drop	0.174
Fraction loss in unit	0.
fraction loss in line run	0.
component upstream of unit, g/s	0.
mol fract. headspace upstream (y)	0.
headspace at conduit discharge, y	0.
headspace end of conduit (y)	2.559e-20
mol fract. headspace vent base	9.217e-07
headspace flow out vent (cc/s)	-1.17e+06
headspace flow down line (cc/s)	1.17e+06
KG surface (m/s)	3886.338
KL surface (m/s)	8.868e-09
flow of waste down hub (1/s)	0.
component flow in waste into unit (g/s)	0.011466
total component into unit, g/s	0.009471
TOTAL AIR EMISSIONS (a/s)	0.001995
(Mg/vear)	0.062918
EMISSION FACTOR (a/cm2-s)	9.657e-12
UNIT EXIT CONCENTRATION (DDMW)	0.008095
DETAILED CALCHIATIONS at Unit 17 ACD 7000	3
Turnet constant biotrostmost	2
Type: aerated protreatment	

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment 17 ASB Zone 3 1 Description of unit 2 Wastewater temperature (C) 30.01 376 3 length of aeration unit (m) 4 width of aeration unit (m) 188 5 depth of aeration unit (m) 0.91 6 Area of agitation (each aerator,m2) 135 7 Total number of agitators in the unit 6 75 8 Power of agitation (each aerator, HP) 9 Impeller diameter (cm) 49.53 1200 10 Impeller rotation (RPM) 0.83 11 Agitator mechanical efficiency 12 aerator effectiveness, alpha 0.83 13 if there is plug flow, enter 1 0 19 14 Overall biorate (mg/g bio-hr) 0 15 Aeration air flow (m3/s) 0.3 16 active biomass, aeration (g/l) 0 17 If covered, then enter 1 18 special input 0 19 pH (enter 0 for no pH adjustment) 7.42 Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F) hl= 0.003687 atm-m3/mol vp= 2014.774 mmHg (38.97 psia) 204.826 y/x 0.14829 g/L gas per g/L liquid Temperature adjustment factor = 1.046 ^(T-25), deg. C k1= 0. L/g-hr dl= 1.505e-05 cm2/s dv= 0.23155 cm2/s Compound flow rate from inlet water is 7.237e-06 g/s. Compound flow rate from inlet vent is 0. g/s. Compound flow rate from inlet duct is 0. g/s. Submerged aeration rate from inlet vent is 0. m3/s. Total submerged aeration is 0. m3/s. The residence time in the unit is 15.272 hr. Biomass production The biomass production rate is 0.mg/hr. (0. mg/L) The fraction dissolved solids converted is 0. . The estimated biomass exit concentration is 0. mg/L. Quiescent wind shear surface Springer The fetch to depth ratio is 329.675. kl is estimated as 7.635e-06 m/s. kg is estimated as 0.010826 m/s. Model: 2 kg is estimated as 0.010826 m/s. Model: 2 The Schmidt number is 0.64779. The friction velocity is 37.398 m/s kg is estimated as 0.023814 m/s. Model: 3 Agitated surface The rotation speed is 125.654 radians per second. The rotation factor NRW is 2.052e+06. The power number NPR is 7.881e-04. The rotation factor NFR is 797.027. kg (agitated) is estimated as 0.18756 m/s. kl (agitated) is estimated as 0.019092 m/s. The specified and growth biomass is 0.3 g/L. The effective KL (surface + diffused air) is 1.391e-04 m/s. The effective stripping time (surface + diffused air) is 109.038 minutes. (1.81731 hrs.) The pump mixing time is 5 x the pumping recirculaion time, 0. min. The ratio of the mixing to the striping (surface + diffused air) is 0. The mean residence time is 916.326 min. (15.272 hr.) The ratio of the pump mixing to the residence time is 0. KG aerated (m/s) 0.19108 KL aerated (m/s) 0.019092 KL OVERALL AERATED (m/s) 0.011483 KG quiescent (m/s) 0.011029

KT quiescent (m/s)	7 6350-06
XI QUEBALL OULERCENT (m/c)	7 60-06
VT OAFWYTT AOTEOCENI (WAS)	1.001.01
KL OVERALL (m/s)	1.391e-04
air stripping time constant (min)	109.038
FRACTION SURFACE VOLATILIZED	0.72669
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.72669
FRACTION BIOLOGICALLY REMOVED	0.18684
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	5.259e-06
(Mg/year)	1.658e-04
EMISSION FACTOR (g/cm2-s)	7.439e-15
UNIT EXIT CONCENTRATION (ppmw)	5.348e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone	2
Type: aerated biotreatment	

WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:21:41 COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment			
1 Description of unit	18	ASB Zone 2	<u> </u>
2 Wastewater temperature (C)		32.08	
3 length of aeration unit (m)		368	
4 width of aeration unit (m)		184	
5 depth of aeration unit (m)		0.97	
6 Area of agitation (each aerator,m2)		135	
7 Total number of agitators in the unit		15	
8 Power of agitation (each aerator.HP)		75	
9 Impeller diameter (cm)		49.53	
10 Impeller rotation (RPM)		1200	
11 Agitator mechanical efficiency		0.83	
12 aerator effectiveness, alpha		0.83	
13 if there is plug flow, enter 1		0	
14 Overall biorate (mg/g bio-br)		19	
15 Apration air flow (m3/s)		0	
16 active biomass paration $(\alpha/1)$		03	
17 If covered, then enter 1		0.5	
18 enocial input		0	
10 special input		7 24	
to ph (encer o for no ph adjuschenc)		1.24	
hl= 0.003921 atm-m3/mol vp= 2142. 217.838 y/x 0.15664 g/L gas per g/L liquid Temperature adjustment factor = 1.046 k1= 0. L/g-hr dl= 1.515e-05 c Compound flow rate from inlet water is 1. Compound flow rate from inlet vent is 0. Compound flow rate from inlet duct is 0. Submerged aeration rate from inlet vent i Total submerged aeration is 0. m3/s. The residence time in the unit is 15.594 Biomass production The biomass production rate is 0.mg/h The fraction dissolved solids convert The estimated biomass exit concentrat Quiescent wind shear surface Sp	^(T-25) m2/s d 803e-04 g/s. g/s. s 0. m3 hr. er. (0. ed is 0 ion is pringer_	<pre>/g (41.446 g /g (41.446 g /v = 0.23433 g/s. /s. mg/L) 0. mg/L.</pre>	cm2/s
The fetch to depth ratio is 302.703.			
ki is estimated as /.0/e-up m/s.	2		
kg is estimated as 0.010000 m/s. Model:	2		
My is estimated as 0.010938 m/s. Model:	Z		
The Schmidt humber is 0.64013.			

The friction velocity is 37.398 m/s

kg is estimated as 0.023996 m/s. Model: 3

```
Agitated surface
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated) is estimated as 0.18868 m/s.
kl (agitated) is estimated as 0.020121 m/s.
   The specified and growth biomass is 0.3 \text{ g/L}.
The effective KL (surface + diffused air) is 3.715e-04 m/s.
The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529
hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.
 KG aerated (m/s)
                                          0.19222
  KL aerated (m/s)
                                          0.020121
  KL OVERALL AERATED (m/s)
                                          0.012174
  KG quiescent (m/s)
                                          0.011143
  KL quiescent (m/s)
                                          7.67e-06
  KL OVERALL QUIESCENT (m/s)
                                          7.637e-06
  KL OVERALL (m/s)
                                          3.715e-04
  air stripping time constant (min)
                                         43.518
  FRACTION SURFACE VOLATILIZED
                                         0.86271
                                       0.
  FRACTION SUBMERGED VOLATILIZED
                                          0.86271
  TOTAL FRACTION VOLATILIZED
  FRACTION BIOLOGICALLY REMOVED
                                       0.097161
  FRACTION ABSORBED
                                         0.
  TOTAL AIR EMISSIONS (g/s)
                                         1.556e-04
                                         0.004907
                 (Mg/year)
  EMISSION FACTOR (g/cm2-s)
                                        2.298e-13
                                      6.185e-06
  UNIT EXIT CONCENTRATION (ppmw)
```

#### PAE H2S Factor Summary of H2SSIM Inputs and Outputs

								Zone 1	Zone 2	Zone 3	Total ASB
PAE - No Stripper Scenario	Zone 1	Zone 2	Zone 3		Main Inlet Ha	ardpipe Units	H2S g/s	0.08	0.03	0.02	0.122 g/s
DO	1.57	7 4.63	4.66	Flow	25.48	1.22 MGD					2200 ODTP/day
Temp	93.34	4 89.74	86.02	Total Sulfide	0.252	1.47 mg/L					1.06E-02 Ib/ODTP
pH	7.04	4 7.24	7.42	Sulfate	390	390 mg/L					
Length	968	8 1208	1235								
Width	968	8 604	617								
Aerators	31	1 15	6								
								Zone 1	Zone 2	Zone 3	Total ASB
PAE - Backup Stripper	Zone 1	Zone 2	Zone 3		Main Inlet Ha	ardpipe Units	H2S g/s	0.08	0.03	0.02	0.126 g/s
DO	1.57	7 4.63	4.66	Flow	25.48	1.22 MGD					2200 ODTP/day
Temp	93,34	4 89.74	86.02	Total Sulfide	0.252	2.93 mg/L					1.09E-02 Ib/ODTP
pH	7.04	4 7.24	7.42	Sulfate	390	390 mg/L					
Length	968	8 1208	1235								
Width	968	B 604	617								
Aerators	31	1 15	6								
								Zone 1	Zone 2	Zone 3	Total ASB
PAE - New Stripper	Zone 1	Zone 2	Zone 3		Main Inlet Ha	ardpipe Units	H2S g/s	0.07	0.03	0.02	0.119
DO	1.57	7 4.63	4.66	Flow	25.48	0.00 MGD					2200 ODTP/day
Temp	93.34	4 89.74	86.02	Total Sulfide	0.252	0.00 mg/L					1.03E-02 Ib/ODTP
pH	7.04	4 7.24	7.42	Sulfate	390	390 mg/L					
Length	968	8 1208	1235								
Width	968	8 604	617								

\*DO are based on average of all DO readings from 2021 and 2022 Subpart S performance testing.

	ition	
-		
	Hardpipe	Units
	Hardpipe	Units MGD
	Hardpipe	Units MGD mg/L

----

1	1	t	2	n	C
		L	U		

	mph	•	
1 Con	F	•	

Temperature	93.34	89.74	86.02		F	-
рН	7.04	7.24	7.42		s.u.	
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌		
Length	968	1208	1235		feet	•
Width	968	604	617		feet	•
Depth	4.5	3.2	3		feet	•
Mixing	Moderat	Moderat -	Moderat		(HAR)	
Number of Aerators	31	15	6			
Total Horsepower	2325	1125	450		НР	1
Impellor Size	1.625	1.625	1.625		feet	•
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms	•
Weir Height	0	0	0		feet	•

**Run H2SSIM** 

View Parameters

Clear Input Sheet

# H2SSIM Results

	-	
<b>Basin Emissions</b>	A CARLER HERE	Units
Total Emissions (H <sub>2</sub> S)	0.119	gms/s
Total Emissions (H <sub>2</sub> S)	8271.8	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.1	tons/yr
Total Emissions (H <sub>2</sub> S)	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.6	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	4987.3	1762.5	1522.0		lbs/yr
Emission Flux (H <sub>2</sub> S)	26.0	11.8	9.8		gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	36.300	6.200	5.400		lbs/yr

New Stripper Scenario

Current Para	meters
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O <sub>2</sub> Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Percent Inlet Sulfide Removed 57.7%

na	ition
1	
-	
╡	
-	

Hardpipe	Units
1.22	MGD -
2.93	mg/L 💌
390	mg/L 🝷

-----

ASB

litions

mph	-
F	-

	and the second second second second	New Jord Street Street Street	States of the second states of the		Contractor Character in
Temperature	93.34	89.74	86.02		F 🝷
рН	7.04	7.24	7.42		s.u.
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌	
Length	968	1208	1235		feet 👻
Width	968	604	617		feet 🝷
Depth	4.5	3.2	3		feet 💌
Mixing	Moderat -	Moderat -	Moderat 💌		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		НР
Impellor Size	1.625	1.625	1.625		feet 💌
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms 💌
Weir Height	0	0	0		feet 💌

Run H2SSIM

View Parameters

Clear Input Sheet

## **H2SSIM Results**

<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.126	gms/s
Total Emissions (H <sub>2</sub> S)	8765.3	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.4	tons/yr
Total Emissions (H <sub>2</sub> S)	4.0	tonnes/yr
Emission Flux (H <sub>2</sub> S)	17.6	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02	A-E	gms/s
Zone Emissions (H <sub>2</sub> S)	5479.5	1763.8	1521.9	1. 5	lbs/yr
Emission Flux (H <sub>2</sub> S)	28.6	11.8	9.8	11 1 2	gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.004	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	45.000	6.500	5.700		lbs/yr

Backup Stripper Scenario **Current Parameters** 0.25 kgen TheteCom 1 06

ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O <sub>2</sub> Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Percent Inlet Sulfide Removed

71.2%

nat	10	n	
_			
-			
4			
- 11			

Hardpipe	Units
1.22	MGD 🝷
1.47	mg/L 💌
390	mg/L 🝷

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ASB

-

litions

mph	•
F	•

A DESCRIPTION OF THE PROPERTY	totals and dependences of the set			A second second second second		-
Temperature	93.34	89.74	86.02		F	-
рН	7.04	7.24	7.42		s.u.	
Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 💌		
Length	968	1208	1235		feet	-
Width	968	604	617		feet	•
Depth	4.5	3.2	3		feet	•
Mixing	Moderat	Moderat -	Moderat			
Number of Aerators	31	15	6			
Total Horsepower	2325	1125	450		HP	
Impellor Size	1.625	1.625	1.625		feet	-
Impellor RPM	1200	1200	1200		RPM	
Diffused Air Flow	0	0	0		cms	•
Weir Height	0	0	0	12.55	feet	-

**Run H2SSIM** 

View Parameters

Clear Input Sheet

# **H2SSIM Results**

		1.0.0
<b>Basin Emissions</b>		Units
Total Emissions (H <sub>2</sub> S)	0.123	gms/s
Total Emissions (H <sub>2</sub> S)	8518.1	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.3	tons/yr
Total Emissions (H <sub>2</sub> S)	3.9	tonnes/yr
Emission Flux (H <sub>2</sub> S)	17.1	gms/m <sup>2</sup> yr
	and the second se	

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.08	0.03	0.02		gms/s
Zone Emissions (H <sub>2</sub> S)	5232.9	1763.2	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	27.3	11.8	9.8		gms/m <sup>2</sup> y
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	41.500	6.500	5.700		lbs/yr

No Stripper Scenario

Current Para	meters
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O <sub>2</sub> Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Percent Inlet Sulfide Removed

65.9%

### **Methanol PAE Emissions Factors**

Methanol PAE Scenarios	Hardpipe ppm	Hardpipe Flow, MGD	Air Stripping g/s	Pulp Production	Methanol Emissions Factor Ib/ODTP
New Stripper	N/A	N/A	3.47	2200	0.30
Backup Stripper	2095	1.22	17.63	2200	1.53
No Stripper	3809	1.22	26.69	2200	2.31

Design MeOH:	1620	lb/hr
	16	lb/ODT

## **K C FORMS - CALCULATING FRACTION BIODEGRADED**

PAE - New Stripper Scenario

Enter data in green shaded sections of this page of this spreadsheet only.

ATMENT UNIT DESCRIPT	ION				II. OVERALL PARAMS -	individual flow	s	
-	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L	
75 HP Aerators	#	31	15	6				
100 HP Aerators	#	0	0	0				
epower	HP	2325	1125	450	Inlet Stream **	25.48	60.0	AVG ASB Inlet, 2021 and 2022
Ire	С	35.4	33.5	31.3	Condensate Stream	0.0	0	
	ft	968	1,208	1,235	Outlet	25.5	5.1	AVG ASB Effluent, 2021 and 20
	ft	968	604	617	** except conde	nsate flow		
epth	ft	4.5	3.2	3				
otation	rpm	1200	1200	1200				
vrea per 75 HP aerator	ft2	1452	1452	1452				
vrea per 100 HP aerator	ft2	2206	2206	2206				
iameter	in	19.5	19.5	19.5	NA - individual flow/conc	data not availal	ole	

LL PARAMS - total flow	ws	100.00	N # 34	III. HAP DAT	ΓA		1.00	and Service	A 1993 0
	Flow	Flow	MeOH	Methanol			Average	Zone Conce	ntration
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3
oncentration	711.11	25.5	60.0	Conc.	mg/L	60.0	7.4	5.4	3.2
				Temp.	F		95.7	92.3	88.3
oncentration			5.10						
∋d	mph		3.8						
LTS		-					12%	9%	5%
nanol		2.1.1.1.1	%			Expected zone	concentratio	on reduction	s similar to 2022
odegraded		8	36.3			No Hardpipe S	tream		
r emissions			5.2						
maining in unit effluent			8.5						

ns:

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## APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

#### Data Date:

PAE - New Stripper Scenario

	Diff in Water	Diff in Air	Henry's Law	Equil. Ratio (Hc) or (Keg)	MW	ScG	Antoir	ne Eqtri
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	c
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

General			
	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

	TURBULENT KL Params		-	
		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators) QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	DIFFUSED			
	Air flow, cfm	0	0	0
	Air flow, m3/s	0.000	0.000	0.000

## PENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Iculating Mass Transfer Coefficient KL for Various Zones

ta Date: PAE - New Stripper Scenario

Surface Aeration													
		Т	urbulent Area		Quiescient Area								
								kL, m/s					
	Temp Adj	kG	kL	KL turb	kG	5.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1		U10 > 3.25	10000	kL	KL quisc	KL overall	
	Ĥ	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s	
ne1				1000	1.000			1.1.1.1.1.1.1					
thanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06	
ne 2											- 1111		
ethanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06	
ne 3													
thanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06	

## FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

## Data Date: PAE - New Stripper Scenario

NAME OF	THE FACILITY							
COMPOU	ND for site specific biorate	determination			Me	thanol		
Number of	zones in the biological trea	atment unit		-				
VOLUME	of full-scale system (cubic	meters)			2 25	50372.98		
Average D	EPTH of the full-scale syst	tem (meters)			3 1.	0878333		
FLOW RA	TE of wastewater to the un	iit (m3/s)		4	F F	1.116		
FLOW RA	TE of condensate to the ur	nit (m3/s)		5	5	0.000		
Total wast	tewater flowrate - (includ	ing condensates)	(m3/s)	5-A		1.116		
ESTIMATE	OF KL (m/s)	<b>9</b> • • • • • • • • • • • • • • • • • • •		e	s s	ee table		
Concentrat	tion in the wastewater treat	ted in the unit (ma/L	.)		7	60		
Concentrat	tion in the condensates (m	a/L)	7	8	3	0		
Concentra	ation in wastewater (total	- inc. cond) in (m	a/L)	8-4		60		
Concentrat	tion in the effluent (ma/L)		<u>.</u>	9	5.	0982378		
o on o on a o					1			
TOTAL IN	ET ELOW (m3/s) line 4 pl	lus the number on li	ne 5 (or 5-A)	1		1.116		
TOTAL RE	SIDENCE TIME (s) line 2	divided by line 10		1		224279	2 60	davs
TOTAL AR	EA OF IMPOUNDMENT (	m2) line 2 divided b	v line 3	12		230157		
10171271			.,					
	Lines 13 through 15 Not Use	ed					-	19
	Emos to through to the out		Estimate of KL					
Zone	Concentration for zone	Area of the	in the zone	AIR	STE	RIPPING		
Number	Ci (mg/L)	zone A (m2)	(m/s)	KL	A Ci	(a/s)		
1	7 38608521	87091 1501	3 54365E-06	1.12		2 2795	0.308621	
2	5 393164807	67793 7816	2 39719E-06			0.8765	0.162515	
2	3 166816433	70821 6825	1 37942E-06			0.309	0.007603	
3	3.100010433	10021.0020	1.070422-00			0.000	0.007000	
4								
5								
TOTALS -	sum for each zone.	15 225706.614		16		3.47		
Removal h	wair stripping (g/s) Ling (	16		17	7	3 47		
Loading in	offluent (g/s) Line 9 times	line 10		15	2	5.69		
Total loadi	(q/s) Line 5 time 8)+(in	n Atline 7)) or fline	5-A*line 8-A1	10	2	67.0		
Romoval h	hig (g/s). {(inte 5 line 6)+(inte 6)+(inte 6)+(interesting and a second se	10.4 minus (line $17$ )	- J-A IIIIe J-Aj. + lino 18\	20	)	57.8		
Eraction hi	adagraded: Divide line 20	by line 10		20		0.863		
Fraction of	ouegraded. Divide line 20	7 by line 19.		2	2	0.003		
Fraction al	remissions. Divide line Tr	ivida lina 19 by 10		24		0.052		
Fraction re	maining in unit entuent. D	ivide line to by 19.		2.	>	0.065		

## **K C FORMS - CALCULATING FRACTION BIODEGRADED**

PAE - Old Stripper Scenario

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Enter data in green shaded sections of this page of this spreadsheet only.

ATMENT UNIT DESCRIPT	ION			II. OVERALL PARAMS -	individual flow	vs	
-	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L
75 HP Aerators	#	31	15	6			
100 HP Aerators	#	0	0	0			
epower	HP	2325	1125	450	Inlet Stream **	25.48	59.5
ire	С	35.4	33.5	31.3	Condensate Stream	1.2	2,095
	ft	968	1,208	1,235	Outlet	26.7	5.1
	ft	968	604	617	** except conde	nsate flow	
epth	ft	4.5	3.2	3			
tation	rpm	1200	1200	1200			
rea per 75 HP aerator	ft2	1452	1452	1452			
rea per 100 HP aerator	ft2	2206	2206	2206			
ameter	in	19.5	19.5	19.5	NA - individual flow/conc	data not availa	ble

LL PARAMS - total flo	ws		1100	III. HAP DAT	ГА			1.000	
	Flow	Flow	MeOH	Methanol			Average	Zone Conce	ntration
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3
oncentration		26.7	152.8	Conc.	mg/L	152.8	41.9	24.2	7.6
				Temp.	F		95.7	92.3	88.3
oncentration			5.10						
≥d	mph		3.8						
LTS		T					27%	16%	5%
nanol			%			Avg. 2021/202	2 Zone Redu	ctions	
odegraded			86.8						
r emissions			9.9						
maining in unit effluent			3.3						

## APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

### Data Date:

PAE - Old Stripper Scenario

	Equil. Ratio (Hc)									
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn			
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С		
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13		
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8		
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27		

General				KL Params
	Units	Value	Name	
viscosity of air	g/cm-s	0.000181	va	w
viscosity of water	g/cm-s	0.002	vw	Re
density of air	g/cm3	0.0012	da	PI
density of water	g/cm3	1	dw	Power Number, p
MW of air	g/mol	29	Mwa	Fr
MW of water	g/mol	18	MWW	Total TurbArea (ft2)
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w	Total TurbArea (m2)
grav const.	lb-ft/s2/lb	32.17	g	Frac. Agitated
R	atm-m3/mol K	8.21E-05	R_	(by surface aerators)
Aerator Motor Eff	fraction	0.85	AerEff	QUIESCENT
O2 Trans Correct		0.83	Beta	Depth
Wind Speed	m/s	1.69	U	SurfArea (ft2)
Diff of Ether	m/s	8.50E-06	Dether	SurfArea (m2)
O2 Trans	lb O2/HP-h	3	J	F/D Ratio
				These Parameters are used ScL - Methanol when F/D < 14 AND U > 3.25 ScL - Acetaldehyde

	KL Params					
		Zone 1	Zone 2	Zone 3		
	w	126.3	126.3	126.3		
	Re	2.07E+06	2.07E+06	2.07E+06		
	PI	35063	35063	35063		
	Power Number, p	7.92E-04	7.92E-04	7.92E-04		
	Fr	8.06E+02	8.06E+02	8.06E+02		
	Total TurbArea (ft2)	45012	21780	8712		
	Total TurbArea (m2)	4181.6	2023.4	809.3		
	Frac. Agitated	0.048	181.6 2023.4 1 ).048 0.030 (			
	(by surface aerators)					
	QUIESCENT					
	Depth	1.37	0.98	0.92		
	SurfArea (ft2)	937472	729750	762343		
	SurfArea (m2)	87208.33	67885.00	70916.98		
	F/D Ratio	243	301	328		
meters are used	ScL - Methanol	NA	NA	NA		
14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA		
m/s	ScL - MEK	NA	NA	NA		
	U* (Friction Velocity)	NA	NA	NA		
	DIFFUSED					
	Air flow, cfm	0	0	0		
	Air flow, m3/s	0.000	0.000	0.000		

TURBULENT

## PENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Iculating Mass Transfer Coefficient KL for Various Zones

ta Date: PAE - Old Stripper Scenario

					Surfac	ce Aeration							
		Turbulent Area			Quiescient Area								
	Temp Adj H						kL, m/s						
		kG kL KL turb		KL turb	kG	U10 > 3.25				kL	KL quisc	C KL overal	
		H m/s m/s m/s	m/s	U10 < 3.25	F/D<14	14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>m/s</th><th>m/s</th><th>m/s</th></f>	F/D>51.2	m/s	m/s	m/s			
ne1													
ethanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06	
ne 2													
ethanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06	
ne 3					1.1.1.1.1.1.1.1.1								
ethanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06	
### FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

### Data Date: PAE - Old Stripper Scenario

NAME OF	THE FACILITY					
COMPOU	ND for site specific biorate of	determination		M	ethanol	
Number of	zones in the biological trea	tment unit		1		
VOLUME (	of full-scale system (cubic m	neters)		2 2	250372.98	
Average D	EPTH of the full-scale syste	em (meters)		3 1	.0878333	
FLOW RA	TE of wastewater to the unit	t (m3/s)		4	1.116	
FLOW RA	TE of condensate to the uni	t (m3/s)		5	0.054	
Total was	tewater flowrate - (includi	ng condensates)	(m3/s)	5-A	1.170	
ESTIMATE	E OF KL (m/s)			6	see table	
Concentra	tion in the wastewater treate	ed in the unit (mg/L	.)	7 5	9.511413	
Concentra	tion in the condensates (mg	I/L)		8 2	094.7948	
Concentra	ation in wastewater (total	- inc. cond) in (m	g/L)	8-A	52.79058	
Concentra	tion in the effluent (mg/L)			9 5	0982378	
TOTAL IN TOTAL RE TOTAL AF	LET FLOW (m3/s) line 4 plu ESIDENCE TIME (s) line 2 c REA OF IMPOUNDMENT (r	us the number on li divided by line 10. n2) line 2 divided b	ne 5 (or 5-A) by line 3	10 11 12	1.170 214000 230157	2.48 days
	Lines 13 through 15 Not Use	d				
1.1.1			Estimate of KL			
Zone	Concentration for zone.	Area of the	in the zone	AIR ST	RIPPING	
Number	Ci (ma/L)	zone, A (m2)	(m/s)	KL A C	i (g/s)	
1	41,94854003	87091.1501	3.54365E-06		12.9462	0.308621
2	24,242506	67793.7816	2.39719E-06		3.9398	0.162515
3	7.579459633	70821.6825	1.37942E-06		0.740	0.097693
4						
5						
e						
TOTALS -	sum for each zone.	15 225706.614		16	17.63	
Removal b	by air stripping (g/s). Line 10	6.		17	17.63	
Loading in	effluent (g/s). Line 9 times	line 10.		18	5.96	
Total loadi	ng (g/s). {(line 5*line 8)+(lin	e 4*line 7)} or {line	5-A*line 8-A}.	19	178.8	
Removal b	by biodegradation (g/s) Line	19 minus (line 17	+ line 18).	20	155.2	
Fraction bi	odegraded: Divide line 20 l	by line 19.		21	0.868	
Fraction ai	ir emissions: Divide line 17	by line 19.		22	0.099	
Fraction re	emaining in unit effluent. Di	vide line 18 by 19.		23	0.033	

### **DIX C FORMS - CALCULATING FRACTION BIODEGRADED**

ite:

PAE - No Stripper

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Enter data in green shaded sections of this page of this spreadsheet only.

### REATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3		Flow MGD	Me m
of 75 HP Aerators	#	31	15	6			
of 100 HP Aerators	#	0	0	0	1 S 3.7 - D 1		
orsepower	HP	2325	1125	450	Inlet Stream **	25.48	-59
ature	С	35.4	33.5	31.3	Condensate Stream	1.2	3,8
	ft	968	1,208	1,235	Outlet	26.7	5
	ft	968	604	617	** except cor	densate flow	
) Depth	ft	4.5	3.2	3			
Rotation	rpm	1200	1200	1200			
1 Area per 75 HP aerator	ft2	1452	1452	1452			
Area per 100 HP aerator	ft2	2206	2206	2206	and the second second		
Diameter	in	19.5	19.5	19.5	NA - individual flow/co	nc data not av	ailable

			III. HAP DAT	ГА				
Flow	Flow	MeOH	Methanol			Average	Zone Conc	entration
m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3
	26.7	231.3	Conc.	mg/L	231.3	63.5	36.7	11.5
			Temp.	F		95.7	92.3	88.3
		5.09824						
mph		3.8						
	Flow <u>m3/sec</u> mph	Flow Flow m3/sec MGD 26.7 mph	Flow         MeOH           m3/sec         MGD         mg/L           26.7         231.3           5.09824           mph         3.8	FlowFlowMeOH mg/LMethanolm3/secMGDmg/L26.7231.35.098245.09824mph3.8	FlowFlowMeOHMethanolm3/secMGDmg/LUnits26.7231.3Conc.mg/L5.098245.09824F	Flow         Flow         MeOH         Methanol         Units         Inlet <u>m3/sec</u> MGD         mg/L         26.7         231.3         Conc.         mg/L         231.3           5.09824         5.09824         F         F         F	Flow         Flow         MeOH         Methanol         Average           m3/sec         MGD         mg/L         Units         Inlet         Zone 1           26.7         231.3         Conc.         mg/L         231.3         63.5           5.09824         5.09824         F         95.7	Flow         Flow         MeOH         Methanol         Average Zone Concernance           m3/sec         MGD         mg/L         Units         Inlet         Zone 1         Zone 2           26.7         231.3         Conc.         mg/L         231.3         63.5         36.7           5.09824         5.09824         Methanol         F         95.7         92.3

II. OVERALL PARAMS - individual flows

SULTS	
ethanol	%
biodegraded	87.9
air emissions	9.9
remaining in unit effluent	2.2

Avg. 2021/2022 Zone Reductions

MeOH

mg/L

59.5 3,809 5.1

### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

### Data Date:

PAE - No Stripper

		Equil. Ratio (Hc)						
	Diff in Water	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoir	e Eqtn
	cm2/s	cm2/s	atm-m3/mol	m3 liq to m3 gas	g/mol		b	С
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

General			
	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

	TURBULENT KL Params			
		Zone 1	Zone 2	Zone 3
	W	126.3	126.3	126.3
	Re	2.07E+06	2.07E+06	2.07E+06
	PI	35063	35063	35063
	Power Number, p	7.92E-04	7.92E-04	7.92E-04
	Fr	8.06E+02	8.06E+02	8.06E+02
	Total TurbArea (ft2)	45012	21780	8712
	Total TurbArea (m2)	4181.6	2023.4	809.3
	Frac. Agitated	0.048	0.030	0.011
	(by surface aerators)			
	QUIESCENT			
	Depth	1.37	0.98	0.92
	SurfArea (ft2)	937472	729750	762343
	SurfArea (m2)	87208.33	67885.00	70916.98
	F/D Ratio	243	301	328
These Parameters are used	ScL - Methanol	NA	NA	NA
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA
m/s	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
	DIFFUSED			
	Air flow, cfm	0	0	0
	Air flow, m3/s	0.000	0.000	0.000

# PENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

ita Date: PAE - No Stripper

	Surface Aeration											
		Tu	urbulent Area					Quiescient Area	1			
				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.000			kL, m/s				
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14 <f d<51.2<="" th=""><th>F/D&gt;51.2</th><th>kL m/s</th><th>KL quisc m/s</th><th>KL overall m/s</th></f>	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
ne1 ethanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
ethanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
ethanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

### FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

### Data Date: PAE - No Stripper

NAME OF	THE FACILITY			-		
COMPOUN	ND for site specific biorate	determination			Methanol	
Number of	zones in the biological trea	tment unit		1	· · · · · · · · · · ·	
VOLUME o	of full-scale system (cubic n	neters)		2	250372.98	
Average D	EPTH of the full-scale syste	em (meters)		3	1.0878333	
FLOW RAT	TE of wastewater to the uni	t (m3/s)		4	1.116	
FLOW RAT	TE of condensate to the un	it (m3/s)		5	0.054	
Total wast	tewater flowrate - (includi	ng condensates)	(m3/s)	5-A	1.170	
ESTIMATE	OF KL (m/s)			6	see table	
Concentrat	tion in the wastewater treate	ed in the unit (mg/L	_)	7	59.511413	
Concentrat	tion in the condensates (mo	1/L)		8	3808.7177	
Concentra	tion in wastewater (total	- inc. cond) in (m	g/L)	8-A	231.34146	
Concentrat	tion in the effluent (mg/L)			9	5.0982378	
		6 76 5 17 2 Mar 5	17.6		1 170	
TOTAL INL	ET FLOW (m3/s) line 4 plu	is the number on li	ine 5 (or 5-A)	10	1.170	
TOTAL RE	SIDENCE TIME (s) line 2 of	divided by line 10.		11	214000	2.48 days
TOTALAR	EA OF IMPOUNDMENT (r	m2) line 2 divided t	by line 3	12	230157	
-	Lines 13 through 15 Not Use	d				
	Lines 15 through 15 Not 03c	u	Estimate of KL			
Zone	Concentration for zone.	Area of the	in the zone	AIR	STRIPPING	
Number	Ci (mg/L)	zone, A (m2)	(m/s)	KL A	Ci (g/s)	
1	63 5146271	87091 1501	3.54365E-06		19,6019	0.308621
2	36,70577636	67793,7816	2.39719E-06		5,9652	0.162515
3	11,47612174	70821,6825	1.37942E-06		1,121	0.097693
4			1.00.00.0		0.025	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.
5						
6						
TOTALS -	sum for each zone.	15 225706.614		16	26.69	
Removal b	v air stripping (g/s). Line 1	6.		17	26.69	
I oading in	effluent (g/s) Line 9 times	line 10		18	5.96	
Total loadir	ng (g/s) {(line 5*line 8)+(lin	e 4*line 7)} or {line	5-A*line 8-A}	19	270.7	
Removal h	v biodegradation (g/s) Line	19 minus (line 17	+ line 18)	20	238.0	
Fraction bi	odegraded: Divide line 201	by line 19		21	0.879	
Fraction ai	r emissions <sup>-</sup> Divide line 17	by line 19		22	0.099	
Fraction re	maining in unit effluent. Di	vide line 18 by 19		23	0.022	
. identifier to					U.ULL	

### APPENDIX C -AIR DISPERSION MODELING DOCUMENTATION

Appendix C - Air Dispersion Modeling Analysis for New Stripper Permitting

### Background:

New-Indy Catawba initially submitted an updated ambient air dispersion modeling analysis in support of the New Condensate Stripper Construction Permit Application (application) in March 2023. Facility-wide modeling of hydrogen sulfide (H<sub>2</sub>S), methyl mercaptan (MMC), and total reduced sulfur (TRS) compounds was conducted using the source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK) that were included in the March 8, 2023 modeling submitted to SCDHEC.

For WWTP sources, New-Indy Catawba used the maximum actual emissions rates as submitted in the October 2021 analysis (for H<sub>2</sub>S, and TRS) and corresponding MMC emissions rates, with the exception of the ASB. Based on U.S. EPA's direction, the October 2021 modeling analysis was performed using WWTP emissions rates derived from the RSK-175 method results, rather than the ALS GC method results.

Refined emissions rates reflecting the new steam stripper operation and foul condensate flow for the ASB were developed in support of the application based on ALS GC method results. Due to the ASB being the only WWTP source impacted by the new condensate steam stripper, New-Indy Catawba initially submitted the ambient air dispersion modeling analysis with the updated ASB emissions rates (ALS GC method), but did not change the emissions rates of the other WWTP sources from the October 2021 modeling analysis (RSK-175 method).

The emissions rates used in the original application's modeling analysis were most recently provided to SCDHEC in New-Indy Catawba's July 6, 2023 response.

In discussions and communications after submittal of the original application, SCDHEC has directed New-Indy Catawba to update the air dispersion modeling analysis with emissions rates for all of the WWTP sources based on the ALS GC method results, specifically in the August 25, 2023 email from Katharine Buckner (SCDHEC). This updated air dispersion modeling analysis was submitted in October 2023.

### **Discussion of Updated WWTP Emissions Rates:**

The average ALS GC results from the July 2021 sampling were used to estimate actual emissions rates, which was then scaled up to a maximum emissions rate using the ratio of the July 2021 actual pulp production to a max of 2700 ADTP/day. The modeling analysis is based on these maximum emissions rates. There are no changes to the Post Aeration Basin, Holding Pond ( $H_2S$  only), and Sludge Pond emissions rates, as they were not dependent upon July 2021 liquid sulfur sampling results.

### Air Dispersion Modeling Results:

The air dispersion modeling analysis was conducted using the updated ALS emissions rates for WWTP sources as discussed above, with the same source parameters and emissions rates for non-WWTP sources and the Post-Aeration Basin as the original modeling analysis for the application. Results of the air dispersion modeling analysis demonstrate that ambient concentrations are below the relevant standards for H<sub>2</sub>S, MM, and TRS for each averaging period.

### New-Indy Catawba, LLC 2023 New Steam Stripper Application

Pollutant	Standard <sup>(a)</sup>		Modeled Concentration	UTM Easting	UTM Northing	Rank <sup>(a)</sup>	Standard <sup>(a)(c)(d)</sup>
		Period."	(µg/m <sup>3</sup> )	(m)	(m)		(µg/m <sup>3</sup> )
це	MAAC	24-hour	20.20	511,397.27	3,856,649.76	lst High	140
1125	EPA Action Level	30-minute	100.80	511,249.70	3,856,644.83	1-hour 1st High	837
MMC	MAAC	24-hour	9.46	510,115.55	3,856,041.31	lst High	10
IVIIVIC	EPA Action Level	30-minute	48.00	510,209.41	3,856,039.95	1-hour 1st High	57,000
TDO	MAAC	24-hour	77.25	511,249.70	3,856,644.83	l st High	140
IKS	EPA Action Level	30-minute	385.32	510,143.86	3,855,999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ\_SC%20Modeling%20Guidelines\_10.15.18\_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to H<sub>2</sub>S.

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.

### APPENDIX D -BACKUP STRIPPER METHANOL MODE ADDENDUM

### Background

The construction permit application for the New Condensate Steam Stripper project (Project) was originally submitted in March 2023. The application was updated in April 2024 to reflect the final project description and project emissions calculations at the request of SCDHEC.

The Mill currently utilizes a dual-treatment approach for compliance with the pulping condensate standards of 40 CFR Part 63, Subpart S. The Mill currently operates the existing steam stripper in "methanol mode", which prioritizes operation of the existing condensate steam stripper to remove or "strip" both total reduced sulfur (TRS) compounds and methanol while being fed ~350 gallons per minute (gpm) of foul condensates. Any excess foul condensate flow is treated with hydrogen peroxide to chemically oxidize the hydrogen sulfide into either elemental sulfur or sulfate, then sent via hardpipe to the aerated stabilization basin (ASB) for biological treatment of methanol. When operating in methanol mode, stripped condensates are recycled to the Brownstock Washers, as needed, or discharged to the ASB via the sewer.

Upon installation of the new steam stripper, the existing steam stripper will operate as a backup steam stripper during periods of downtime on the new steam stripper. As part of the Project, the Mill is proposing to operate the backup steam stripper in "TRS mode," which entails feeding all of the foul condensates collected at the mill to the backup steam stripper (nominally 850 gpm). No foul condensates would be sent directly down the hardpipe when the backup steam stripper is in TRS mode.

In TRS mode, the backup steam stripper is expected to still be capable of stripping all of the TRS compounds from the foul condensates (nominal >98% removal). However, due to the higher feed rate of foul condensates to the backup stripper, it is not expected to still be capable of stripping all of the methanol (nominal 45% removal expected). Consequently, the stripped condensate would need to be sent via existing hardpipe to the ASB for further biological treatment of methanol, consistent with the PAE calculations. Emissions calculations for the backup stripper in TRS mode were presented in the original construction permit application submitted in March 2023.

The Mill has been required to operate the existing steam stripper in methanol mode. As such, the Mill is unable to gather meaningful trial data for confirmation of the expected performance of the existing steam stripper operating in TRS mode. After further discussions with SCDHEC concerning the potential technical limitations of gathering data on TRS mode, the Mill provided SCDHEC an update to the PSD applicability calculations to include the alternate operating scenario of the backup stripper operating in methanol mode (i.e., the backup stripper operating as it currently does as the primary, existing stripper). This information, also provided in this updated application, demonstrates that operating the backup stripper in either TRS or methanol mode results in no change to the PSD applicability conclusions of the project.

### Methanol Mode Emissions

This section addresses the differences in the project emissions calculations between the backup stripper operating in either TRS or methanol mode. For each pollutant, New-Indy presented emissions factors for both operating modes in the Appendix B calculations, but the worst-case operating mode was used for PSD applicability calculations to demonstrate the flexibility between the two modes.

One key difference between the two operating modes is that methanol mode requires more steam fed to the stripper. Generally, the Mill has updated the post-project emissions calculations for products of combustion resulting from generation of steam for the backup stripper to account for the higher steam requirements of methanol mode, which results in a small increase in post-project emissions from the original application submittal. Since the existing stripper has operated in methanol mode during the entirety of the baseline, steam heat input for the projected backup stripper methanol mode scenario was assumed to equal the baseline value.

Emissions resulting from the incineration of the backup stripper off gases (SOG) in the combination boilers vary, particularly for VOC and TRS compounds (and consequently SO<sub>2</sub>), based on how much of these compounds are present in the SOG prior to combustion, which depends on several variables, including stripper feed flow rate and stripper removal efficiency. The operating mode of the backup stripper affects both of these variables. Although methanol mode results in a higher stripper removal efficiency, it is at a reduced feed rate, which would both impact the mass of VOC and TRS compounds present in the SOG.

For simplicity, New-Indy based emissions from the backup stripper SOG incineration on the assumption that 100% of the VOC and TRS compounds present in the full volume of foul condensates would be stripped into the SOG and then result in incineration emissions. This is the most conservative SOG emissions calculation as it assumes a 100% stripper removal efficiency for both VOC and TRS compounds at the full foul condensate flow rate (nominal 850 gpm).

The key difference between the backup stripper operating modes is the post-project emissions from the ASB. When the backup stripper is in TRS mode, the ASB would receive up to 850 gpm of condensate that has been stripped of TRS compounds but still containing ~55% of its original methanol. When the backup stripper is in methanol mode, the ASB would receive ~500 gpm of foul condensate. TRS compounds would be treated with hydrogen peroxide addition and the methanol would be treated biologically in the ASB.

Appendix B includes the H2SSIM, WATER9, and Form XIII calculations for determining the ASB emissions factors for VOC, TRS, and H<sub>2</sub>S when the backup stripper is operating in TRS mode. This appendix includes H2SSIM, WATER9, and Form XIII calculations for the ASB VOC, TRS, and H<sub>2</sub>S emissions factors when the backup stripper is operating in methanol mode.

New-Indy used the worst-case emissions factor between the two scenarios for each pollutant's PSD applicability calculations to demonstrate that PSD is not triggered during post-project periods that the backup stripper must be operated, whether it operates in TRS or methanol mode.

### Backup Stripper (Methanol Mode) Scenario - Projected Actual Emissions H<sub>2</sub>S, TRS Compounds, and VOC New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings (prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from $H_2O_2$	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H <sub>2</sub> O <sub>2</sub> )	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.29	0.92	0.24	6.93E-03
H2SSIM/WATER9 Results	H2S, g/s	DMDS, g/s	DMS, g/s	MMC, g/s
ASB Zone 1	0.07	0.35	0.19	5.81E-03
ASB Zone 2	0.03	5.66E-03	4.06E-03	1.06E-04
ASB Zone 3	0.02	1.09E-04	1.45E-04	3.51E-06
Total ASB	0.12	0.36	0.19	5.92E-03
PAE Emissions Factors	H2S, Ib/ODTP	DMDS, Ib/ODTP	DMS, Ib/ODTP	MMC, Ib/ODTP
Total ASB	1.05E-02	3.08E-02	1.69E-02	5.12E-04

Post-Project Foul Condensate Flow: Post-Project Foul Condensate Flow: Post-Project ASB Influent Flow: Total ASB Flow: Total ASB Flow: Pulp Production 500 gpm 0.72 MGD 25.48 MGD 26.20 MGD 1148 L/s 2200 ODTP/day MW 24

34
94
62
48

### NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM) Version 1.3

Data Type 1. Site Ide	ntificatio	n				Data Type 5. Zone Physic	cal and Chemical	Conditions							
Company N	ame		New	/-Indy	]	Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Unit	s	Model Controls		
Facility Na	me	Catawba S		Catawba SC		Catawba SC		Dissolved Oxygen	1.57	4.63	4.66		mg/	L	L'ARRENCE.
Basin Nan	ne		A	SB		Temperature	93.34	89.74	86.02	F		•	Run H2SSIM		
Data Type 2. Model 2	ype 2. Model Zone Informati		tion			рН	7.04	7.24	7.42		s.u.				
Number of Zones	3	•				Redox Condition	Aerobic 💌	Aerobic 💌	Aerobic 💌	Aerobic 🔻			View		
Zone Location of Hardpipe	1	•				Length	968	1208	1235		feet	•	Parameters		
Type of Basin	ASB	•				Width	968	604	617		feet	•	Clear Input		
Data Type 3. Load Ch	ad Characteristics		5	Depth	4.5	3.2	3		feet	feet 💌	Sheet				
Loading Characteristics	Main Influe	n Int	Hardpipe	Units		Mixing	Moderat -	Moderat -	Moderat 💌		1				
Flow	25.4	8	0.72	MGD -		Number of Aerators	31	15	6						
Total Sulfide	0.25	2	1.47	mg/L 💌	1	Total Horsepower	2325	1125	450		HP				
Sulfate	390		390	mg/L 🔫		Impellor Size	1.625	1.625	1.625		feet	•			
Data Type 4. Atmosp	heric Co	nditic	ins	THE R.		Impellor RPM	1200	1200	1200	1	RPM	1			
Windspeed	3.55	5	mph 👻			Diffused Air Flow	0	0	0		cms	•			
Ambient	79		F 🗣	1		Weir Height	0	0	0		feet	-			

Temperature

#### D-4

### **H2SSIM** Results

### Backup Stripper Methanol Mode Scenario

Basin Emissions		Units
Total Emissions (H <sub>2</sub> S)	0.121	gms/s
Total Emissions (H <sub>2</sub> S)	8417.2	lbs/yr
Total Emissions (H <sub>2</sub> S)	4.2	tons/yr
Total Emissions (H <sub>2</sub> S)	3.8	tonnes/yr
Emission Flux (H <sub>2</sub> S)	16.9	gms/m <sup>2</sup> yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H <sub>2</sub> S)	0.07	0.03	0.02	15 S. A.	gms/s
Zone Emissions (H <sub>2</sub> S)	5132.3	1762.9	1521.9		lbs/yr
Emission Flux (H <sub>2</sub> S)	26.7	11.8	9.8		gms/m <sup>2</sup> yı
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	39.300	6.400	5.600		lbs/yr

Current Para	meters
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O <sub>2</sub> Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Percent Inlet Sulfide Removed 63.0%

COMPOUND NAME	conc in	fe air	fe bio	conc out	emissions
	(ppmw)			(ppmw)	(g/s)
DIMETHYL DISULFIDE	8.367e-1	0.36428	0.61827	1.46e-2	3.499e-1
DIMETHYL SULFIDE (DMS)	2.074e-1	0.80097	0.17688	4.593e-3	1.907e-1
HYDROGEN SULFIDE	2.835e-1	0.98155	0.	5.231e-3	3.195e-1
METHANETHIOL(methyl mercaptan)	5.699e-3	0.8877	0.09361	1.065e-4	5.808e-3
Total rate for all compounds					8.658e-1
SUMMARY FOR EMISSIONS AT UNIT 17 ASB 03-14-2024 09:38:13	Zone 3 aerated	d biotreatm	nent		
COMPOUND NAME	conc in (ppmw)	fe air	fe bio	conc out (ppmw)	emissions (g/s)
DIMETHYL DISULFIDE	5.231e-4	0.18124	0.76948	2.578e-5	1.088e-4
DIMETHYL SULFIDE (DMS)	2.136e-4	0.58962	0.31941	1.943e-5	1.446e-4
HYDROGEN SULFIDE	2.231e-4	0.88747	0.	2.511e-5	2.273e-4
METHANETHIOL(methyl mercaptan)	4.197e-6	0.72787	0.18714	3.567e-7	3.507e-6
Total rate for all compounds SUMMARY FOR EMISSIONS AT UNIT 18 ASB 03-14-2024 09:38:13	Zone 2 aerated	d biotreatm	nent		4.842e-4
COMPOUND NAME	conc in	fe air	fe bio	conc out	emissions
	(ppmw)			(ppmw)	(g/s)
DIMETHYL DISULFIDE	1.46e-2	0.3375	0.62668	5.231e-4	5.658e-3
DIMETHYL SULFIDE (DMS)	4.593e-3	0.7705	0.183	2.136e-4	4.063e-3
HYDROGEN SULFIDE	5.231e-3	0.95735	0.	2.231e-4	5.749e-3
METHANETHIOL(methyl mercaptan)	1.065e-4	0.86336	0.09723	4.197e-6	1.056e-4

### APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date:

PAE - Backup Stripper (Methanol Mode)

Instructions:

Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPT		II. OVERALL PARAMS - individual flows					
	Units	Zone 1	Zone 2	Zone 3		Flow MGD	MeOH mg/L
Number of 75 HP Aerators	#	31	15	6			
Number of 100 HP Aerators	#	0	0	0			
Total Horsepower	HP	2325	1125	450	Inlet Stream **	25.48	59.5
Temperature	С	35.4	33.5	31.3	Condensate Stream	0.7	3,809
Length	ft	968	1,208	1,235	Outlet	26.2	5.1
Width	ft	968	604	617	** except cond	ensate flow	
Average Depth	ft	4.5	3.2	3			
Aerator Rotation	rpm	1200	1200	1200			
Agitation Area per 75 HP aerator	ft2	1452	1452	1452			
Agitation Area per 100 HP aerator	ft2	2206	2206	2206			
Impellor Diameter	in	19.5	19.5	19.5	NA - individual flow/con	c data not av	ailable

II. OVERALL PARAMS - tot	al flows			III. HAP DAT	ТА		1.	1.0.0		100 m
	Flow	Flow	MeOH	Methanol			Detect			
	m3/sec	MGD	mg/L		Units	Inlet	Zone 1	Zone 2	Zone 3	Limit
Influent Concentration		26.2	162.5	Conc.	mg/L	162.5	44.6	25.8	8.1	0.5
				Temp.	F		95.7	92.3	88.3	
Effluent Concentration			5.09824	19.00						
Wind Speed	mph		3.8							

IV. RESULTS	
fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	10.1
Fraction remaining in unit effluent	3.1

27% 16% Avg. 2021/2022 Zone Reductions

5%

### **APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED** PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date:

PAE - Backup Stripper (Methanol Mode)

	Equil. Ratio (Hc)									
	Diff in Water cm2/s	Diff in Air	Henry's Law	or (Keq)	MW	ScG	Antoine Eqtn			
		cm2/s atm-m3/mo		m3 liq to m3 gas	g/mol		b	с		
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13		
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8		
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27		

General			
1.	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

#### TURBULENT **KL** Params

		Zone 1	Zone 2	Zone 3	
	w	126.3	126.3	126.3	
	Re	2.07E+06	2.07E+06	2.07E+06	
	PI	35063	35063	35063	
	Power Number, p	7.92E-04	7.92E-04	7.92E-04	
	Fr	8.06E+02	8.06E+02	8.06E+02	
	Total TurbArea (ft2)	45012	21780	8712	
	Total TurbArea (m2)	4181.6	2023.4	809.3	
	Frac. Agitated	0.048	0.030	0.011	
	(by surface aerators)				
	QUIESCENT				
	Depth	1.37	0.98	0.92	
	SurfArea (ft2)	937472	729750	762343	
	SurfArea (m2)	87208.33	67885.00	70916.98	
	F/D Ratio	243	301	328	
These Parameters are used	ScL - Methanol	NA	NA	NA	
when F/D < 14 AND U > 3.25	ScL - Acetaldehyde	NA	NA	NA	
m/s	ScL - MEK	NA	NA	NA	
	U* (Friction Velocity)	NA	NA	NA	
	DIFFUSED Air flow, cfm	0	0	0	

0.000

0.000

0.000

Air flow, m3/s

## APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: PAE - Backup Stripper (Methanol Mode)

-					Surfa	ce Aeration						
		Turbulent Area			Quiescient Area							
	Temp Adj				kG	kL, m/s						
		kG	kL	KL turb		1110 < 3.25	E/D-14	U10 > 3.25	E/D>51.2	kL m/s	KL quisc	KL overall
Zone1		11/5	11/5	11//5	1105	010 - 3.25	110-14	1450/0501.2	F/D-51.2	11//5	11//5	11//5
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

### FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

### Data Date: PAE - Backup Stripper (Methanol Mode)

	THE FACILITY					
COMPOUND for site specific biorate determination					Methanol	
Number of zones in the biological treatment unit				1		
VOLUME of full-scale system (cubic meters)				2	250372.98	
Average D	Average DEPTH of the full-scale system (meters)				1.0878333	
FLOW RATE of wastewater to the unit (m3/s)				4	1.116	
FLOW RATE of condensate to the unit (m3/s)				5	0.032	
Total wast	Total wastewater flowrate - (including condensates) (m3/s)				1.148	
ESTIMATE	ESTIMATE OF KL (m/s)				see table	
Concentral	tion in the wastewater treat	ed in the unit (mg/L	.)	7	59.511413	
Concentrat	tion in the condensates (mo	a/L)		8	3809	
Concentration in wastewater (total - inc. cond) in (mg/L)				8-A	162.53984	
Concentration in the effluent (mg/L)				9	5.0982378	
					4.440	
TOTALINI	LET FLOW (m3/s) line 4 pl	us the number on li	ne 5 (or 5-A)	10	1.148	0.50
TOTAL RE	SIDENCE TIME (s) line 2	divided by line 10.		11	218116	2.52 days
	Lines 13 through 15 Not Use	ed	Estimate of KI			
Zone	Concentration for zone	Area of the	in the zone	AIR	TRIPPING	
Number	Concentration for zone,	Area of the	111 116 20116	/ \11 \ \		
	(1) (ma(1))	$70ne \Delta (m2)$	(m/s)	KI A	Ci (a/s)	
1 tumber	CI (mg/L)	zone, A (m2) 87091 1501	(m/s) 3 54365E-06	KL A	Ci (g/s)	0 308621
1	CI (mg/L) 44.62519102 25.78937099	zone, A (m2) 87091.1501 67793.7816	(m/s) 3.54365E-06 2.39719E-06	KL A	Ci (g/s) 13.7723 4 1912	0.308621
1 2 3	44.62519102 25.78937099 8.06308953	zone, A (m2) 87091.1501 67793.7816 70821.6825	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A	Ci (g/s) 13.7723 4.1912 0.788	0.308621 0.162515 0.097693
1 2 3	44.62519102 25.78937099 8.06308953	zone, A (m2) 87091.1501 67793.7816 70821.6825	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A	Ci (g/s) 13.7723 4.1912 0.788	0.308621 0.162515 0.097693
1 2 3 4	44.62519102 25.78937099 8.06308953	zone, A (m2) 87091.1501 67793.7816 70821.6825	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A	Ci (g/s) 13.7723 4.1912 0.788	0.308621 0.162515 0.097693
1 2 3 4 5 6	44.62519102 25.78937099 8.06308953	zone, A (m2) 87091.1501 67793.7816 70821.6825	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A	Ci (g/s) 13.7723 4.1912 0.788	0.308621 0.162515 0.097693
1 2 3 4 5 5 70TALS -	44.62519102 25.78937099 8.06308953 sum for each zone.	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A 16	Ci (g/s) 13.7723 4.1912 0.788 18.75	0.308621 0.162515 0.097693
1 2 3 4 5 6 TOTALS - Removal b	44.62519102 25.78937099 8.06308953 sum for each zone.	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6.	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A 16 17	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75	0.308621 0.162515 0.097693
1 2 3 4 5 TOTALS - Removal b Loading in	Ci (mg/L) 44.62519102 25.78937099 8.06308953 sum for each zone. y air stripping (g/s). Line 1 effluent (g/s). Line 9 times	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6. line 10.	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06	KL A 16 17 18	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75 5.85	0.308621 0.162515 0.097693
1 2 3 4 5 6 TOTALS - Removal b Loading in Total loadi	Ci (mg/L) 44.62519102 25.78937099 8.06308953 sum for each zone. y air stripping (g/s). Line 1 effluent (g/s). Line 9 times ng (g/s). {(line 5*line 8)+(lir	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6. line 10. te 4*line 7)} or {line	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06 5-A*line 8-A}.	KL A 16 17 18 19	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75 5.85 186.6	0.308621 0.162515 0.097693
1 2 3 4 5 6 TOTALS - Removal b Loading in Total loadi Removal b	Ci (mg/L) 44.62519102 25.78937099 8.06308953 sum for each zone. y air stripping (g/s). Line 1 effluent (g/s). Line 9 times ng (g/s). {(line 5*line 8)+(lir y biodegradation (g/s) Line	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6. line 10. he 4*line 7)} or {line 19 minus (line 17	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06 5-A*line 8-A}. + line 18).	KL A 16 17 18 19 20	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75 5.85 186.6 162.0	0.308621 0.162515 0.097693
TOTALS - Removal b Loading in Total loadi Removal b	44.62519102 25.78937099 8.06308953 sum for each zone. y air stripping (g/s). Line 1 effluent (g/s). Line 9 times ng (g/s). {(line 5*line 8)+(lir y biodegradation (g/s) Line odegraded: Divide line 20	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6. line 10. te 4*line 7)} or {line 19 minus (line 17 by line 19.	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06 5-A*line 8-A}. + line 18).	KL A 16 17 18 19 20 21	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75 5.85 186.6 162.0 0.868	0.308621 0.162515 0.097693
1 2 3 4 5 6 TOTALS - Removal b Loading in Total loadi Removal b Fraction bi Fraction ai	sum for each zone. y air stripping (g/s). Line 1 effluent (g/s). Line 9 times ng (g/s). {(line 5*line 8)+(lir biodegradation (g/s) Line odegraded: Divide line 20 r emissions: Divide line 17	zone, A (m2) 87091.1501 67793.7816 70821.6825 15 225706.614 6. line 10. he 4*line 7)} or {line 19 minus (line 17 by line 19.	(m/s) 3.54365E-06 2.39719E-06 1.37942E-06 5-A*line 8-A}. + line 18).	KL A 16 17 18 19 20 21 22	Ci (g/s) 13.7723 4.1912 0.788 18.75 18.75 5.85 186.6 162.0 0.868 0.101	0.308621 0.162515 0.097693

### **Buckner**, Katharine

From:	Steven Moore <smoore@all4inc.com></smoore@all4inc.com>
Sent:	Thursday, May 2, 2024 2:31 PM
To:	Rachel Davis; Buckner, Katharine
Cc:	Caleb Fetner; Sheryl Watkins
Subject:	Re: couple issues with the revised app
Attachments:	UPDATED Figure 2-1.pdf

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Improved Figure 2-1 attached. Please let us know if additional measures are needed.



From: Rachel Davis <Rachel.Davis@new-indycb.com>
Sent: Thursday, May 2, 2024 1:41 PM
To: Caleb Fetner <cfetner@all4inc.com>; Steven Moore <smoore@all4inc.com>; Sheryl Watkins
<swatkins@all4inc.com>
Subject: Fwd: couple issues with the revised app

See Katharine's email below, she needs it ASAP please.

Rachel

From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Thursday, May 2, 2024 1:31:32 PM
To: Rachel Davis <Rachel.Davis@new-indycb.com>
Subject: RE: couple issues with the revised app

Please ask him to send it as soon as he can.

Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Buckner, Katharine
Sent: Thursday, May 2, 2024 1:26 PM
To: Rachel Davis <Rachel.Davis@new-indycb.com>
Subject: RE: couple issues with the revised app

### Thanks Rachel.

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



From: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Sent: Thursday, May 2, 2024 1:04 PM
To: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Subject: Re: couple issues with the revised app

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Yes ma'am, it's the same version. I will forward your email to Caleb.

### Rachel

From: Buckner, Katharine <<u>bucknekk@dhec.sc.gov</u>>
Sent: Thursday, May 2, 2024 11:49:29 AM
To: Rachel Davis <<u>Rachel.Davis@new-indycb.com</u>>
Subject: couple issues with the revised app

### **External Email**

Hey Rachel,

I have been through most of the revised application for the new stripper that you provided me at the site visit on Tuesday. A couple of figures and a couple of tables are blurry. There are quite a few pages in appendix B that were printed too large for the page. Can you provide replacements for these Specifically, Figure 2-1, pg 2-3 Table 3-1, pg 3-17 (there are two page 3-17, the first one is text, the second is the table) Table 3-3, pg 3-24 Figure 5-6, pg B-21 Figure on pg B-22 Beginning after page B-115, several of the pages were printed too large for the paper size. These are H2SSIM outputs and Appendix C Forms. It was quite a few and page numbers were not on them.

I checked back on the one Caleb emailed on Monday. Only Figure 2-1 and a lot of the pages after B-115 are still the culprits. The pages after B-115 were pdfed as larger pages than 8x11.

We could use the one Caleb sent on Monday, but can you get the Figure 2-1 fixed? Is the emailed version the exact same as the copy you handed me on Tuesday?

### Thanks,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213 bucknekk@dhec.sc.gov

S.C. Dept. of Health & Environmental Control 2600 Bull Street Columbia, SC 29201

Connect: www.scdhec.gov Facebook Twitter



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Figure 2-1 Simplified Mill Flow Diagram

### **Buckner**, Katharine

From:	Sheryl Watkins <swatkins@all4inc.com></swatkins@all4inc.com>
Sent:	Tuesday, April 30, 2024 4:10 PM
То:	Buckner, Katharine
Cc:	Rachel Davis; Steven Moore; Caleb Fetner
Subject:	New-Indy Catawba - Comments on Condition B.26 (Revised Draft Construction Permit for the New Stripper)
Attachments:	RB3 revised SO2 BACT B.26 from DHEC (4-30-24).pdf

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi, Katharine! Thank you for providing the revised permit language for condition B.26 in the draft Construction Permit for the New Stripper (attached). On behalf of New-Indy Catawba, we have two requested clarifications to address that the original BACT analysis did not consider fossil fuel firing and is based on furnace design and proper operation (i.e., good combustion practices) when burning black liquor solids (PSD c/p-DA, issued March 16, 2006):

- First sentence: "(S.C. Regulation 61-62.5, Standard No. 7) The No. 3 Recovery Furnace is subject to the existing SO<sub>2</sub> BACT limits during black liquor solids firing of:"
- Second paragraph, third sentence: "Readings collected when black liquor solids are not fired in the recovery furnace is shutdown or not operating may not be used in the calculations."

Let us know if you have any questions and we would appreciate seeing a final version of the draft permit and sob. Thanks!



Sheryl Watkins, P.E. / Senior Technical Manager / ATL Office <a href="mailto:swatkins@all4inc.com/">swatkins@all4inc.com/</a> Direct: 678.293.9428 / Cell: 386.206.0266 / <a href="mailto:Profile">Profile</a> / <a href="mailto:LinkedIn">LinkedIn</a>

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### **Buckner**, Katharine

From:	Caleb Fetner <cfetner@all4inc.com></cfetner@all4inc.com>
Sent:	Tuesday, April 23, 2024 2:08 PM
То:	Buckner, Katharine
Cc:	Rachel Davis; Steven Moore; Sheryl Watkins
Subject:	RE: Questions on new stripper project
Attachments:	Response to DHEC questions posed in March 27 email (4-22-24).docx

\*\*\* Caution. This is an EXTERNAL email. DO NOT open attachments or click links from unknown senders or unexpected email. \*\*\*

Hi Katharine,

Attached are New-Indy's responses to your questions below. Let us know if you have any questions.

Also – here are our comments on the Consent Decree and Ash Handling construction permits and SOBs.

### DRAFT-2024-03-14\_CP-50000175.v1.0 (Ash Handling CP)

• The current project description states that there is a "requirement to discontinue the practice of adding solids to the clarifier." The inherent operation of the clarifier involves sending solids, including fiber solids, in order to allow the solids to settle out of the wastewater for removal. The existing permit language would be at odds with the inherent operation of a clarifier. New-Indy is proposing to add the following clarifying sentence to the C/P to reconcile this issue.

Page 3 of 11: Permission is hereby granted to install and operate new equipment as part of meeting the requirement to discontinue the practice of adding solids to the clarifier, as directed by the federal Consent Decree entered in Civil No. 0:21-cv-02053-SAL, United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (Consent Decree). Specifically, the solids referred to in the Consent Decree are understood to be wet sluiced solids collected from the combination boilers.

### DRAFT-2024-03-14\_CP-50000175.v1.0sob (Ash Handling SOB)

- Page 2 of 7: Combination Boiler No. 1, No. 7 conveyor to fly ash silo should be 3,100 lb/hr rather than 3,900 lb/hr.
- Page 3 of 7: PM<sub>10</sub> and PM<sub>2.5</sub> controlled emissions should be both 0.096 tons/yr rather than 0.96 tons/yr.
- Page 5 of 7: 40 CFR 61 section edit as follows:

### <u>Not Applicable</u>

The Dry Ash Handling System does not have any emissions of asbestos, coke oven emissions, radio nuclide, radon, vinyl chloride, benzene, and mercury. However, the system does emit beryllium and arsenic contained in the ash, however, these emissions are not from the types of industries or sources covered by the Part 61 NESHAPs.

**Suggested edit to the facility descriptions in all four documents:** *In 2021, the pulp production was converted from bleached to unbleached and utilizes one two paper machine and one pulp dryer. A second paper machine at the mill is currently idled.* 



**Caleb Fetner** / Managing Consultant 678.293.9431 / <u>Profile</u> / <u>LinkedIn</u>

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From: Buckner, Katharine <bucknekk@dhec.sc.gov>
Sent: Wednesday, March 27, 2024 3:23 PM
To: Rachel Davis <Rachel.Davis@new-indycb.com>; Sheryl Watkins <swatkins@all4inc.com>; Caleb Fetner <cfetner@all4inc.com>; Steven Moore <smoore@all4inc.com>
Subject: Questions on new stripper project

Hey Everyone,

I am working on addressing the comments in the SOB for the new stripper. I have some questions that pertain to or have arisen from that.

- Each stripper has a condensate feed tank. What happens to the contents of one tank when the other stripper is operating? For example, the existing stripper will need to be operated, yet there is condensate in the new LP Steam Stripper Feed Tank. What happens to the contents of the new LP Steam Stripper Feed Tank? Will the contents stay put until the new stripper is operated again so that there are breathing losses from this tank that vent to the LVHC Collection System? Or will the contents be transferred to the existing stripper feed tank?
- 2. Is it expected that the LP Steam Stripper Rectified Liquid (SRL) Methanol Tank will always have material in it so that there are breathing losses from this tank that vent to the LVHC Collection System?
- 3. In comments in the SOB received on March 16, 2024, a request has been made to use the October 2021 SO2 testing of the combination boilers instead of conducting new testing. Will the operating scenario for the existing stripper during the October 2021 be the same after the equipment for the new stripper is installed? Will the operating scenario be the same as October 2021 with the new LP Steam Stripper Feed Tank and new LP Steam Stripper Rectified Liquid (SRL) Methanol Tank also venting to the LVHC collection system?
- 4. One of EPA's comments was is there vendor/company documentation to show the existing stripper can meet the removal targets, especially at the maximum foul condensate throughput of 850 gallons per minute?
- 5. DHEC's consent order says New-Indy shall optimize, operate, and maintain the existing steam stripper... (Conclusions of Law, item 5.). It is understood that this will be done once the new stripper is on line. How will the optimization be assessed for the existing stripper?
- 6. EPA commented that it was not clear that emission increases were presented for the No. 2 Recovery Furnace. Here is what the SOB says about it. Is there some language that can be added to make it clearer? Is the black liquor in a tank? Is the SRL added to that tank? Does that tank directly feed both No. 2 and No. 3 Recovery Furnaces? So what does the emission calculations present as far as the combustion of the black liquor in the recovery furnaces and increase in emissions? Is that the increase for one or both?

SRL combustion in Nos. 2 or 3 Recovery Furnaces – SRL is added to the black liquor, which is combusted in the Nos. 2 and 3 Recovery Furnaces. Emissions from the combustion of SRL in the recovery furnaces were estimated. The SRL is expected to contain approximately 40% of the TRS, based on information provided by the vendor. Approximately 99% of the sulfur from the combustion of the TRS will be absorbed within the salt fume inside the recovery furnaces.

Please provide responses as soon as you can.

### Thank you,

**Katharine K. Buckner** Wood and Surface Coating Permit Section Bureau of Air Quality – Air Permitting Division

Office: (803) 898-3213

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### Response to questions posed in a March 27, 2024 email from Katharine Buckner.

I am working on addressing the comments in the SOB for the new stripper. I have some questions that pertain to or have arisen from that.

Q1: Each stripper has a condensate feed tank. What happens to the contents of one tank when the other stripper is operating? For example, the existing stripper will need to be operated, yet there is condensate in the new LP Steam Stripper Feed Tank. What happens to the contents of the new LP Steam Stripper Feed Tank? Will the contents stay put until the new stripper is operated again so that there are breathing losses from this tank that vent to the LVHC Collection System? Or will the contents be transferred to the existing stripper feed tank?

R1: As there are not any back-up steam strippers that we are aware of in operation in the pulp and paper industry, the Mill will complete operation, startup, shutdown, and maintenance procedures for both the new and existing steam stripper as part of a written process hazard analysis for the "stripper system" upon startup of the new steam stripper. However, it is expected that when either stripper shuts down, there would be no attempt initially to draw down the process condensate in the tank. The tank would remain enclosed and any breathing losses would be vented to the closed vent LVHC collection system. If necessary from a safety or operational standpoint, the Mill would draw down the tank to a minimum level needed for standby position.

Q2: Is it expected that the LP Steam Stripper Rectified Liquid (SRL) Methanol Tank will always have material in it so that there are breathing losses from this tank that vent to the LVHC Collection System?

R2: The Mill expects that when the SRL system is offline that there would be no attempt initially to draw down the SRL methanol in the tank. The tank would remain enclosed and any breathing losses would be vented to the closed vent LVHC collection system. If necessary from a safety or operational standpoint, the Mill would draw down the tank to a minimum level needed for standby position.

Q3: In comments in the SOB received on March 16, 2024, a request has been made to use the October 2021 SO2 testing of the combination boilers instead of conducting new testing. Will the operating scenario for the existing stripper during the October 2021 be the same after the equipment for the new stripper is installed? Will the operating scenario be the same as October 2021 with the new LP Steam Stripper Feed Tank and new LP Steam Stripper Rectified Liquid (SRL) Methanol Tank also venting to the LVHC collection system?

R3: The lbs SO<sub>2</sub>/ADTP emissions factor developed from the October 2021 SO<sub>2</sub> testing effort on the combination boilers is based on/representative of operating the existing steam stripper in "Methanol" Mode, which is representative of 98% removal of the TRS and greater than 92% removal of methanol from the pulping condensates, but at reduced condensate feed flow rate to the stripper. The mill would expect that the condensate feed flow rate to the stripper to be higher in the "TRS" Mode, with a higher expected TRS loading in the stripper off-gases (SOG), and a higher lbs SO<sub>2</sub>/ADTP emissions factor at the combination boilers. Therefore, we expect to utilize the SO<sub>2</sub> emissions factor used in the PSD analysis for the new stripper SOG burning for the existing stripper SOG burning under both the "TRS" and "Methanol" Modes of operation (Note: The October 2021 test showed the existing stripper SOG SO<sub>2</sub> emissions factor of 1.06 lb/ADTP as compared to the more conservative SO<sub>2</sub> emissions factor of 1.4 lb/ADTP used in the PSD analysis for the new stripper SOG).

The new and existing steam stripper feed tanks and SRL methanol tank will be or are (in the case of the existing steam stripper feed tank) vented to the existing LVHC system; therefore, the emissions will be captured and controlled in the No. 3 Recovery Furnace or combination boilers.

Q4: One of EPA's comments was is their vendor/company documentation to show the existing stripper can meet the removal targets, especially at the maximum foul condensate throughput of 850 gallons per minute?

R4: There is currently only limited (approximately 1 hour) operational data for the existing stripper operating at approximately 830 gpm. As the DHEC consent order requires that the Mill operate the existing steam stripper in "methanol" mode (i.e., higher steam to condensate feed ratio with target methanol removal efficiencies greater than 92% for compliance under 40 CFR 63, Subpart S), the Mill cannot currently operate the existing stripper in the total reduced sulfur (TRS) mode without violating the order. In "TRS" mode, the Mill would operate the existing backup stripper at a lower steam to feed ratio to achieve up to 850 gpm feed flow. As this information cannot be collected/evaluated until the new stripper is online, the Mill has provided project emissions increase calculations for operating the existing stripper in "methanol" mode. As emissions increases for all pollutants are below the PSD SER for both the "TRS" and "Methanol" modes, the Mill will have the option to run in either mode as a back-up to the new stripper system. TRS and methanol performance curves for the existing steam stripper will be established as part of the initial performance testing effort.

Q5: DHEC's consent order says New-Indy shall optimize, operate, and maintain the existing steam stripper... (Conclusions of Law, item 5.). It is understood that this will be done once the new stripper is online. How will the optimization be assessed for the existing stripper?

R5: The Mill plans to prepare a written startup and operating guide as part of the initial performance test that will establish the curve for removal efficiencies for TRS and methanol as a function of stripper steam to condensate feed ratio; thereby optimizing the its operation under the backup stripper scenarios.

Q6: EPA commented that it was not clear that emission increases were presented for the No. 2 Recovery Furnace. Here is what the SOB says about it. Is there some language that can be added to make it clearer? Is the black liquor in a tank? Is the SRL added to that tank? Does that tank directly feed both No. 2 and No. 3 Recovery Furnaces? So what does the emission calculations present as far as the combustion of the black liquor in the recovery furnaces and increase in emissions? Is that the increase for one or both?

SRL combustion in Nos. 2 or 3 Recovery Furnaces – SRL is added to the black liquor, which is combusted in the Nos. 2 and 3 Recovery Furnaces. Emissions from the combustion of SRL in the recovery furnaces were estimated. The SRL is expected to contain approximately 40% of the TRS, based on information provided by the

vendor. Approximately 99% of the sulfur from the combustion of the TRS will be absorbed within the salt fume inside the recovery furnaces.

R6: The Mill will conduct testing on the inlet and outlet of the new steam stripper, which will demonstrate how much TRS is captured in the stripper off-gases and could potentially be condensed into the SRL. The Mill will also test for the sulfur content of the SRL stream to confirm the 40/60 split between the SRL and SRL LVHC. The Mill will also use the sulfur content of the SRL stream to demonstrate the sulfur loading from the SRL being mixed in the black liquor does not significantly impact the percent sulfur in the as-fired black liquor and; therefore, does not significantly change the emissions from the No. 2 Recovery Boiler with the expected inherent sulfur removal in the salt fume and recycled saltcake.

### **Buckner**, Katharine

From:	Rachel Davis <rachel.davis@new-indycb.com></rachel.davis@new-indycb.com>
Sent:	Tuesday, April 16, 2024 1:49 PM
То:	Buckner, Katharine
Cc:	McCaslin, Steve; Hardee, Christopher; smoore@all4inc.com; Caleb Fetner; Sheryl Watkins
Subject:	New Indy New Stripper Construction Permit follow up
Attachments:	2024-04-16 NICB RF3 SO2 CEMS-New Stripper Project.docx; 2024-04-16 RF3 Sulfur
	Balance.xlsx
Importance:	High

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Ms. Katharine, per our conversations concerning the SO<sub>2</sub> CEMS for RB<sub>3</sub> in the new stripper construction permit, please see the attached proposal for the operation of a temporary CEMS and supporting justification behind this proposal.

Please let me know if you have any questions.

Thank you and have a blessed day!

Rachel G. Davis Environmental Manager O: 803-981-8206 rachel.davis@new-indycb.com



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### New-Indy Catawba LLC Additional Information in Support of the Construction Permit Application for the New Condensate Steam Stripper

New-Indy Catawba LLC (New-Indy Catawba) submitted a construction application for the New Condensate Steam Stripper (Project) to the SC DHEC Division of Air permitting on March 22, 2023 in accordance with the SC DHEC Consent Order to Correct Undesirable Levels of Air Contaminants, signed November 23, 2022 (Consent Order), the terms of which also include requirements of the EPA Consent Decree entered in Civil No. 0:21-cv-02053-SAL, *United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (Consent Decree).* The construction permit application is currently under review by SCDHEC and the United States Environmental Protection Agency (U.S. EPA). SCDHEC, U.S EPA, and New-Indy Catawba are in discussions and New-Indy Catawba is providing the following additional information to support the technical review, statement of basis (SOB), and the draft air construction permit conditions that will undergo a 30-day public notice period for the Project:

- Proposed method for post-project demonstration that the project-related emissions increase for SO<sub>2</sub> does not exceed the Prevention of Significant Deterioration (PSD) significant emissions rate (SER) (i.e., the Project is not a major modification in regards to SO<sub>2</sub>) and;
- Proposed compliance methodology post-project for demonstrating continuous compliance with the existing best available control technology (BACT) sulfur dioxide (SO<sub>2</sub>) emissions limit for the No. 3 Recovery Furnace (Equipment ID No. 5105, RF3).

# Proposed Method for Post-project Demonstration that the Project-related Emissions Increase for SO<sub>2</sub> Does Not Exceed the PSD SER (i.e., the Project is not a major modification in regards to SO<sub>2</sub>).

Although the PSD applicability calculations submitted with the original application demonstrate a ~100 ton per year (tpy) decrease in SO2 project-related emissions, this conclusion is mainly dependent upon several variables, namely the sulfur capture in RF3.

After discussions with DHEC, New-Indy Catawba is proposing the following method to confirm the RF3 sulfur capture efficiency that was used in the construction permit application post-project.

### Sulfur Capture in the No. 3 Recovery Furnace

**Impact on PSD Calculations and Application Projected Value:** The sulfur capture efficiency of RF3 was estimated to calculate the incremental increase in  $SO_2$  emissions from incinerating stripper rectified liquid (SRL)/SRL LVHC and LVHC gases. The project-related emissions of  $SO_2$  do not include emissions from black liquor solids (BLS)/natural gas firing, so the emissions calculation method in the application was based on applying the estimated sulfur capture efficiency to the pre-control emissions factors for the SRL/SRL LVHC and LVHC streams (i.e., the sulfur content of these streams converted to an  $SO_2$  basis).

New-Indy Catawba expects to achieve greater than 99% sulfur capture in RF3 after completion of the project, but conservatively calculated post-project emissions in the construction permit application based on 99%.

**Method:** Temporary operation of an SO<sub>2</sub> continuous emissions monitoring system (CEMS) on RF3 pre and post-project. Demonstrating continuous compliance with the current BACT limit will confirm the sulfur capture and removal efficiency of the smelt bed salt fume is equal to or greater than 99 percent as represented in the construction permit application.

Project-related SO<sub>2</sub> emissions do <u>NOT</u> include the emissions resulting from BLS and natural gas firing (i.e., the installation of the new steam stripper and RF3 becoming primary control for existing LVHC gases does not affect the BLS or natural gas firing in RF3). Although the CEMS will provide actual emissions data from RF3, those emissions will include emissions from BLS and natural gas firing. As the SO<sub>2</sub> CEMS cannot differentiate SO<sub>2</sub> emissions resulting from BLS/natural gas firing and SO<sub>2</sub> emissions resulting from LVHC/SRL/SRL LVHC incineration, the proposed compliance method cannot be to simply compare the difference in pre-project SO<sub>2</sub> CEMS data and the post-project SO<sub>2</sub> CEMS data against the PSD SER.

### Sulfur Balance

As demonstrated in the attached "RF3 Sulfur Balance.xlsx" spreadsheet, a sulfur balance around RF3 can be used to determine the sulfur capture efficiency. During current, pre-project operations, there are two input streams of sulfur to RF3:

- 1. Sulfur in the virgin BLS fed to the saltcake mix tank and,
- 2. Sulfur present in the recycled saltcake that is mixed with the virgin BLS prior to burning.

There are several potential output streams of sulfur from the RF3:

- 1. The majority of the sulfur that is captured in the smelt
- 2. Sulfur in SO2 emissions
- 3. Sulfur in TRS emissions
- 4. Sulfur in uncaptured saltcake that make up a portion of PM emissions
- 5. Sulfur in the captured saltcake that is recycled and mixed with virgin BLS.

Since Output (5) is recycled to become Input (2), those sulfur streams cancel each other out of the sulfur balance. The sulfur capture efficiency of RF3 can then be calculated as:

### Sulfur Capture Efficiency % = 1 – [(sulfur emitted as SO2, TRS, and PM) /sulfur input to RF3]

New-Indy is providing in the attached spreadsheet an hourly sulfur balance around RF3, pre-project. Hourly sulfur input is calculated using recent sulfur content testing on the virgin liquor and the maximum hourly firing rate of BLS. The uncaptured sulfur (i.e., the sulfur emitted out of the stack) were calculated at the currently permitted emissions rates:

- SO2: BACT limit of 50 ppmdv @ 8% O2 (nominally equivalent to 126 lb/hr)
- TRS: Limit of 5 ppmdv @ 8% O2 (nominally equivalent to 6.7 lb/hr)
- PM: Limit of 0.025 gr/dscf @ 8% O2
  - Based on NCASI technical memo, sulfate compounds were assumed to make-up 63.6% of total filterable PM. It was assumed that all of the sulfate present in the filterable PM is sodium sulfate for purposes of conversion to a mass of sulfur basis.

This sulfur balance demonstrates that the RF3 (pre-project) achieves an estimated 99.1% sulfur capture efficiency in order to comply with its permitted emissions rates. Since the TRS and PM contributions to uncaptured sulfur are relatively small, New-Indy is proposing that upon completion of the project, compliance via temporary CEMS with the SO2 BACT limit of 50 ppmdv @ 8% O2 on an annual average will also serve as demonstration that RF3 is achieving greater than 99% sulfur capture on an annual average that was used as the basis of the construction permit. In other words, New-Indy is demonstrating that compliance with the annual average BACT limit via the temporary CEMS will also confirm a key variable used in the PSD applicability calculations.

It is important to note that upon completion of the project, there will be additional sulfur inputs to RF3 via the SRL/SRL LVHC/LVHC. Thus, an even higher sulfur capture efficiency than 99.1% will be demonstrated via compliance with the SO2 BACT limit.

New-Indy is proposing to use both the pre-project and post-project SO<sub>2</sub> CEMS data to demonstrate compliance with the annual average BACT limit. This will confirm the sulfur capture efficiency of 99% as assumed in the construction permit application to estimate the incremental increase in SO<sub>2</sub> emissions resulting from SRL/SRL LVHC/LVHC incineration in RF3. Confirming the sulfur capture efficiency will provide DHEC evidence that the project-related emissions of SO<sub>2</sub> do not increase greater than the SER. Specifically, New-Indy Catawba is proposing the following methodology:

- Operate the temporary SO<sub>2</sub> CEMS for a period of approximately six (6) months PRIOR to installation and startup operation of the New Condensate Steam Stripper to establish/confirm the sulfur capture and removal efficiency in RF3. The CEMS will be installed as soon as feasible to maximize data capture prior to the Mill commencing burning LVHC gases in RF3.
- 2. Operate the temporary  $SO_2$  CEMS for a period of approximately 24 months AFTER:
  - a. The Mill commences burning LVHC gases in RF3 as the primary control method and,
  - b. Startup operation of the New Condensate Steam Stripper and RF3 burning SRL/SRL LVHC.

### Proposed Compliance Methodology for Continuous Compliance with the Existing BACT SO<sub>2</sub> Emissions Limit for the No. 3 Recovery Furnace

Due to this post-project PSD confirmation involving the temporary installation of a  $SO_2$  CEMS on RF3, New-Indy is also providing a proposed temporary compliance methodology for the existing BACT  $SO_2$  emissions limit for RF3.

Condition C.47 of Title V Operating Permit (TVOP) TV-2440-0005 limits  $SO_2$  emissions from the No. 3 Recovery Furnace to 50 ppmv at 8%  $O_2$  (dry basis) or 551 tpy on an annual average basis. Compliance is currently demonstrated by stack testing (3, 1-hr runs) once every 4 years, or annually if results exceed 50% of the emissions limit.

New-Indy proposes the following approach for demonstration of continuous compliance with the No. 3 Recovery Furnace SO<sub>2</sub> BACT limit during the temporary operation of the SO<sub>2</sub> CEMS, as well as the criteria for removing the CEMS after operation for an approved period of time:

- While the SO<sub>2</sub> CEMS is installed, demonstrate that the Mill meets the No. 3 Recovery Furnace SO<sub>2</sub> BACT emissions limits through calculation of the annual average SO<sub>2</sub> concentration and emissions rate from the SO<sub>2</sub> CEMS Data. The SO<sub>2</sub> CEMS concentration and emissions rate data will be calculated and rolled up on an hourly, daily, and on a 12-month rolling average basis and the 12-month rolling average calculated values will be compared the 50 ppmv at 8% O<sub>2</sub> (dry basis) and 551 tpy BACT emissions limits as follows:
  - Calculate the hourly corrected SO<sub>2</sub> concentration (ppmvd @ 8% O<sub>2</sub>):

Hourly average corrected  $SO_2$  concentration (ppmvd @ 8%  $O_2$ ) = Measured raw ppmvd  $SO_2$  CEMS (average for the hour) \* (20.9 – actual % $O_2$  average for the hour)/(20.9 – 8)

 $_{\odot}$  Calculate the daily and annual average corrected SO\_2 concentration from valid hourly and daily SO\_2 ppmvd @ 8% O\_2:

Daily average corrected SO2 concentration (ppmvd @ 8% 02)

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\sum_{i=1}^{24} [Valid hourly average corrected SO2 concentration (ppmvd @ 8% 02)]
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$$\sum_{i=1}^{24} \frac{Valid\ hours}{day}$$

Annaul average corrected SO2 concentration (ppmvd @ 8% 02)

 $\sum_{i=1}^{365} [Valid \ daily \ average \ corrected \ SO2 \ concentration \ (ppmvd @ 8% \ O2)]$ 

$$\sum_{i=1}^{365} \frac{Valid\ days}{year}$$

 $\circ$  Calculate the hourly SO<sub>2</sub> emissions rate in lbs/hr:

Hourly SO<sub>2</sub> emissions rate = (Hourly average ppmvd SO<sub>2</sub> corrected to 8% O<sub>2</sub>) / (1e6 parts)\* (MW SO<sub>2</sub>, 64.1 lb/lbmol) / (385 scf/lbmol)\* (RF3 flow factor derived from stack test data in dscf @ 8% O<sub>2</sub> / TBLS) \* (Hourly TBLS rate)

Note: The flow factor used in the equation above will be calculated as the average of the flow factors from the last three stack testing efforts.

- $\circ~$  Daily SO\_2 emissions rate (tons): Sum each valid 1-hour SO\_2 emissions rate in lbs/hr / (2,000 lb/ton)
- 12-month SO<sub>2</sub> emissions rate (tons): Sum each valid Daily SO<sub>2</sub> emissions rate in tons for the first twelve-month period and then for each day thereafter on a rolling 12month basis.
- Criteria for removal of temporary SO<sub>2</sub> CEMS: At the completion of the 24-month period following start-up of the new steam stripper, if the SO2 CEMS data (calculated as described above) demonstrates continuous compliance with the annual average SO2 BACT limit, that will also serve to confirm the RF3 salt fume absorbs sulfur and keeps it from forming SO<sub>2</sub> at 99% sulfur removal or above even after the additional sulfur input resulting from the project. This will provide justification for terminating operation of the SO<sub>2</sub> CEMS and institution of routine compliance testing for SO<sub>2</sub>.
| Hourly Sulfur Input                 |             |   | Sulfur In                           | Sulfur Out                            |
|-------------------------------------|-------------|---|-------------------------------------|---------------------------------------|
|                                     | 85          | TBLS/hr                                       | S in Virgin BLS =                   | S in Smelt/Green Liquor               |
| Virgin BLS                          | 5.31        | % Sulfur, OD basis                            | <del>S from salt cake recycle</del> | S from salt cake recycle              |
|                                     | 9,022.8     | lbs, sulfur                                   |                                     | S in SO2 emissions RB3                |
|                                     |             |   |                                     | S in TRS emissions RB3                |
| Hourly Sulfur Output (not captured) |             |   |                                     | S in saltcake portion of PM emissions |
|                                     | 50          | ppmdv @ 8% O2 (Permit Limit)                  |                                     |                                       |
| RB3 SO2                             | 126         | lb/hr, SO2 (equivalent to 551 tpy)            |                                     |                                       |
|                                     | 62.9        | lbs, sulfur                                   |                                     |                                       |
| RB3 TRS                             | 5           | ppmdv @ 8% O2 (Permit Limit)                  |                                     |                                       |
|                                     | 6.69        | lb/hr, TRS as H2S                             |                                     |                                       |
|                                     | 6.3         | lbs, sulfur                                   |                                     |                                       |
|                                     | 0 025       | gr/dscf@ 8% 02 (Permit Limit)                 |                                     |                                       |
| RB3 PM (saltcake)                   | 54 1        | lh/hr PM                                      |                                     |                                       |
|                                     | 34.4        | lb/hr. sulfate (NCASI memo for interior mill) |                                     |                                       |
|                                     | 7.8         | lbs, sulfur (assuming MW of sodium sulfate)   | Sodium Sulfate 142 g/mo             | l                                     |
|                                     | Total Sulfu | ır Not Captured                               | _                                   |                                       |
|                                     | 77.0        | lbs, sulfur                                   |                                     |                                       |
|                                     | 99.1%       | sulfur capture                                |                                     |                                       |
|                                     |             | [1 - (sulfur emitted/virgin BLS)]             |                                     |                                       |

\*Sulfur balance was conducted on an hourly basis for ease of correlating to units of permitted emissions rates. The SO2 BACT limit is an annual average.

