DRAFT SEDIMENT CAPPING WORK PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

November 2017

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LIST OF ACRONYMS

BMP	Best Management Practices
CY	Cubic Yards
EE/CA	Engineering Evaluation/Cost Analyses
EOD	Explosive and Ordnance Demolition
FDP	Field Demonstration Project
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
JA	Joint Application
MEC	Materials of Explosive Concern
MGP	Manufactured Gas Plant
MRA	Modified Removal Action
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permit
PAHs	Polynuclear Aromatic Hydrocarbons
PCN	Pre-Construction Notification
PDR	Project Delineation Report
RAWP	Remedial Action Work Plan
RD	Remedial Design
RSLs	Regional Screening Levels
RSSL	Rocky Shoal's Spider Lily
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company (primary subsidiary of SCANA Services, Inc.)
SCIAA	South Carolina Institute of Archeology and Anthropology
SCWP	Sediment Capping Work Plan
SHPO	South Carolina State Historic Preservation Office
SF	Square Feet
TLM	Tar-Like Material
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USGS	United States Geological Survey
UXO	Unexploded Ordnance
VCC	Voluntary Cleanup Contract

1.0 INTRODUCTION

This Sediment Capping Work Plan (SCWP) presents the remedial activities that will be completed by South Carolina Electric and Gas Company (SCE&G) to address the tar-like material (TLM) that exists within a portion of the Congaree River in Columbia, South Carolina as shown on Figure 1-1. This work plan, and its' component work plans, will be reviewed and approved by the South Carolina Department of Health and Environmental Control (SCDHEC) in consultation with other agencies and project stakeholders.

There has been a considerable amount of work undertaken in support of this project, which is available in the Administrative Record and can be found on DHEC's website at the following location: http://www.scdhec.gov/HomeAndEnvironment/Pollution/CleanUpPrograms/OngoingProjectsUpdates/CongareeRiverSediment/AdministrativeRecord/. The Administrative Record is also available for review at the main branch of the Richland County Public Library located at 1431 Assembly Street, Columbia, SC 29201.

In a letter dated August 16, 2016, SCE&G was requested by SCDHEC to pursue the sediment capping alternative for various reasons detailed in the letter (Appendix A). The SCDHEC letter also provides an excellent summary of the record and events that led to the decision to implement the capping alternative to address the TLM-impacted sediments within the Congaree River.

In summary, efforts to achieve approval for the removal of TLM-impacted sediments via the cofferdam approach were exhausted and it became apparent that there was no removal method that would meet all the criteria necessary for obtaining the permit. The agency concerns regarding potential risks and negative effects of using a cofferdam to isolate the removal area could not be overcome. As an alternative approach, SCE&G attempted to demonstrate the efficacy of using 1-cubic yard sandbags while completing a pilot project (primarily intended to address the potential unexploded ordnance issues) which was referred to as the Field Demonstration Project (FDP). The FDP Documentation Report was submitted to the agencies on July 12, 2016 and provides the findings of Phase 1. The use of the 1-cubic yard bags during the FDP proved to be unsuccessful and the agencies' convictions against the use of a three-phase rock cofferdam were further solidified. The flood event of October 2015 clearly validated the agency concerns and risks associated with installing a cofferdam to facilitate the removal action.

Based on the USACE permitting process, the capping work is also referred to as Phase 2.

1.1 Project Description

This Sediment Capping Project requires the placement of a physical barrier in the form of an engineered capping system over the impacted sediment within the project area. Figure 1-2 provides the limits of the engineered cap. The area to be capped is approximately 100,000 square feet or approximately 2.3 acres of the river sediment. The actual location, orientation and manufacturer of the capping materials will be confirmed during the bidding process and in consultation with the selected construction contractor. Generally, the proposed Sediment Capping Project will consist of:

- Removal of the existing sandbar to facilitate capping and provide a more gradual transition to surrounding bottom surface contours;

- Removal and replacement of existing rocks, boulders, tree stumps, etc. [to the extent feasible] to facilitate placement of the ACB mats; and
- Placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the 2.3 acre impacted sediment area.

Additionally, please note that the capping materials will also be installed from the bottom of the existing access road (i.e., approximate end of the pavement at the boat ramp) westward, into the river and integrated with the actual sediment cap, as shown in Figure 1-2. This extra boat ramp area is:

- Approximately 60 feet wide and 100 feet long (6,000 square feet);
- Has been a long-term, chronically-susceptible area for erosion due to run-off; and
- Must be addressed to help prevent future erosion under the planned sediment cap.

After construction activities are completed, an annual monitoring and inspection program will be implemented (Appendix R).

1.2 Regulatory Background

In June 2010, the occurrence of TLM within the Congaree River was reported to SCDHEC. Preliminary testing conducted on the material by SCDHEC and SCE&G indicated that the material may be attributable to the Huger Street former manufactured gas plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s. The location of the former MGP and the general site location are shown on Figure 1-1. A brief summary of the various regulatory background information is provided below.

SCDHEC – SCDHEC-BLWM and SCE&G agreed to investigate and delineate the extent of TLM within the Congaree River under an existing Voluntary Cleanup Contract (VCC #02-4295-RP) for the former MGP site located at 1409 Huger St [please refer to the Administrative Record for additional information on the VCC].

USACE – SCE&G has been working with the USACE to obtain the appropriate permits to work within and adjacent to the Congaree River. On September 22, 2016, SCE&G submitted a Joint Application (JA) and Pre-Construction Notification (PCN) [Appendix F] for the Sediment Capping Project [USACE Project Number: SAC-2011-01356-6NO]. The approval to conduct the sediment capping project under the Nationwide Permit #38 – Cleanup of Hazardous and Toxic Waste was provided on October 18, 2017 and is included in Appendix F. This approval is based on the information provided in the JA/PCN and permits the project to be completed as proposed in the JA/PCN and this SCWP.

SHPO/SCIAA – This project will also involve potential historic and cultural resource management activities. Therefore, the USACE and SCE&G have been working closely with the South Carolina Institute of Archeology and Anthropology (SCIAA) and the State Historical Preservation Office (SHPO) to develop an appropriate approach to recover and preserve any potential historical properties that may be located within the project area and from the submerged lands of the State of South Carolina. The Memorandum of Agreement (MOA) between and among the USACE, SCE&G and SHPO/SCIAA and the corresponding support plans are provided in Appendix E.

The Permits and Approvals are discussed in detail in Section 2.4.

1.3 Evolution of the Sediment Capping Alternative

After the delineation activities were completed, SCDHEC requested that SCE&G conduct an Engineering Evaluation/Cost Assessment (EE/CA) to discuss potential remedial alternatives to address the TLM-impacted sediment. The Final EE/CA was submitted to SCDHEC on January 15, 2013 and was approved on February 7, 2013 [please refer to the Administrative Record]. The EE/CA presented a detailed evaluation of the following alternatives:

- Alternative 1 - No Action;
- Alternative 2 - Monitoring and Institutional Controls;
- Alternative 3 - Sediment Capping and Institutional Controls; and
- Alternative 4 - Removal and Off-Site Disposal.

In March 2013, DHEC identified a **preferred** cleanup alternative for the Congaree River sediments and soils as **No. 4 – Removal of the TLM and Impacted Sediments**. As discussed in Section 1.0, SCE&G worked with local, state and federal agencies, and multiple environmental consultants, to the exclusion of all other previously identified alternatives (including capping) for six years to find a way to implement Alternative 4. Unfortunately, there simply is no method for sediment removal that will meet all of the requirements of the permitting agencies, specifically the Corps of Engineers and other federal agencies. Sediment capping is a standard practice that has been commonly used and proven effective. The purpose of capping is to prevent material from moving, and SCE&G would continue to monitor the capped area to make sure it is working properly.

In the letter dated August 16, 2016, (Appendix A) SCDHEC reached the following conclusion:

> *The Department has reevaluated the available options presented in the EE/CA and has determined that based on the construction and permitting limitations, it is not feasible to conduct a removal of the TLM / impacted sediment in the Congaree River. Therefore, it is the Department's determination that the best remedy for the site is capping of a modified removal area. The primary objective of the capping approach is to limit or prevent human exposure to impacted sediments within the Modified Removal Area. The Department requests SCE&G pursue Alternative 3 – Sediment Capping and Institutional Controls as provided in the final EE/CA (approved by the Department in February 2013). SCE&G should begin the design and permit process for the capping alternative as soon as possible.*

1.4 Sediment Capping Objectives

The sediment capping objectives are very straight forward:

- The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the MRA area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas; and

- The secondary objective is to prevent re-suspension and potential downstream migration of the impacted sediment.

The following overall goals and objectives were presented in the EE/CA and will be attained by implementing this SCWP:

- Reduce or eliminate the potential for human health or environmental impacts related to the TLM identified in the project area;
- Physically remove, treat or isolate TLM and TLM-containing sediment and river bottom debris from within the project area to the extent practicable;
- Prevent re-suspension and downstream migration of impacted material into currently un-impacted areas;
- Reduce the potential for flux of dissolved constituents into the water column;
- Conduct activities in a manner that reduces impacts to the river resources and habitat;
- Utilize the best available techniques and equipment based on the actual conditions encountered in the project area;
- Restore the project area as close to its original pre-remediation conditions as practicable; and
- Safely conduct the scope of work with as minimal of an impact on the surrounding community and river environment as practicable.

1.5 Overview of this Sediment Capping Work Plan

This SCWP will describe the anticipated overall approach to safely and efficiently install the sediment cap, while adhering to the appropriate federal, state and local requirements. This work plan will serve as a guide for implementation. However, providing SCE&G and their contractor(s) maximum flexibility during implementation of this plan is critical to effectively address unforeseen difficulties and/or extreme weather conditions.

Numerous regulatory agencies, as well as other various stakeholder groups, have had input into this project and Section 2.4, Permits and Approvals, provides additional detailed information regarding this input. Many of the details presented herein for addressing the capping of the TLM were developed based on various agency submittals, applications and/or in response to comments received from the public notification process.

Due to the complexity of this multi-faceted project, this SCWP has been written to briefly describe each project component and then refers the reviewer to an appendix that contains a specific plan, permit application or other work product that provides additional details for a particular issue (i.e., Riverbank and Shoreline Restoration Plan). This approach has the advantages of:

- Allowing the overall plan to be presented in a concise format;
- Providing sufficient detailed information in the standalone documents; and
- Facilitating the review and approval process for the appropriate component plans.

For example, the Navigation Plan (Appendix O) will be submitted to the U.S. Coast Guard (USCG) for review and approval now that the permit from the U.S. Army Corps of Engineers (USACE) has been received. [By regulation, USCG can only review the Navigation Plan after the USACE Permit has been received.]

If any changes, modifications or other responses to comments are required during the review process, each specific plan, submittal or permit application will be revised and re-inserted into the Final SCWP.

1.6 Additional Recent Studies Completed Within the Project Area

In March 2017, SCDHEC conducted surface water sampling activities to determine if the Congaree River water was impacted by constituents from the TLM-impacted sediment. The SCDHEC sampling plan and the complete analytical results of the sampling activities are available in the Administrative Record. A total of 14 surface water samples were collected from within the project area and tributaries of the Congaree River. A figure and a table from the report depicting the sampling locations are provided in the report in Appendix A. No MGP-related constituents were detected in these samples collected by SCDHEC.

SCE&G has since developed a Surface Water - Sampling Analysis Plan (SW-SAP) [Appendix S] based on the SCDHEC plan and will continue to collect surface water samples every six months for the near future. The SCE&G SWSP was approved on July 21, 2017. The intent of the sampling program is to replicate SCDHEC's efforts and collect comparable data from similar locations at routine intervals. The first SCE&G event was completed in September 2017 and confirmed no detections of constituents were observed. Based on the results from these events, the TLM located in the sediments does not appear to be impacting the surface water of the Congaree River.

In addition, the Aquatic Biology Section of SCDHEC conducted an aquatic macroinvertebrate bioassessment in the Congaree River to determine if sediment impacted by coal tar is having an adverse impact on the indigenous macroinvertebrate fauna in the vicinity of the project area. The study was conducted in June 2017 and determined that the macroinvertebrate community from the project area was comparable to the upriver control area. Both areas received a bioclassification score of 4.5 (excellent) on the Carolina Biocondition Scale. The Aquatic Macroinvertebrate Bioassessment completed by SCDHEC is available in the Administrative Record and a summary of the conclusions are provided in Appendix A.

Completion of these recent studies by SCDHEC provides important additional information and independent verification that the TLM is not adversely contributing to impacts in either the surface water or the macroinvertebrate community that inhabits the sediment within the project area. This information also provides further justification for the appropriateness of the capping approach.

2.0 SEDIMENT CAPPING ALTERNATIVE

2.1 Sediment Capping Area Details

The Congaree River is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977). The river depth varies in the project area due to the variability of the

bedrock river bottom elevations and the more recent sediment deposition from the upriver breech in the Columbia Canal experienced during the flood of October 2015 (See Section 2.1.1). The bottom elevations fluctuate from an approximate high of 116 feet MSL to approximately 109 feet MSL in the area to be capped. All elevations are referenced to NAVD '88. Figure 1-2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline. Please note these contours are pre-new-sediment deposition contours (see Section 2.1.1). Average river flow elevation is approximately 116.5 feet MSL with a historical range of approximately 110 to 152 feet in elevation.

The project area abuts the eastern shoreline, which rises sharply from the water's edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately 500 feet. Gist Street is the first paved land surface encountered to the east of the project area. The riverbank is forested in the project area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway (Figure 1-2) and is much thicker and overgrown further south.

Access to the river at the project site is available by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river. This access road is also referred to as the boat ramp. The Senate Street alluvial fan (Figure 2-1), a key, sometimes submerged, land feature in this area, is located at the end of the access road / boat ramp. The alluvial fan is a relatively flat portion of the project area that extends out into the river and appears to have developed over time from upland sediment deposition. At normal, or lower water levels, the alluvial fan area is exposed as dry land. It may be the main access point during completion of future field activities unless another access point is required by the contractor or the adjacent land area is not available.

As seen on the aerial photograph presented in Figure 2-1, directly north and upriver of the alluvial fan is designated as the northern project area and it is the widest part of the area to be capped at approximately 200 feet in width. It contains the sand bar, which is slated for removal during the capping installation. Directly upstream of the sand bar is the boulder field, which constitutes the northern border of the MRA. South of the alluvial fan is known as the southern project area and the width of capping is reduced to between 50 and 100 feet in this area.

As shown on Figure 2-2, multiple sediment borings were installed along the eastern edge of the Congaree River during the TLM delineation. TLM impacts ranged in thickness from none detected to 4.90 feet in thickness at location M6. In general, the thickest layer of TLM is located westward, directly out into the river from the alluvial fan and directly downstream of that location. The extreme northern and southern portions of the project area exhibited TLM deposits of much lesser thicknesses. For a full description of the extent of impacts please refer to the Project Delineation Report submitted in March of 2012, contained in SCDHEC's administrative record. It is also important to note that the boring/delineation data was collected prior to the major storm event of October 2015, as described below.

2.1.1 Major Storm and Flooding Event of October 2015

While conducting the Phase 1 MRA - Field Demonstration Project (FDP) [the FDP is described in greater detail in section 2.1.4], a significant storm event occurred in the Columbia area that resulted in extreme amounts of precipitation runoff to the Congaree River drainage basin. The City of Columbia received

12.5 inches of rain within a 5-day period. On October 4, 2015, the river crested at 31.81 feet (based on the river gage located directly across from the MRA), which corresponds to an approximate elevation of 145 feet (NGVD '29). The last time river levels exceeded this elevation was in 1936 (33.34 feet) and the river has only exceeded this elevation a total of seven times since 1893. The highest historic crest was 39.80 feet in 1908.

Because of the significant flooding event that occurred in October 2015, the Columbia Canal located directly upstream of the project area was breeched and released hundreds of thousands of tons of sediment downstream into the project area and beyond. This sediment was deposited as the flood waters subsided and a significant portion of the new sediment is still in place over the MRA today. Figure 2-3 was created by conducting a bathymetric survey of the project area after the storm event utilizing an echo sounder and comparing the resulting river bottom contours to the pre-storm event contours. The figure illustrates that the project area underwent a significant bathymetric change because of the storm and new sediment deposition. The top of sediment elevation increased after the storm by a range of approximately 0 to 5.5 feet, depending on the location. As a result, most of the project area is covered with an additional layer of new, un-impacted sediment, which will further enhance the cap, once installed and provide an additional "natural cap" to areas outside the MRA.

Also, due to the breach in the Columbia Canal, the hydroelectric dam is no longer functional and the absence of water flow from the dam has allowed the new sediment to remain south of the Gervais Street Bridge. The additional sediment deposit in this area has resulted in the establishment of a new shoreline, which is quickly becoming vegetated, as shown on Figure 2-1.

2.1.2 Recent Aerial Imagery within the Phase 2 Area to be Capped

Figure 2-1 provides a recent (September 2016) detailed aerial photograph of the project area taken utilizing a low-flying remote-controlled drone. The photo clearly shows the project area components including the boulder field to the north, sand bar and the newly deposited sediment along the shoreline, which is a result of down-river sediment migration and the breech of the Columbia Canal.

2.1.3 Historical Areas Within / Adjacent to the Phase 2 Area

There are numerous historical and archaeologically significant areas located in the vicinity of the project area. A Cultural Resources Identification Survey (CRIS) was conducted by TRC (Appendix E) that covered the overall planned project area and the general vicinity. In addition, potential historical sites were researched using ArchSite, which is a geographic information system (GIS) maintained by SHPO and SCIAA.

Two separate National Historic Register sites are located in the general vicinity of the project area along with numerous archeological sites. The historical registered sites consist of the Gervais Street Bridge and the Columbia Canal. Both properties are shown on Figure 2-4 and listed on Table 2-1. The Gervais Street Bridge is located directly upstream of the project area. Implementation of the capping project is not expected to adversely impact the Gervais Street Bridge. Figure 2-4 shows that the approximate location of the Columbia Canal. Although the planned capping activities are located adjacent to the historical designation area as defined by the National Register, project related activities are not expected to adversely impact this historic property.

The cultural resources survey identified several archeological sites located in the vicinity of the area to be capped and the adjacent project support area. These historically significant areas are shown on Figure 2-4 with their applicable descriptions and site ID numbers. Possible ruins from a saw mill (site ID: 38RD224) and a former structure foundation (site ID: 38RD234) are located directly adjacent to and partially within the project area. Consistent with the approved plans (Appendix E), the site archeologist will locate these areas in the field and they will be avoided and protected to the extent practicable during completion of sediment capping project. An underwater deposit of historic items (site ID: 38RD234) is also located within the planned capping area. The placement of the engineered cap will further isolate and will serve to protect these areas. An archeologist will also be on-site to properly document and secure any potential historical items, if encountered during the planned capping activities. The items will be transferred to SCIAA/SHPO, in accordance with the approved plans and MOA (Appendix E).

As shown on Figure 2-4, the Civil War era dump site (site ID: 38RD286) located within and adjacent to the river will be the archeological area most affected by the capping approach. The presence of the Civil War dump site presents two primary issues or concerns for completing the overall sediment remediation project. The concerns consist of:

- The potential for the artifacts to be unexploded ordnance (UXO); and
- Recovering and properly conserving any historical artifacts encountered within the project area.

SCE&G, SCDHEC and the USACE have invested considerable time and effort into addressing these issues.

To mitigate the first issue, multiple UXO management plans were developed to specify the potential management of such items. These plans were submitted to the USACE for review and approval and are included as Appendix D and further described in Section 3.0. As the project has evolved to the sediment capping approach, the previously approved UXO management plans were reviewed, revised and subsequently approved in early 2017 by the USACE to reflect the specific details pertaining to the capping approach (Section 3.2 and Appendix D).

Regarding the second issue, the cap will be placed directly on top of the undisturbed sediment and is not expected to uncover or expose any other historical items. Based on numerous prior artifact recovery efforts, both properly sanctioned and/or undocumented, it is estimated that only a minimal amount of historically significant items may still exist within the planned project area. Since SCE&G intends to minimize sediment disturbance as much as possible, any underlying historical items, should they be present, will not be observed. In the event that any historical items are identified during completion of the project, the on-site archeologist will document the finding and secure the item for transmittal to SCIAA/SHPO in accordance with the approved plans and agreements (Appendix E).

2.1.4 Field Demonstration Project Implementation Results

The field work associated with the Field Demonstration Project (FDP) was initiated in the fall of 2015. Completion of the FDP was hampered by significant rainfall events within the Congaree River drainage basin and subsequent severe increases in the river level elevations. The storm and flooding of early October 2015 and the related breach of the Columbia Canal resulted in the deposition of thousands of tons of “new” sediment in the river and shoreline of the project area. However, several key findings into

the potential UXO component of the project were identified and are applicable to the proposed future capping options. The findings include:

- No potential UXO or historically significant items were identified on the adjacent landside area;
- Of the 51 previously identified Magnetic Anomalies investigated – Zero (0) were UXOs;
- 5 'negative finds' – meaning nothing was found at the previously identified metal anomaly location (i.e., no object found at approximately 10% of the locations);
- There was a relatively large amount of "cultural debris" (i.e., metallic junk) unearthed; and
- Evaluating the metal anomalies was a time consuming and meticulous process due to the volume of subsurface metallic debris that existed within the study area.

The FDP Documentation Report was submitted to the agencies on July 12, 2016 and provides the complete details and findings of the completed field work. The findings are also provided on Figure 2-5.

2.2 Overview of the Sediment Capping Alternative

The project objective is the placement of a physical barrier in the form of an engineered capping system over the majority of impacted sediment to prevent human contact. Figure 1-2 provides the limits of the planned capping area. The area, as shown on Figure 1-2, is approximately 100,000 square feet or approximately 2.3 acres.

Based on the design criteria included in the engineering evaluation discussed in Section 2.2.1, the cap will consist of a geotextile fabric material overlain by articulated concrete blocks (ACBs) connected together to form a mat. The ACBs will be placed from approximately the 116-foot elevation line and they will extend westward, out into the river for approximately 50 to 200 feet, depending on the location. The deployment scenario provided in this work plan has been developed for planning purposes, the precise location, orientation, placement techniques and construction/deployment sequence will be at the discretion of the construction contractor and will likely be dictated by actual field conditions encountered during construction.

With an average river flow elevation for the general project area of approximately 116.5 feet (based on data from 2010 to 2014), most of the ACBs will be placed below normal river flow elevations, except for the erosion prevention area on the boat ramp. The openings in the ACBs, also referred to as cores or cells, will be visible through the water, at low water levels. Even with the underlying geotextile material, it is anticipated that the capping system will settle a few inches into the soft sediment. It is also anticipated that the open cells within the ACB mats will fill with deposited clean sediment [from the top] over time and result in a more natural looking surface. ACB mats will be visible, subject to any future sediment deposition.

Additionally, capping materials will also be installed from the bottom of the existing access road (i.e., approximate end of the pavement at the boat ramp) westward, into the river and integrated with the actual sediment cap. A conceptual layout utilizing typically sized 8 foot x 20 foot articulated mats is shown in Figure 2-6. With this placement plan, approximately 660 mats will be required to adequately cover the MRA. A cross-sectional view of the proposed cap in a portion of the northern project area is provided on Figure 2-7.

Field implementation of the capping alternative will require land based construction support activities that will include improving access to the project area for personnel, equipment and delivery of capping materials. The anticipated improvements are shown on Figure 2-8.

It should be noted that if the land area on the east side of the river immediately adjacent to the project area is not available at the time of construction, alternate project support plans will be submitted for review and approval. The location of the landside support area has no effect on the capping work as described in this SCWP.

Once the cap is installed, construction equipment, work pads, and non-permanent road construction materials will be completely removed from the river and the disturbed river bank and shoreline will be restored to pre-existing conditions, to the extent practicable, in accordance with the Appendix K Riverbank and Shoreline Restoration Plan.

2.2.1 Sediment Cap Conceptual Design

A Conceptual Design of Sediment Capping Options was developed by Rizzo Associates (Rizzo), which is included in Appendix B. Rizzo utilized conservative flow velocity assumptions and specific project area details to determine a stable, long-term capping solution for the project area. The recommended design is presented for implementation in this SCWP.

Based on the design criteria included in the evaluation, the engineered cap will consist of a geotextile fabric material overlain by articulated concrete blocks (ACBs) connected together to form a mat. The individual concrete mats (ACBs) are approximately 20 feet long, 8 feet wide and 8 inches thick. The 8-inch thickness of the blocks was determined by Rizzo to be acceptable to withstand the conservative maximum flow velocities, based on the assumptions stated in the conceptual design. For the evaluation, Rizzo utilized the ArmorFlex® ACB's. Appendix C provides specifications for an equivalent, readily available ACB mat product manufactured by SHORETEC®. The actual product and manufacture of the ACB's will be determined in consultation with the construction contractor. At a minimum, the actual cap materials used for construction will meet or exceed the criteria used in the conceptual design evaluation.

2.2.2 Erosion Control Area

As previously stated, capping materials will also be installed from the bottom of the existing access road (i.e., approximate end of the pavement at the boat ramp) westward, into the river and integrated with the actual sediment cap, as shown in Figure 2-6. This erosion control area is approximately 60 feet wide and 100 feet long (6,000 square feet), and has been a long-term, chronically-susceptible area for erosion due to high velocity runoff down the Senate Street Extension. Extending the concrete mats and geotextile up into this area will guard against future erosion, potential undermining of the cap and create a seamless transition from the Senate Street Extension asphalt roadway into the capped area.

2.3 Justification for Extent of Capping

The decision on the location and the extent of the engineered cap was made based on the intent to cover as much of the deposits of TLM as practical, and to isolate the areas where the potential for human exposure is greatest due to activities such as swimming or wading. As a result, the area located directly adjacent to the alluvial fan was identified as the primary cap location since it is easily accessed by

recreational river users, is relatively shallow during normal river flows and contains the majority of the TLM impacted sediment.

Figure 2-2 provides the sediment sampling locations and the approximate thicknesses of the TLM identified in the sediment borings. Figure 2-1 provides a recent aerial photograph that shows current project area features. The exposed bedrock is visible in most of the area and the sediment thicknesses are minimal (approximately 0.25 feet). Because of the minimal TLM impacts and shallow sediment thickness, the northern border of the sediment capping area was established just south of the boulder field.

As can be seen on Figure 2-2, the engineered cap will cover the majority of the sediment sample locations where appreciable thicknesses of TLM were identified. This is the case in the northern and central portions of the project area where some of the thickest deposits are located. TLM occurrence is more pronounced nearer the shoreline in the southern project area and thins out quickly in the borings located further away from shore in the deeper water. As a result, the engineered cap was reduced in width and located nearer to the shoreline. The decision to limit the cap placement to the area adjacent to the eastern shoreline was made for the following reasons:

1. Human access to this area is limited due to a steep banked shoreline and deeper water at normal flows (approximately 7 to 8 feet deep during normal flows);
2. Significantly lesser amounts of TLM were identified in borings N9 and M10; and
3. Additional thickness (approximately 3 to 4 feet inside the project area and up to approximately 5 feet outside of the project area) of newly deposited sediment resulting from the “superstorm” is serving as a “natural cap” for these locations (Figure 2-3).

Borings located to the south and downstream of the MRA, such as M12, M13, N13 and L13, show lesser thicknesses of TLM and are in deeper water (4 to 10 feet at normal river flows), which will limit their potential for human contact. As can be seen from Figure 2-3, these sediment boring locations are also in the area where the newly deposited sediment ranges from 0.5 to 3 feet in thickness.

Following this rationale, it is apparent that the engineered cap will be sufficient to satisfy the primary objectives of limiting or preventing human exposure to the TLM impacted sediments in the most readily accessible areas. Generally, areas that are not to be capped were found to contain minimal TLM impacts and are located in deeper water, which limits human access ability.

The cap will also prevent re-suspension and potential downstream migration of the significant majority of impacted sediment. Areas outside of the engineered cap are currently “naturally capped” due to the layer of deposited sediment in low velocity areas that will serve to hold the impacted material in place.

2.4 Permits and Approvals

Several pre-construction permit submittal and approval activities are in the process of being completed. As previously discussed, the USACE provided approval to complete the sediment capping activities as described herein under the Nationwide Permit 38. The approval is provided in Appendix F. In addition to the SCDHEC Bureau of Land and Waste Management (BLWM) approval of this SCWP, other permits,

approvals or agreements that are or may be required for implementation of the sediment cap alternative include:

- Verification of SCDHEC Water Quality Certification (401 Permit – received on October 24, 2017);
- Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) National Pollutant Discharge Elimination System (NPDES) permit approval from the City of Columbia and SCDHEC for land disturbance activities associated with the access improvements and construction of the landside support zone is discussed in Section 2.4.1;
- Acceptance of removed material (sandbar) for disposal at the Waste Management Richland County Landfill, as described in Section 2.4.2; and
- USGC review and approval of the Navigation Plan, as described in Section 2.4.3.

2.4.1 SCDHEC NPDES Permit and City of Columbia Land Disturbance Permit

SCE&G will develop and submit a C-SWPPP to SCDHEC and the City of Columbia prior to mobilization. The approval is currently anticipated to be in the form of authorization under a South Carolina NPDES General Permit for Storm Water Discharges from Construction Activities (Permit Number SCR10000). The final permit submittal and the issued permit will be provided in the final documentation report for the capping project. All construction activities will be completed in accordance with the requirements identified in the approved C-SWPPP.

2.4.2 Waste Disposal Approvals

SCE&G anticipates transporting any waste material to the Waste Management Richland County Landfill located in Elgin, SC. The material will include impacted or unimpacted material from the sand bar removal and other excavations along with debris such as rock, brick, concrete rubble, urban debris or other metal or wood debris that may be encountered. Disposal facilities utilized by SCE&G are typically audited and pre-approved by SCE&G's Corporate Environmental Services personnel. Material excavated and transported off-site will be manifested in accordance with applicable requirements. Richland County landfill was the facility utilized for disposal of the coal tar impacted material from the former Huger Street MGP Site.

Previously, sample analytical data from the TLM impacted sediment samples collected during the investigation was used to characterize the material for disposal and obtain facility acceptance. The existing waste profile will be re-certified. Disposal facility material acceptance documentation and any disposal manifests will be provided in the final documentation report.

2.4.3 Navigation Plan Approval

The USCG will be provided the Navigation Plan (Appendix O). The Navigation Plan was developed in accordance with the guidelines from the "U.S. Coast Guard Aids to Navigation System" publication and through consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office. The plan provides specific methods for notifying boaters and other users of the river in the vicinity of the construction site (upriver and downriver) and the need to take appropriate measures to avoid the active construction area. It provides the specific methods for demarcating the area to be avoided and the buoy/signage/lighting scenario for the project. Completion of the project will have no adverse impact on navigation in the Congaree River.

2.5 Sediment Cap Construction Elements

SCE&G has agreed, through consultation with subject matter experts and governmental agencies, to limit the potential "in-river" construction season to May through October in order to eliminate the potential for disturbance of aquatic organism spawning activities that may occur in the vicinity of the project area. As a result, intrusive activities within the confines of the river will only take place during the agreed upon timeframe. Landside preparation activities can occur outside of the May to October timeframe and will likely commence soon after receipt of the above listed approvals. The following sections provide a general overview of the construction activities (Section 2.5.1) followed by more detail regarding the main components of the project (2.5.2 through 2.5.5). Section 3 and the attached appendices provide additional information in the form of individual support plans that cover the specific project related implementation activities.

2.5.1 General Sequence of Capping Activities

As stated above, initial site activities will likely include establishing an office compound and improving access to the sediment work area. Once these activities are completed, the mussel relocation contractor will mobilize to relocate mussels from the project area to another suitable location within the river. The Mussel Relocation Plan (Appendix G) provides specific details pertaining to this aspect of the project. This activity will be completed before beginning intrusive activities within the river, most likely during the last part of April.

Next, the sediment contactor will mobilize the specialized equipment and the initial capping components to the site. Initial work in the river will consist of the UXO team evaluating the sand bar area for any potential UXOs. After the area has been "cleared", excavation of the sand bar will commence. Access platforms will be constructed and placed in the river as needed. Cap installation will begin and will likely entail utilizing varying methods of access and placement depending on the location, river flow, depth of water, etc. Due to the dynamic river environment and significant variations in flow depth resulting from precipitation events, work will likely be periodically delayed when river levels are too high to effectively place the capping materials.

Once the cap has been installed, the construction equipment and means of access will be removed from the river and restoration of the disturbed areas will be completed including restoration of the river bank and the landside support zone and the office compound.

2.5.2 Site Preparation and Site Operations

The following details regarding the anticipated project site preparation and support activities were based primarily on the previously (and successfully) executed FDP work plan. Also, many of the attached project support plans contained within the various appendices assume a similar use of the adjacent landside area. However, it should be noted, that SCE&G may need to implement an alternate contingency plan for project access and support should this area not be available at the time of construction. In the event that the adjacent landside area is not available, SCE&G will submit an Alternate Site Operations Plan (Alternate SOP). The Alternate SOP will not affect any of the capping objectives.

The Site Operations Plan (Appendix L) is intended to provide general procedures to safely and effectively implement the proposed sediment cap. Although the project is relatively straight forward, several site

preparation activities will take place prior to initiating the cap placement activities. The conceptual approach to the site operations plan is summarized on Figure 2-8. Some variations to the plan may occur, depending on site conditions encountered at the time of implementation. The actual layout for site operations will be finalized at the discretion of field personnel, provided SCE&G, SCDHEC and the appropriate property owner concur with any significant modifications.

Site preparation and operations will involve the following activities:

- Landside support zone construction including site security and fencing, capping material and equipment staging areas;
- Establishment of an office trailer area;
- Erosion and sedimentation controls;
- Work zones; and
- Utility clearance and management.

A gravel covered parking and office area will be established prior to initiation of the work. Utility and communication lines will also be installed as required. Figure 2-8 provides a conceptual layout for the fencing and office trailer locations should the adjacent property be available.

Access improvements will be a critical component of the overall project. In general, access areas will be graded to reduce the slope and geotextile and gravel will be placed to provide a stable area for equipment to traverse. The access road locations are shown for illustrative purposes only and access will be improved only where needed to minimize disturbance of the river bank and riparian corridor.

2.5.3 Erosion Control and C-SWPPP Implementation

Prior to any land disturbance activities, the best management practices (BMPs) identified in the C-SWPPP) will be installed. The C-SWPPP will be submitted for approval to the City of Columbia prior to starting work. Once reviewed and approved it will be strictly adhered to during completion of the project. The anticipated BMP requirements will be minimal since land disturbance activities are expected to be limited and of short duration. Disturbed land will either be quickly stabilized by the addition of gravel, for a staging area, or reseeded to establish ground cover. Typical BMPs will include installation of a construction entrance, and the use of silt fence and erosion control socks at the limits of the land disturbance areas to contain sediment in the work area. Typical temporary road construction will likely consist of deploying a geotextile material over an area and placing crushed stone on top of the geotextile. Dust control measures such as a water truck and a street sweeper will be utilized to maintain the work area and the site entrance during completion of the project. Dusty conditions or mud/silt tracked beyond the site entrance will be addressed immediately.

2.5.4 Sand Bar Removal and Filling of Low Areas

The sand bar thickness ranges from approximately 1 to 2 feet above the bedrock with a top elevation of approximately 116 feet. As shown on Figure 2-2, the sand bar area was previously sampled and found to be unimpacted by the TLM at the sample locations. Removal of the approximate 1-2 feet of material via excavation will allow for the sediment cap to be installed and for it to be below the normal water level (116.5 feet) during typical flow periods. This will improve the aesthetics of the completed project.

The removed material will be transported off-site for disposal. It is anticipated that an excavator, dragline or crane will be utilized to remove the sand bar once access to the area is established. Total suspended solids (TSS) monitoring and best management practices (BMPs) intended to reduce silt suspension and downstream movement will be instituted during removal of the sand bar and the other filling activities, etc. The TSS Monitoring Plan in Appendix H provides additional details on these activities and the Site Operations Plan (Appendix L) provides details regarding the on-site staging and handling of sand bar material.

Some portions of the project area may require limited grading of existing sediment to facilitate an even or smooth and continuous mat placement (e.g., the sandbar removal). Conversely, some small, irregularly shaped depressions in the river bottom may need to be filled to allow the mats to adequately cover the underlying sediment. To the extent practicable, clean, imported backfill will be used to fill low areas to minimize disturbance to the existing bottom sediment. These types of filling operations are anticipated to be minimal but may be required because the ACB mats need to be in direct contact with the subgrade or destabilizing processes (i.e., erosion or channeling under the mats) may result.

In addition, large submerged trees, moveable boulders and other obstructions located within the planned cap area will be temporarily removed and replaced in the approximate original locations. Temporary removal will facilitate cap placement and replacement will maintain the original aquatic habitat characteristics of the project area.

2.5.5 Placement of Geotextile and Articulated Concrete Mats (ACMs) and Blocks

The following text describes the placement of the cap materials, subject to any logistical or technical changes required by the contractor, or necessary at the time of construction.

The exact placement method for the cap will depend on a variety of factors including the location and flow/depth and river characteristics at that particular section of the project area. Mat deployment is anticipated to proceed generally from north to south. As planned, small platform barges will be brought onto the site. After the barges are assembled on dry land and fastened together, they will be pushed into position in the river with heavy machinery. Temporary timbers will likely be used to facilitate movement and leveling of the barges. Figure 2-8 provides an illustration of the work area and mat placement operations.

The ACB mat placement scenario will include a crane and/or excavator working from the shore and the secured barge platforms or “work pads”. The temporary access roads constructed near or in the existing river bank will permit the equipment to access and place the cap material over the project area. These roads may be either moveable timber or reinforced fiberglass “mud mats” that will permit equipment movement without sinking into the sediment. The capping material will likely be staged on flat bed trailers and transferred to the work area for deployment by the crane or excavator, as needed. For portions of the project area located near the shoreline (southern project area), the ACB mats will likely be placed with the equipment from the shoreline. Disturbing the actual river bank will be minimized.

The general sequence of activities will include constructing access roads with timbers or mats, deployment of the silt curtain or berm constructed of big sand bags around a designated work area, construction of the work platforms and installation of the engineered cap system. TSS monitoring both

above (for background measurements) and below (for real-time monitoring) the work area will be conducted, as needed, during intrusive activities.

For the ACB mats that are deployed on the eastern, or landside edge of the cap, it is anticipated that a small anchor trench will be excavated, and the edge of the mats will be laid into the anchor trench. The anchor trench will help secure the mats on the slope, improve the transition from native sediment to cap material and serve to prevent erosion under the mats from upslope run-off areas.

The geotextile material will likely be pre-cut and affixed to the bottom of the concrete mats (with some additional material left on the edges for overlap) in the landside support zone to facilitate placement. This method of deployment will allow for the mat and geotextile to be lifted and placed as a unit in one motion as was successfully utilized by SCE&G at another river capping project in South Carolina. In areas where large boulders or severely uneven river bottom sections prevent the effective use of the mats, pieces of geotextiles and singular concrete blocks (i.e., singular ACBs or "blocks") will be hand placed.

Placement of the geotextile and ACB mats will continue up the bank to the east, as seen on Figure 2-6, until tie-in with the existing asphalt roadway (Senate Street Extension) is complete. Grading of the mat extension area will likely be required to create a smooth transition area from the end of the asphalt roadway to the main mat placement area. The upland mats will be filled with imported fill material and will be temporarily seeded to promote vegetation and reduce tripping and foot entrapment hazards.

2.6 Site Restoration Activities

It is SCE&G's intent to complete the project with as minimal of an impact to the project area and the landside support zone as practical. Restoration activities will consist of removing all temporary construction improvements and re-grading and re-vegetating all disturbed areas.

2.6.1 Cap Area

Site restoration activities within the capped area will be minimal and will likely be limited to replacement of any temporarily relocated boulders, trees or other natural objects back into their approximate original locations, once the capping material is in place. The locations of these objects will be documented before they are moved so that they can be replaced once the cap is installed. This activity will preserve some of the project area's natural habitat characteristics.

2.6.2 Riverbank/Shoreline

SCE&G is committed to preserving as much of the current riverbank/shoreline, as practicable. Portions of the riparian corridor not slated for disturbance will be demarcated with flagging or fencing to ensure that they are not damaged by heavy equipment movement. This preservation technique will be a key component of the overall project.

In areas where shoreline impacts are unavoidable, SCE&G will conduct restoration activities, which will include recreating the approximate shoreline slope, stabilization of the bank via riprap and/or bioengineered solutions and restoration of vegetative cover, where practicable. The Riverbank and Shoreline Restoration Plan (Appendix K) provides details relating to potential restoration activities.

2.6.3 Landside Support Zone Area

SCE&G reserves the option to submit an Alternative Site Operations Plan should the adjacent property be unavailable at the time of construction. Construction and operation of the landside support zone will likely require clearing and grading activities to establish access roads, material and equipment storage and laydown areas. SCE&G will strategically locate material laydown and storage areas in areas that will limit the need for clearing and grading activities, as much as practical.

All landside disturbed areas not designated by the property owner to be left in place will be restored by removing equipment, materials, structures, etc. followed by final grading and re-establishment of vegetative cover. A conceptual scenario showing complete restoration of the adjacent property is provided on Figure 2-9. The details associated with final reconstruction of the landside support zone will be included in the C-SWPPP and subsequently approved by the City of Columbia. In general, the gravel and geotextile material utilized to construct the roads and laydown/storage areas will be removed and transported off-site for disposal. Final grading will be conducted, and vegetative cover re-established utilizing an SCDHEC approved seed mixture. Erosion and sedimentation control measures will be left in place until stabilization of disturbed areas is deemed complete.

Responsibility for landside components left in place, at the discretion of the property owner, will be transferred to the property owner once restoration activities are completed.

2.7 Post–Construction Monitoring/Mitigation Plan

Following successful completion of the project, SCE&G plans to conduct a period of monitoring of the sediment cap to ensure that its integrity is maintained and that it remains in place, as designed. The Post Construction Monitoring/Mitigation Plan (Appendix R) includes semi-annual visual inspections of the cap for the first year and annually for five additional years. The purpose of the inspections is to identify maintenance items or any potential areas of concern (i.e., erosion issues, undermining, etc.). Deposition of river born natural debris such as sediment, trees, limbs and other natural objects is expected and will serve to re-establish the aquatic habitat and a more natural appearance in the capped area. These items will be left in place on the cap unless they are deemed to potentially pose a threat to the cap's integrity. In this case, they may be removed during the inspection and maintenance activities, if necessary. If structural faults or other issues with the cap are identified SCE&G will develop plans to mitigate the issues as quickly as possible.

3.0 PHASE 2 - MRA SUPPORT PLANS

Sections 1.0 and 2.0 have provided background and general information on the planned sediment capping activities. Section 3.0 introduces the site-specific support plans that are provided as appendices to this document. The support plans provide details pertaining to the major components of the project. This approach has the advantages of:

- Allowing the overall plan to be presented in a concise format;
- Providing sufficient detailed information in the standalone documents; and
- Facilitating the review and approval process for the appropriate component plans.

In general, the MRA support plans include the following categories:

- Site Worker Protection;
- Community Relations / Public Information Plans;
- Unexploded Ordnance (UXO) Management; and
- Implementation Plans.

3.1 Health and Safety Plan

The Health and Safety Plan or HASP (Appendix J) is the primary source of safety related information for worker protection for the project and includes a project specific evaluation of the potential hazards and the corresponding control and mitigation activities. Task specific hazard matrices are included as are air monitoring frequencies and action levels, personnel responsibilities, training requirements and emergency procedures. All personnel working at the site will be given a HASP briefing and will review the HASP prior to conducting work on the site. In accordance with the HASP, routine air monitoring measurements will be obtained during any intrusive excavation operations, such as removal of the sand bar, to assure a safe working environment.

3.2 Community Relations / Public Information Plans

The Project Notification Plan (Appendix M) provides the steps that SCE&G, USACE and SCDHEC will take to notify the public near the project area, third party stakeholders, local officials and emergency response agencies of anticipated major project milestones or changes, etc. It will ensure timely notification of important project details, as required, throughout completion of the project. In addition, the Public Safety Plan (Appendix N) provides a summary of the project's specific safety management practices.

The Traffic Control Plan is provided as Appendix P. It provides the specific details regarding site access during completion of the project and the prescribed routes that project related traffic will utilize to access the project area. Since the capping project will be a relatively low impact activity, it is not expected to increase traffic significantly in the area surrounding the site. However, implementation of the plan will ensure that site-related traffic will take the safest routes into and away from the site. SCE&G will ensure that all drivers utilize the routes specified in the Traffic Control Plan and will periodically monitor transportation operations to maintain compliance with the Plan. SCE&G will also respond to complaints or issues from the residents and businesses in the project area.

Although not expected to be a concern due to the limited intrusive activities associated with the proposed sediment cap installation, a Community Air Monitoring and Odor/Dust Control Plan was developed. The Plan is provided in Appendix Q, and establishes work area and site perimeter air monitoring procedures. These procedures will be implemented during intrusive activities only, to ensure that site related constituents of concern are routinely monitored, documented and controlled [if required] throughout completion of the project. The plan also specifies actions that will be taken to control dust from site roads, such as operation of a water truck.

3.3 UXO Management Plans

With respect to the potential UXOs and/or historical items in the project area, SCE&G believes that any artifact and/or UXO that may have been present in the area to be capped is likely covered by an additional layer of sediment (of varying thickness) deposited during the flood of 2015. Placement of the engineered capping materials on top of the project area is intended to NOT disturb potential UXOs or historical items and once installed, the engineered cap will provide an added layer of protection or isolation with respect to potential human contact.

The detailed plans developed to address potential UXO management issues for the FDP are still relevant and will be adhered to for implementation of the capping alternative, with only a minor modification as to when the plans are implemented as discussed below. The four "UXO" plans were included within the PCN for the FDP and are included in this SCWP (Appendix D):

- Draft Final Work Plan for Munitions Response Removal Action and Construction Support (revised in January 2017);
- Explosives Safety Submission, Munitions and Explosives of Concern, Removal Action and Construction Support;
- Diving Operations Plan; and
- Diving Safe Practices Manual.

As stated earlier, the existing UXO plans that were successfully executed for the FDP program were revised to reflect the capping approach and have subsequently been approved by the appropriate USACE-UXO personnel (Appendix D). As part of the review for the various aspects of the capping approach, the USACE-UXO team developed two new "MEC [Material of Explosive Concern] Assessments":

- The first assessment evaluates the actual placing of the capping materials; and
- The second assessment evaluates the sand bar excavation activities.

Based on these assessments, the installation of the capping materials indicates a "low probability" of encountering MEC and the removal of the sand bar has a "moderate to high probability" of encountering MEC.

Therefore, all work will be completed in accordance with the approved plans as listed above and contained in Appendix D. For implementation purposes, SCE&G plans to have one member of the UXO team and one member of the archeologist's staff present on-site during construction activities. Should either the UXO team member (or the archeologist's representative) observe any UXO and or artifact or other item or issue of concern (or historical significance), the capping/construction work will immediately stop, and the plans described above will be implemented to the maximum extent practicable. Work will not be restarted until all parties are satisfied that the intent of the plans has been fulfilled.

The UXO team will be present to pre-screen the sand bar area prior to excavation.

3.4 Implementation Support Plans

3.4.1 Mussel Relocation Plan

Advanced screening of the MRA will be completed to preserve indigenous freshwater mussels that may be present within the project footprint. In 2006 a reconnaissance survey was conducted by Alderman Environmental Services, Inc. to assess the freshwater mussel populations within Lake Murray and the lower Saluda and upper Congaree Rivers in support of the Saluda Hydroelectric Project (FERC No. 516). The findings of the survey were summarized in the "Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006). The survey included two locations in the upper Congaree River that were within or directly adjacent to (downstream) the planned project area.

As a result of the previous findings from the Alderman survey, SCE&G recognizes that no threatened or endangered mussels are likely present within the project area. However, several sensitive mussel species are likely to exist within the planned area to be capped. In order to complete the project with as minimal of a negative impact to the Congaree River resources as practicable, SCE&G plans to conduct mussel relocation operations prior to initiating "in-river" construction activities.

The anticipated mussel relocation activities are explained in detail in the Mussel Relocation Plan provided in Appendix G. Mussels located within the planned footprint of the sediment cap will be collected and relocated by divers before "in-river" construction operations begin.

3.4.2 Real-Time Water Quality Monitoring

Sediment containment during active construction will be a critical element of the project. Mitigation plans include deploying a floating silt curtain around the active work area and/or placement of large sands bags, similar to those used during implementation of the FDP. [Although the large sand bags were not effective for water isolation purposes, they should aid in sediment containment efforts.] The sand bags will likely be placed directly downstream of the active work zone, perpendicular to the flow direction, to collect and help prevent downstream migration of sediment. Real-time, total suspended solids (TSS) monitoring will also be conducted, as specified in the TSS Monitoring Plan (Appendix H), to monitor the following areas:

- An up-stream, (background) zone;
- The active construction work area;
- An entrained sediment reduction area (i.e., mixing zone); and
- A down-stream monitoring area.

The purpose of the monitoring would be to compare background TSS levels with downstream TSS levels to detect a significant increase [with allowance for an acceptable sediment mixing and deposition zone], which would trigger additional controls or the modification of current construction practices to reduce the downstream TSS levels.

3.4.3 Water Management Plan

Since installation of the engineered cap is going to be a relatively non-intrusive activity, management of impacted water from site-related activities is not currently anticipated. However, as a contingency, SCE&G will construct a water management system on-site in order to be prepared should the need arise

to containerize and properly dispose of water impacted by TLM. The Water Management Plan (Appendix I) provides details pertaining to these contingency measures.

4.0 SCHEDULE CONSIDERATIONS

Table 4-1 provides a planned schedule of activities for the project. Key components of the schedule include:

- Obtain required permits and approvals;
- Contractor selection;
- Support zone construction;
- Mussel Relocation; and
- Construction of the sediment cap.

Support zone activities are expected to begin in early 2018. In keeping with the agreed upon “in-river” construction time frame, the mussel relocation operation and mobilization of the sediment contractor, equipment and capping materials will begin in early May 2018. Barring any major delays or frequent river level related shut downs, the “in-river” construction work is expected to be completed by the end of October 2018.

5.0 REPORTING

Routine communications will be maintained between SCE&G and SCDHEC (and other agencies as may be required) throughout the project. Written project reports will be provided to SCDHEC during implementation and after completion of the cap installation. The reporting approach will include:

- Issuing weekly progress reports, with photographs of completed activities submitted via e-mail; and
- Submitting a Final Sediment Capping Documentation Report.

TABLES

TABLE 2-1

LISTING OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES

Congaree River Sediments
Columbia, South Carolina

Historic Place[1,2]	Location	Level of Significance	Area of Significance
Gervais Street Bridge	Spans Congaree River in West Columbia, SC	State	Architecture
Columbia Canal	East bank of the Broad and Congaree Rivers from the diversion dam to the southern railroad bridge in Columbia, SC	National	Industry

Archaeological Site[3]	Location	ID#
Underwater Civil War Era Ordnance Dumpsite	East bank of the Congaree River at the outfall of Unnamed Tributary #1 into Congaree River	38RD286
Possible Ruins of Briggs' Saw Mill	East bank of the Congaree River south of the Gervais Street Bridge and Unnmamed Tributary #1	38RD224
Late 19th to Early 20th Century Structure Foundation - House	East bank of the Congaree River south of the Senate Street Extension boat launch	38RD234
Underwater Deposit of Historic Ceramics and Metal Artifacts	Eastern portion of Congaree River south of the Alluvial Fan	38RD278
19th to 20th Century Bottle Dump/Landfill	Eastern bank of the Congaree River just Southeast of the Total Project Area	38RD223
Expanded Boundary of Underwater Civil War Era Ordnance Dumpsite	Eastern portion of the Congaree River from the Gervais Street Bridge to Unnamed Tributary #2	38RD286

Notes:

1. Table includes properties near to or coinciding with the Congaree River Sediment Project and included on the National Register of Historic Properties.
2. Historic Place Source: South Carolina Institute of Archeology and Anthropology & South Carolina Department of Archives and History.
3. Archaeological Site Source: Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC.
4. Figure 2-4 provides location of areas listed above.

TABLE 4-1

CONGAREE RIVER SEDIMENT CAPPING PROJECT SCHEDULE

Congaree River Sediments
Columbia, South Carolina

Anticipated Date	Description
October 18, 2017	SCE&G receives USACE NWP-38 (permit) to install the cap
December 1, 2017	SCE&G submits the Sediment Capping Work Plan (SCWP) to SCDHEC
December 2 - December 31, 2017	Review/Comment/Revise SCWP
January 15, 2018	SCDHEC - Public meeting to discuss elements of the SCWP
January 16 - February 16, 2018	Review/Comment/Revise SCWP
February 28, 2018	SCDHEC - Approval of the SCWP
February 1, 2018	Submit Comprehensive Storm Water Polution Prevention Plan (C-SWPPP) to the City of Columbia
March 15, 2018	Mobilization for the field work Establish site operations and security measures, access improvements, equipment and material procurement
May 1, 2018	Start "in-the-river" construction activities
May - July 30, 2018	Cap - northern area
August 1 - September 30, 2018	Cap - southern area
October 1, 2018	Site restoration activities
October 31, 2018	Demobilization and project completion
January 31, 2019	Submit final documentation report

FIGURES

BROAD RIVER

Timmerman Bridge

Randolph Cem

St Peters Cem

Sch

ELMWOOD

INTERSTATE I-126

Governors Mansion

232

HUGER

LAUREL

250

CONGAREE RIVER

BDY

Howard Sch

Reservoirs

WT

Irwin Park

TAYLOR

150

Correctional Institution

HUGER ST. FORMER MGP SITE LOCATION

SALUDA RIVER

12

GIST STREET

1
378

N & S

SENATE STREET

Powerplant

4 LANE

LEAPHART

ST

LUCAS

GERVAIS STREET BRIDGE

Gaging Sta

RICHLAND-LEXINGTON CO

SEDIMENT CAPPING AREA

Brookland Sch

AVE

200

BLOSSOM STREET BRIDGE

2

PO

6TH

DRIVE

Brookland-Cayce

0 537 1,074 1,611 2,148

SCALE (APPROXIMATE)

FIGURE 1-1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

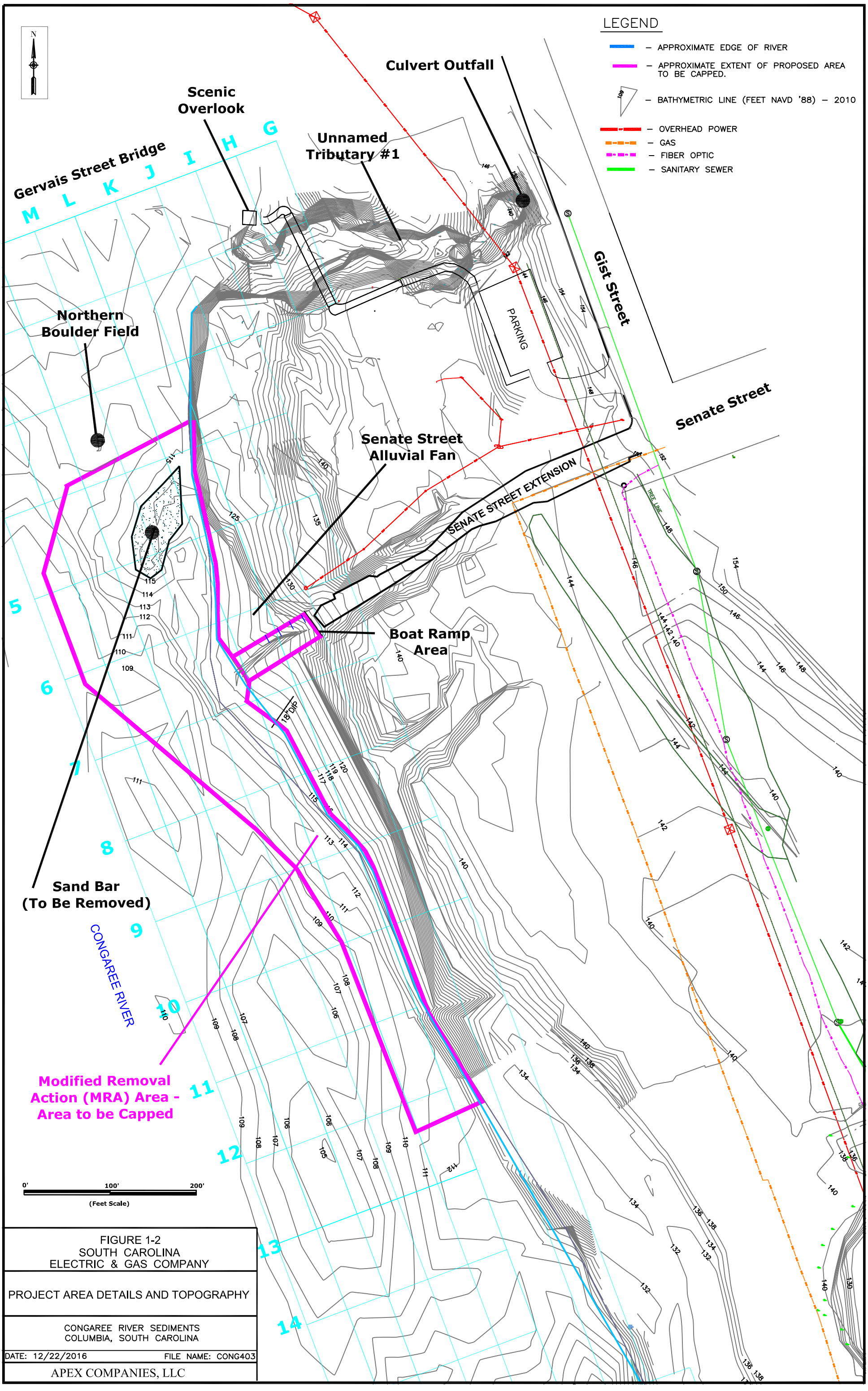
SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 09/13/16 FILE NAME: CONG402

APEX COMPANIES, LLC


N
LEGEND
– APPROXIMATE EDGE OF RIVER
– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.
– BATHYMETRIC LINE (FEET NAVD '88) – 2010
– OVERHEAD POWER
– GAS
– FIBER OPTIC
– SANITARY SEWER
Culvert Outfall
Scenic Overlook
Unnamed Tributary #1
Gervais Street Bridge
Gist Street
Senate Street
Northern Boulder Field
Senate Street Alluvial Fan
SENATE STREET EXTENSION
PARKING
TREE LINE
Boat Ramp Area
18" DIP
Sand Bar (To Be Removed)
CONGAREE RIVER
Modified Removal Action (MRA) Area - Area to be Capped
0'
100'
200'
(Feet Scale)
FIGURE 1-2
SOUTH CAROLINA ELECTRIC & GAS COMPANY
PROJECT AREA DETAILS AND TOPOGRAPHY
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 12/22/2016
FILE NAME: CONG403
APEX COMPANIES, LLC

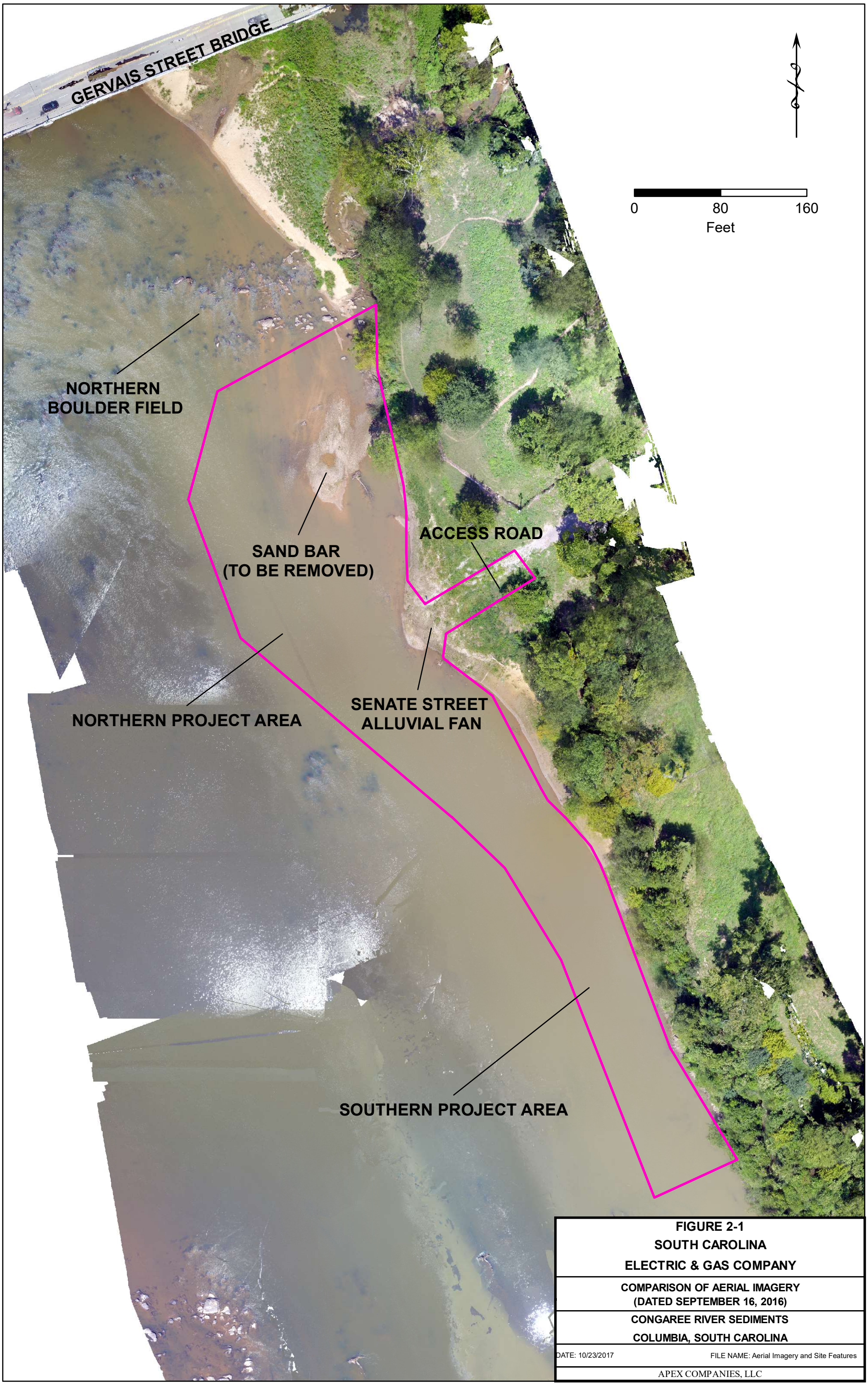


FIGURE 2-1

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

COMPARISON OF AERIAL IMAGERY
(DATED SEPTEMBER 16, 2016)

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 10/23/2017 FILE NAME: Aerial Imagery and Site Features

APEX COMPANIES, LLC

SAND BAR
(TO BE REMOVED)

PROPOSED AREA
TO BE CAPPED

SENATE STREET EXTENSION

CONGAREE RIVER

18"DIP

LEGEND

— APPROXIMATE EDGE OF RIVER

— APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.

— BATHYMETRIC LINE (FEET NAVD '88) – 2010

— TLM NOT OBSERVED

— TLM OBSERVED

— INACCESSIABLE OR OBSTRUCTED ANOMALIES PREVALENT

— TLM ODOR AND/OR POTENTIAL VISUAL TLM

S-1.0
T-0.2 — SEDIMENT AND TLM THICKNESS PER GRID IN FEET (S = SEDIMENT / T = TLM)

0' 40' 80' 120' 160'
(Feet Scale)

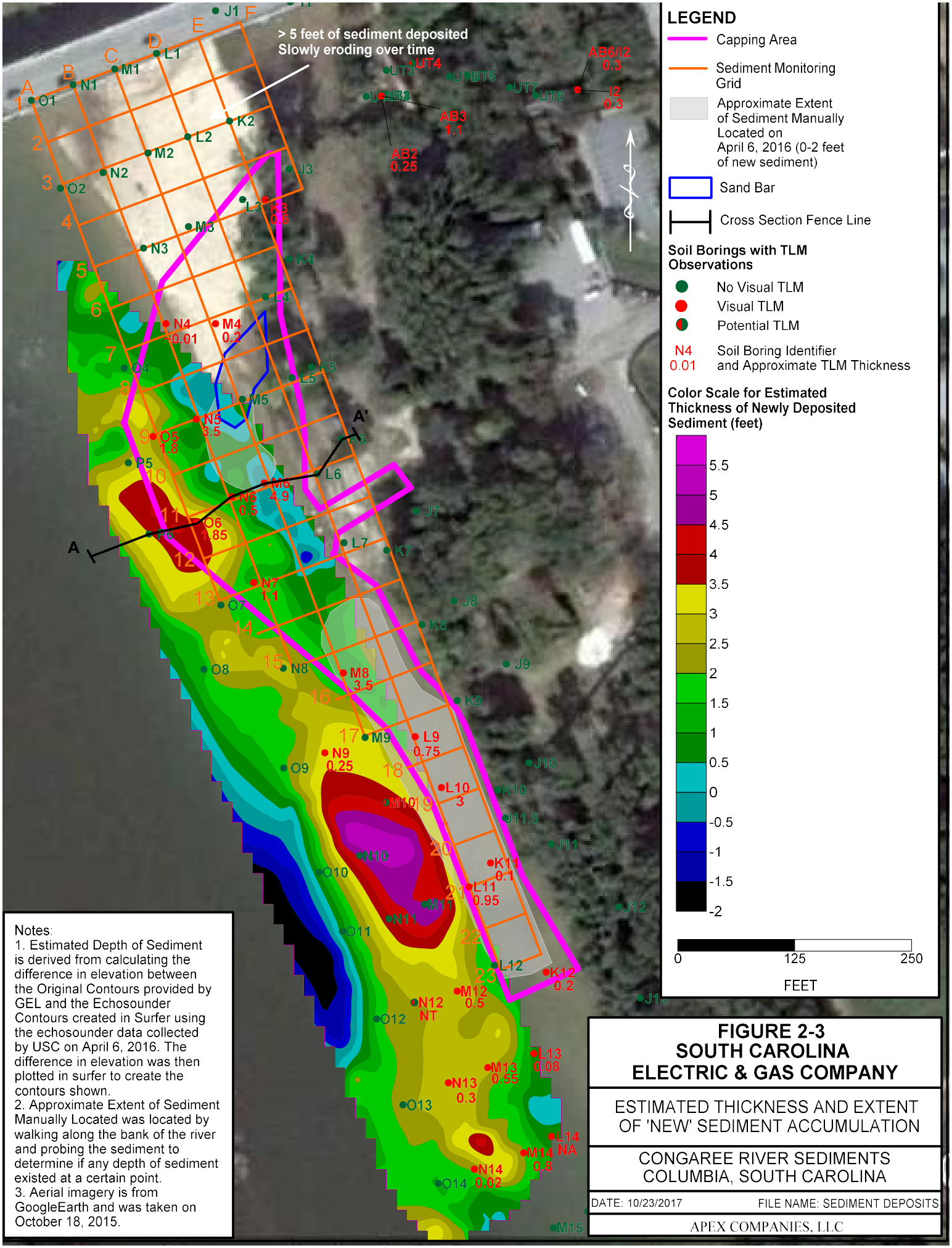
FIGURE 2-2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION AND
SEDIMENT INVESTIGATION INFORMATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/23/2017 FILE NAME: CONG416

APEX COMPANIES, LLC



Notes:
1. Estimated Depth of Sediment is derived from calculating the difference in elevation between the Original Contours provided by GEL and the Echosounder Contours created in Surfer using the echosounder data collected by USC on April 6, 2016. The difference in elevation was then plotted in surfer to create the contours shown.
2. Approximate Extent of Sediment Manually Located was located by walking along the bank of the river and probing the sediment to determine if any depth of sediment existed at a certain point.
3. Aerial imagery is from GoogleEarth and was taken on October 18, 2015.

FIGURE 2-3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

ESTIMATED THICKNESS AND EXTENT OF 'NEW' SEDIMENT ACCUMULATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/23/2017 FILE NAME: SEDIMENT DEPOSITS

APEX COMPANIES, LLC

38RD286 - Underwater Civil War Era Ordnance Dump Site

GERVAIS STREET BRIDGE

38RD224 - Possible Ruins of Briggs' Saw Mill

38RD234 - Late 19th to Early 20th Century Structure Foundation - House

38RD278 - Underwater Deposit of Historic Ceramics and Metal Artifacts - Possible Dump Site of 38RD234

VISIBLE CANAL B

38RD286 - Expanded Boundary of Underwater Civil War Era Ordnance Dumpsite

38RD223 - 19th to 20th Century Bottle Dump/Landfill

LEGEND

- Total Project Area
- Capping Area
- Archaeological Sites
- Approximate Boundary of National Registry Historical Places

Notes:
1. Archaeological Sites are from the Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC. Boundaries and locations are approximate.

Scale
0 125 250
Feet

FIGURE 2-4
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT AREA AND HISTORICAL INFORMATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE:10/23/2017 **FILE NAME: Arch sites Capping 2**

APEX COMPANIES, LLC

38RD224 - Possible Ruins of Briggs' Saw Mill

38RD234 - Late 19th to Early 20th Century Structure Foundation - House

Southern Pit (4 ft. deep by 6 ft. wide)

Possible Casing

38RD278 - Underwater Deposit of Historic Ceramics and Metal Artifacts - Possible Dump Site of 38RD234

LEGEND

Magnetic Anomalies

- Manhole (1)
- Electromagnetic Anomaly (5)
- Possible Ordnance (83)
- Pipeline Associated (12)

Magnetic Anomaly Status

- Location Cleared - Cultural Debris (46)
- Location Cleared - Negative Find (5)
- Location Not Cleared (23)
- Location Unable to be Located by Surveyor (13)

Lane Status

- Lane Status
- Cleared Lane (1,288 Sq. Ft.)
- Additional Excavation Investigation Location
- Location Cleared During Lane Clearing - Cultural Debris (3)

Archaeological Sites by NRHP Status

- Not Assessed

Soil Borings with TLM Observations

- No Visual TLM
- Visual TLM
- Potential TLM

- Isolation Berm - Big Bags
- Alluvial Fan
- Southern FDP Area

1 inch = 40 feet

0 40 80

Feet

FIGURE 2-5
SOUTH CAROLINA ELECTRIC & GAS COMPANY

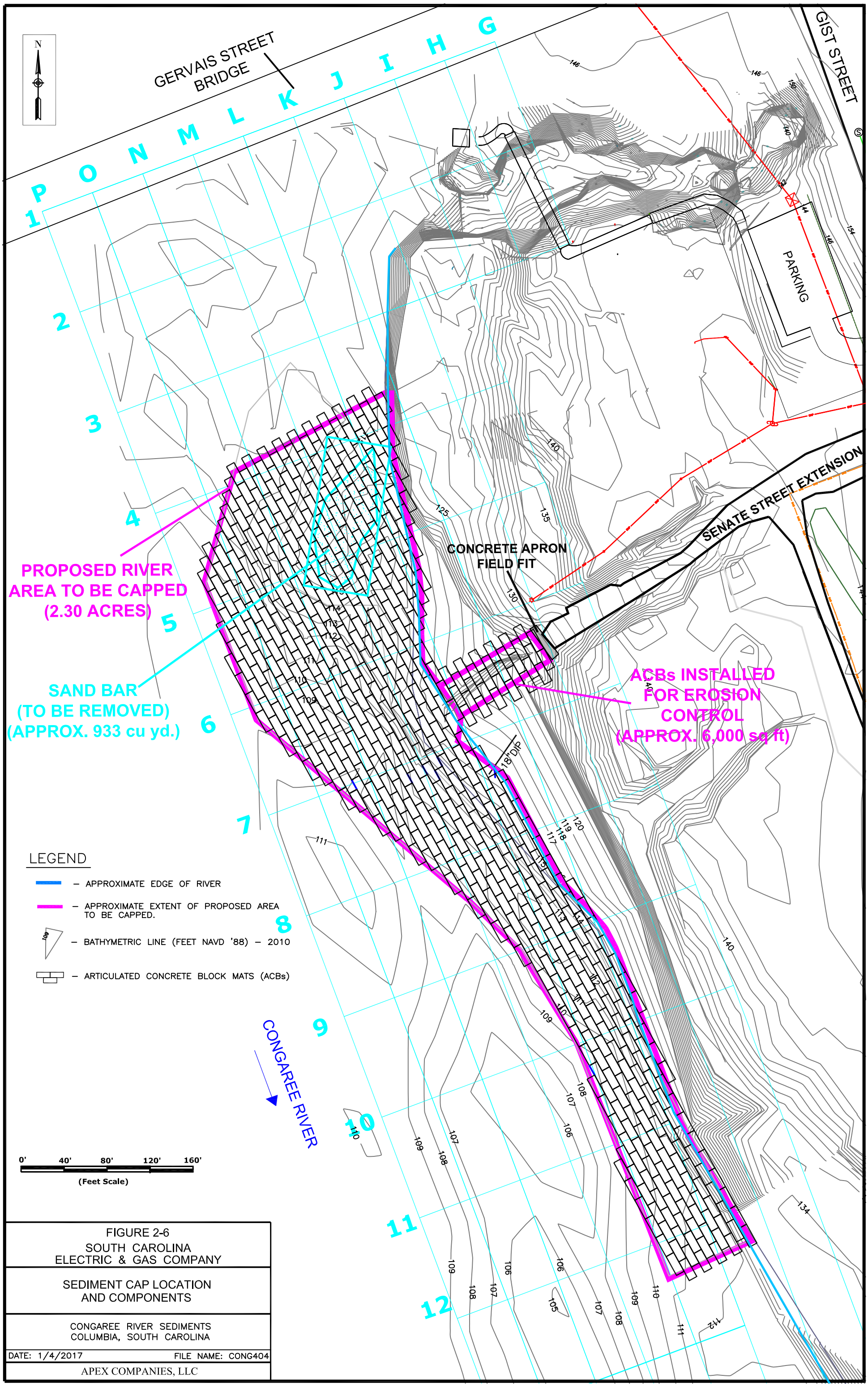
FDP IMPLEMENTATION FINDINGS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

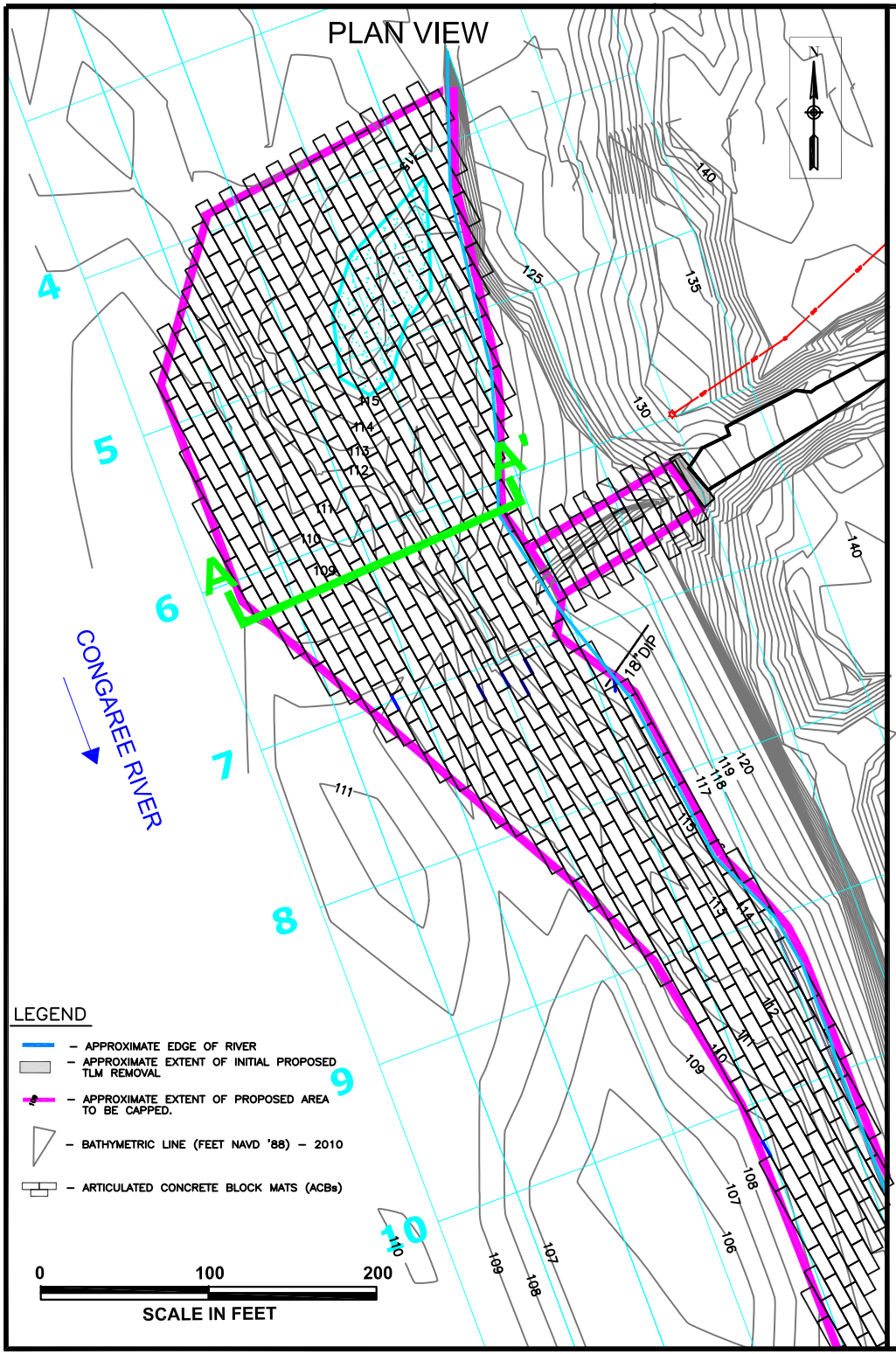
DATE: 1/4/2017

FILE NAME: FDP Implementation

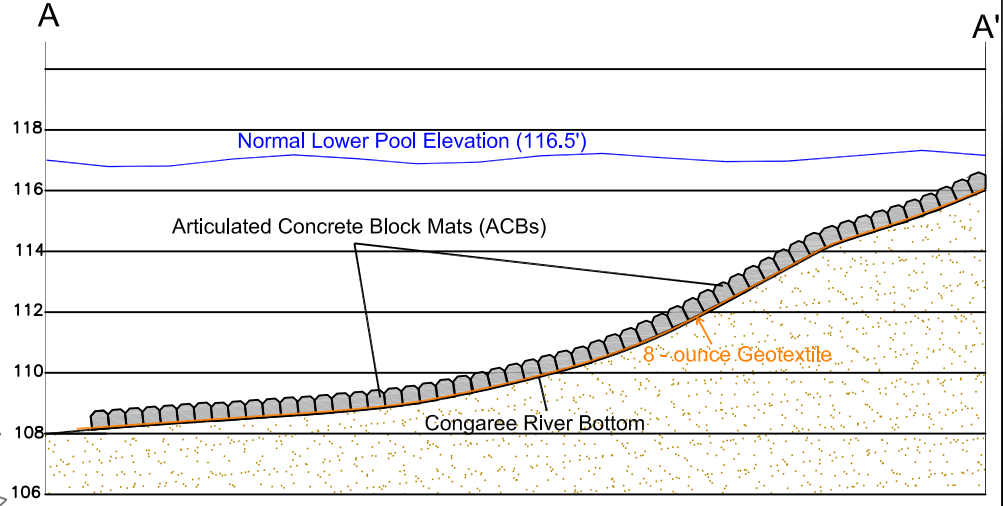
APEX COMPANIES, LLC


N
GERVAIS STREET BRIDGE
GIST STREET
PARKING
SENATE STREET EXTENSION
CONCRETE APRON FIELD FIT
18"DIP
PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)
SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)
ACBs INSTALLED FOR EROSION CONTROL (APPROX. 6,000 sq ft)
CONGAREE RIVER
LEGEND
– APPROXIMATE EDGE OF RIVER
– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.
– BATHYMETRIC LINE (FEET NAVD '88) – 2010
– ARTICULATED CONCRETE BLOCK MATS (ACBs)
0' 40' 80' 120' 160'
(Feet Scale)
FIGURE 2-6
SOUTH CAROLINA ELECTRIC & GAS COMPANY
SEDIMENT CAP LOCATION AND COMPONENTS
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 1/4/2017 FILE NAME: CONG404
APEX COMPANIES, LLC

PLAN VIEW



CROSS SECTIONAL VIEW A-A' (TYPICAL)



NOTE

CROSS SECTION VIEW NOT TO SCALE
FOR ILLUSTRATIVE PURPOSES ONLY.

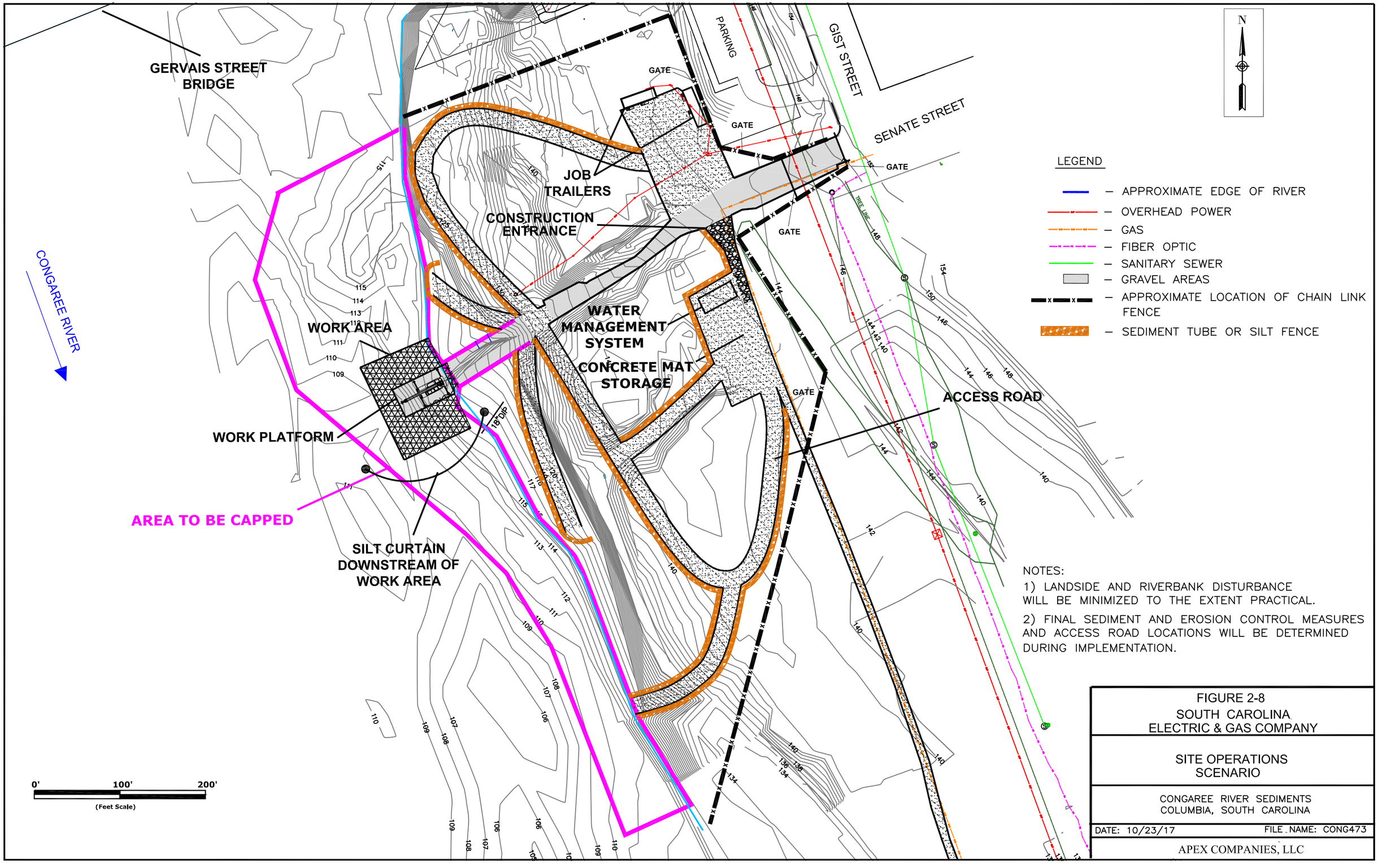
FIGURE 2-7
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

CROSS SECTION OF CAPPED AREA

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 1/4/17 FILE NAME: CONG408

APEX COMPANIES, LLC



NOTES:

1) LANDSIDE AND RIVERBANK DISTURBANCE WILL BE MINIMIZED TO THE EXTENT PRACTICAL.

2) FINAL SEDIMENT AND EROSION CONTROL MEASURES AND ACCESS ROAD LOCATIONS WILL BE DETERMINED DURING IMPLEMENTATION.

FIGURE 2-8
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/23/17 FILE NAME: CONG473

APEX COMPANIES, LLC

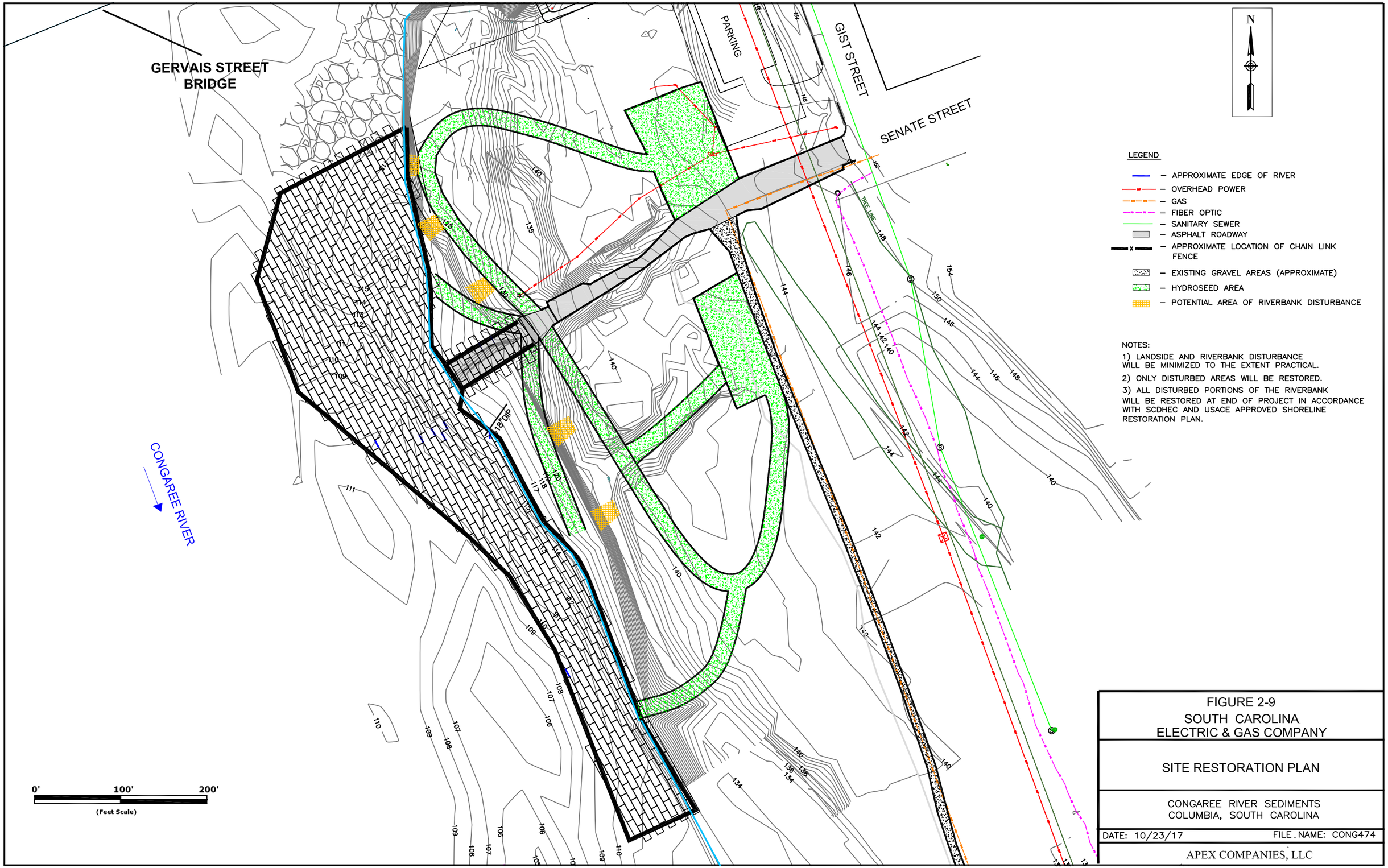


FIGURE 2-9
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE RESTORATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/23/17 FILE NAME: CONG474

APEX COMPANIES, LLC

APPENDIX A

SCDHEC CORRESPONDENCE AND RECENT STUDIES

A-1

SCDHEC Letter Requesting SCE&G to Pursue a Capping Alternative, August 16, 2016

dhec
Healthy People. Healthy Communities.

August 16, 2016

Mr. Robert Apple
SCANA Environmental Division
South Carolina Electric and Gas Company
4077 Haywood Road
Mills River NC 28759

RE: SCE&G Congaree River Sediments, Columbia SC
Removal Action Alternative
File # 52561, VCC# 02-4295-RP

Dear Mr. Apple,

In light of the 2015 flooding event and its impacts to the Congaree River, as well as the constraints with excavation of sediment from the Congaree River, the Department of Health and Environmental Control (Department) has reevaluated the alternatives from the 2013 Engineering Evaluation / Cost Analysis (EE/CA) for cleanup of the tar like material (TLM) in the Congaree River. Based on the current conditions, and the ability to obtain proper permits and safely conduct a removal action without adverse impacts to human health and the environment, the Department is requesting SCE&G pursue EE/CA Alternative 3 – Sediment Capping and Institutional controls instead of the removal alternative previously envisioned.

SUMMARY OF THE ADMININSTRATIVE RECORD

The following presents a summary of the administrative record maintained by SCDHEC:

- In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the Department. Three sediment samples were collected and analyzed by the Department and SCE&G. It was determined that that the TLM may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was located approximately 1,000 feet to the northeast of an outfall to the Congaree River. The MGP was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

- The Huger St. Former MGP Site is currently being administered by the Department via a Voluntary Cleanup Contract (VCC# 02-4295-RP). This VCC has been extended to include the impacted Congaree River sediment.

- After the initial discovery of TLM in June of 2010, SCE&G in conjunction with the Department conducted investigation activities within in the Congaree River to delineate the extent of TLM-impacted sediments. The delineation work was completed in five separate phases over approximately 18 months. The results of the delineation activities were submitted to the Department on March 23, 2012 in the Project Delineation Report (PDR) [MTR, March 2012]. Overall, the delineation activities extended from near the Gervais Street Bridge downriver approximately 9,050 feet to the area near the abandoned lock and dam. The PDR was approved by the Department on April 23, 2012.

- Next, SCE&G submitted an Engineering Evaluation/Cost Analysis (EE/CA) that evaluated potential options to address the TLM within the river. The EE/CA evaluated potential remedial approaches with respect to implementability, effectiveness and cost. In all, four remedial approaches were identified and analyzed in the final EE/CA approved by the Department in a letter dated February 7, 2013:

    - Alternative 1 - No Action – The TLM-impacted sediments would be left in their current state with no removal or mitigation activity;

    - Alternative 2 - Monitoring and Institutional Controls – Routine monitoring and evaluation of sediment conditions from within the impacted area would be conducted on a regular basis. Institutional controls in the form of a shoreline fence and signage would be put in place to limit access to the area.

    - Alternative 3 - Sediment Capping and Institutional Controls – This remedy would place a physical barrier in the form of an engineered capping system over the impacted sediment within the project area.

    - Alternative 4 - Removal and Off-Site Disposal – TLM and impacted sediment (and debris) would be excavated and transportation off-site to an approved disposal facility. This approach would include constructing a temporary cofferdam within the river to isolate the area to be excavated.

- The Department conducted a public meeting on March 21, 2013 to discuss the

nature and extent of impacts and potential cleanup alternatives. All of the public comments received supported Alternative 4 - Removal and Off-Site Disposal. Therefore, in a letter dated May 8, 2013, the Department requested SCANA begin the design and permit process for Alternative 4 – Removal and Off-Site Disposal of the impacted sediments.

- Based on the EE/CA, the removal action alternative provided the best overall protection of human health and the environment, when compared to the other alternatives. The purpose of this remedy was to remove the most risk from exposure to contaminated material.

- A critical element of the removal alternative was the construction of a cofferdam to isolate the impacted area. The cofferdam had to be of sufficient size, height, and magnitude to withstand the fluctuating river while not adversely affecting the environment.

- While working through the design and permitting process, significant concerns were identified related directly to the construction of the cofferdam. These concerns included:
    - Risk in the form of potentially increasing shoreline erosion on the west bank;
    - Risk in the form of creating flooding on the west bank;
    - Risk in the form of an overtopping event or events;
    - Risk in the form of a catastrophic overtopping event where the cofferdam material and exposed TLM would be washed downriver; and
    - Risk associated with constructability leakage and removal of the proposed cofferdam.

- Based on these risks and concerns, the full-scale removal approach was abandoned and a Modified Removal Action was considered. This newly proposed Removal Action would consist of removing TLM-impacted material from a "focused" or "targeted" area of the site. The area would primarily consist of the thicker deposits of impacted material that are generally located closer to the existing eastern shoreline, where potential exposure due to activities such as swimming or wading is greater. Conceptually, implementation of the Modified Removal Action, would be completed using large sand bags or some other temporary means to sequentially isolate water from small subsections of riverbed within the "targeted" area to facilitate removal of TLM.

- On March 2, 2015, SCE&G in conjunction with the Department moved forward with the design and permitting of the Modified Removal Action and

SCE&G began revising all previously submitted plans to incorporate the approved modifications.

- A Field Demonstration Project (FDP) Work Plan was designed to primarily evaluate procedures for handling and managing metal anomalies that exist through-out the project area. These metal anomalies were considered potential unexploded ordnance (UXO). Implementation of the FDP allowed for the USACE-approved UXO management plans to be implemented on "dryland", before expanding the work into the full-scale river area.

- On September 1, 2015, the USACE approved the Pre-Construction Notification (PCN) for Implementing the FDP Work Plan;

- On September 2, 2015, the Department approved the FDP Work Plan.

NEW INFORMATION CONSIDERED

FDP implementation activities were conducted from September 8, 2015 through December 2015. Important findings include:

1. No potential UXO or historically significant items were identified;
2. Of the 51 previously identified Magnetic Anomalies investigated – Zero (0) were UXOs;
3. 5 'negative finds' – meaning nothing was found at the previously identified metal anomaly location (i.e., no object found at approximately 10% of the locations);
4. There was a relatively large amount of "cultural debris" (i.e. metallic junk) unearthed;
5. Evaluating the metal anomalies was a time consuming and meticulous process due to the volume of subsurface metallic debris that existed within the study area;
6. The project area is located adjacent within a very dynamic river environment. Due to the unpredictable nature of the river, isolating a work area with large sand bags proved to be ineffective during implementation of the FDP.
7. Based on multiple high–water events observed during the FDP, sandbags were not an effective way to allow for excavation of contaminated material from the river. In order to complete removal activities a "full-scale" cofferdam must be constructed.
8. The storm and flooding of early October 2015 and the related breach of the Columbia Canal resulted in the deposition of thousands of tons of "new" sediment in the river and shoreline of the project area. Much of the impacted sediment has been covered with a layer of new sediment, at varying thicknesses.

CONCLUSION

The Department has reevaluated the available options presented in the EE/CA and has determined that based on the construction and permitting limitations, it is not feasible to conduct a removal of TLM / impacted sediment in the Congaree River. Therefore, it is the Department's determination that the best remedy for the site is capping of a modified removal area. The primary objective of the capping approach is to limit or prevent human exposure to impacted sediments within the Modified Removal Area. The Department requests SCE&G pursue Alternative 3 – Sediment Capping and Institutional Controls as provided in the final EE/CA (approved by the Department in February 2013). SCE&G should begin the design and permit process for the capping alternative as soon as possible.

If you have any questions or comments please contact me at (803) 898-0747 or by email at berresjl@dhec.sc.gov.

Sincerely,

Lucas Berresford
State Remediation Section
Bureau of Land and Waste Management

cc: Harry L Mathis, P.G., Midlands Region EQC Director, via email
R. Gary Stewart, P.E., Manager State Remediation Section, via email
Mark Giffin, BOW
File 52561

A-2

SCDHEC Surface Water Results, April 7, 2017

dhec
Healthy People. Healthy Communities.

April 7, 2017

Mr. Robert Apple
Environmental Division
South Carolina Electric and Gas Company
4077 Haywood Rd
Mills River NC 28759

RE: Surface Water Monitoring Results
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Apple,

The State Voluntary Cleanup Program with the assistance of the Site Assessment Section collected surface water samples on March 21, 2017, on the eastern side of the Congaree River from approximately the Gervais Street Bridge to the Blossom Street Bridge. Samples were collected in approximately 200 foot intervals around 15-25 feet from the river's edge. Additional samples were collected from tributaries flowing into the river and a background sample was collected upgradient of the Fleet Maintenance MGP Site in a stream running through Memorial Park.

Sampling results were received by the Department on April 4, 2017. With the exception of one detection of bis(2-Ethylhexyl)phthalate, all other samples yielded no detections. This detection is a common laboratory contaminant and is suspected to be a false detection. Additionally, a duplicate sample was collected at this location at the same time as the original sample and laboratory results were non-detect for all constituents for the duplicate sample.

The Department requests that South Carolina Electric and Gas submit a work plan that proposes a schedule and locations for regular surface water sampling in the Congaree River. This plan should be submitted to the Department by July 1, 2017.

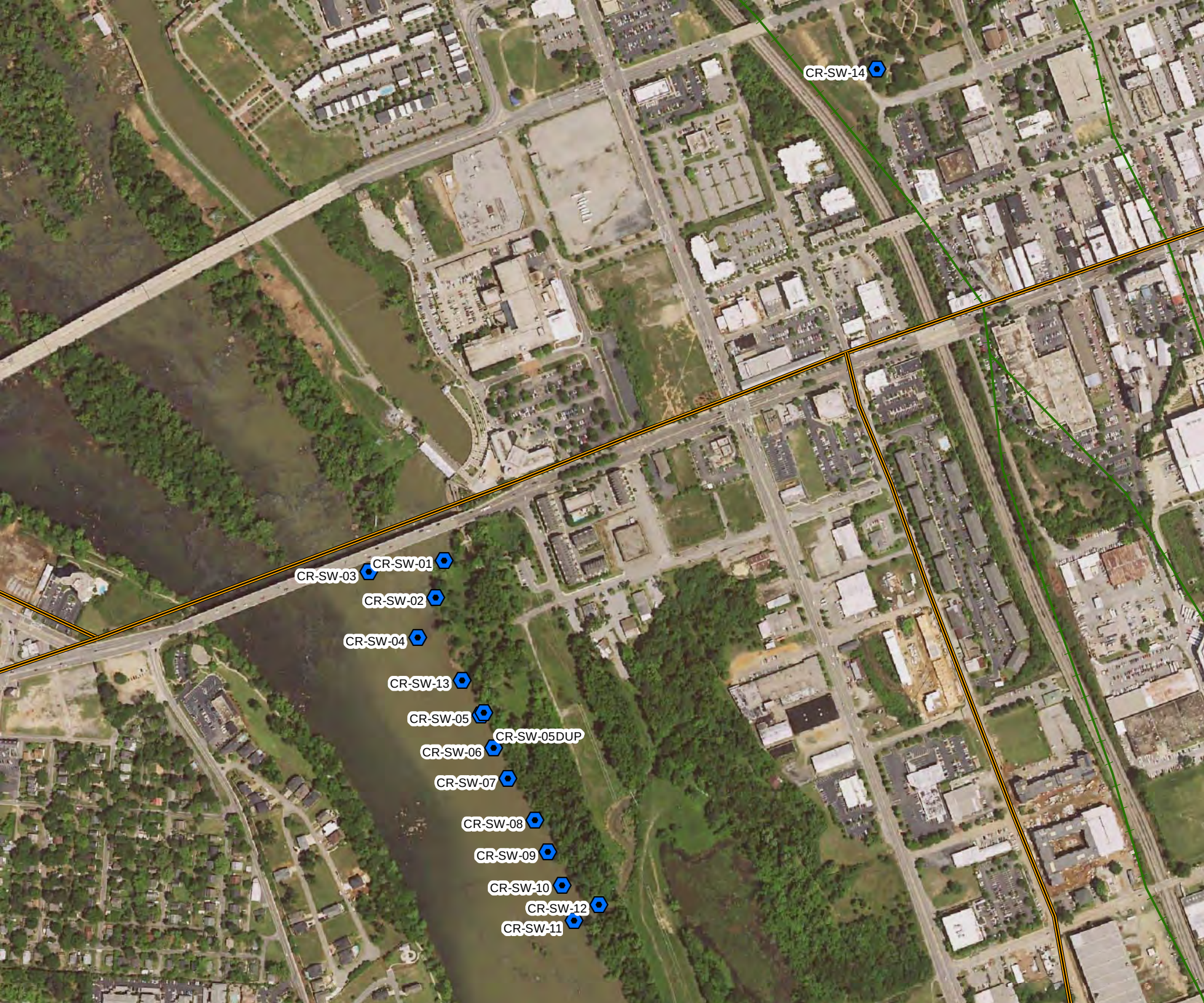
If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

Greg Cassidy

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Harry Mathis, Midlands EA Region


CR-SW-14
CR-SW-01
CR-SW-03
CR-SW-02
CR-SW-04
CR-SW-13
CR-SW-05
CR-SW-05DUP
CR-SW-06
CR-SW-07
CR-SW-08
CR-SW-09
CR-SW-10
CR-SW-12
CR-SW-11

SECTION A: Project Planning Elements		
A1. Title (*Project Name*):	SCE&G Huger Street MGP	
Project Location:	Congaree River between Gervais and Blossom Streets, Columbia SC	
Originating Organization:	SCDHEC State Voluntary Cleanup Section	
SCDHEC Section Managers	Lucas Berresford, Section Manager Jonathan McInnis, Section Manager	
Section Manager's Signature		Date: 03/07/17
Section Manager's Signature		Date: 03/07/17
Project Manager's Name, Position, and Organization:	Greg Cassidy, Project Manager, State Remediation, SCDHEC	
Project Manager's Signature:		Date: 03/07/17
Project Manager's Name, Position, and Organization	Jason Williams, Project Manager, Site Assessment, SCDHEC	
Project Manager's Signature:		Date: 03/07/17

A2. Table of Contents	

	Figure 1 – Proposed Sample Locations 9	
A3. Distribution List	Sampling Team, Waste Assessment	
A4. Project Personnel	**Organization**	**Responsibilities**
Jason Williams	SCDHEC	Site Assessment Project Manager and Site Safety Officer
Greg Cassidy	SCDHEC	State Voluntary Cleanup Project Manager
Dana Cook	SCDHEC	Sampling
Ben Bair	SCDHEC	Sampling
Tim Kadar	SCDHEC	Sampling
Robert Cole	SCDHEC	Sampling
Karen Seaber	SCDHEC	Sampling
Comments:		
Organization Chart: Refer to SCDHEC Site Assessment Program Level QAPP		
A5. Background:	The purpose of this investigation is to determine the surface water quality in the Congaree River as it relates to the coal tar deposits from former manufactured gas plant operations.	
A6. Project Description:	Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) both of which have been adopted by South Carolina as law, the Site Assessment Section and State Voluntary Cleanup Section, South Carolina Department of Health & Environmental Control will collect samples at the above listed site. For this study, the surface water pathway will be evaluated by sample collection and evaluation. Sampling for this site will include the collection of twelve (12) surface water samples. Two surface water sampling locations in the Congaree River will be sampled near the top of the water column and near the bottom of the water column. The samples collected will be used to determine if there has been a release to the environment. This will serve as a baseline sampling event for a long term monitoring plan for the Congaree River project. Sampling at the site will be conducted during the week of March 13, 2017.	
Decision(s) to be made based on data:	The information gathered from this investigation will be used to determine if coal tar in the river bed is having an adverse effect to surface water and serve as the baseline for future monitoring events.	
Applicable regulatory information, actions levels, etc.	Refer to SCDHEC Site Assessment Program Level QAPP	
Field Study Date:	March 21, 2017	

Projected Lab Completion Date:	April 21, 2017
Final Report Completion Date:	May 21, 2017

A7. Quality Objectives and Criteria

All water samples collected in this study will be analyzed for the following:
VOCs
SVOCs

MS/MSD samples will be collected based on the number of samples.. A water temp blank will be prepared for each day in the field for the respective media and one preservative blank will also be collected.

Refer to SCDHEC Site Assessment Program Level QAPP.

A8. Special Training/Certifications

Refer to SCDHEC Site Assessment Program Level QAPP

A9. Documents and Records

Refer to SCDHEC Site Assessment Program Level QAPP.

All field observations, measurements and sampling activities supporting the field investigation will be recorded and documented according to the SESD *Operating Procedure for Logbooks*, SESDPROC-010-R3 and the SCDHEC SOP&QA Manual.

SECTION B: Data Generation and Acquisition

B1. Sampling Design

Refer to SCDHEC Site Assessment Program Level QAPP.

Sample Number	Sample Media	Analyses	Location/Rationale
CR-SW-01	Surface Water	VOA SVOA	Location: Taken from outfall from Under Gervais Street.
CR-SW-02	Surface Water	VOA SVOA	Location: At the outfall of the stream that runs from the outfall to the Congaree river.

CR-SW-03	Surface Water	VOA SVOA	Location: Taken from an area upgradient of the Gervais street bridge. Rationale: This point is to set a background concentration in an area that does not have coal tar in the sediment.
CR-SW-04	Surface Water	VOA SVOA	Location: Taken from off the sandbar where coal tar deposits have been previously identified. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-05	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-04. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-06	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-05 . Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-07	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-06. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-08	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-07. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-09	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-08. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-10	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-09. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-11	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-010. Rationale: To determine water quality and potential impacts from coal tar.

CR-SW-12			Location: Taken approximately 200 feet downstream of CR-SW-11. Rationale: To determine water quality and potential impacts from coal tar
CR-SW-13			Location: Taken approximately 200 feet downstream of CR-SW-12. Rationale: To determine water quality and potential impacts from coal tar.

Volume, Holding Time, and Preservation Requirements. See SCDHEC Site Assessment Program Level QAPP

Maps or Diagrams with sample locations: See Attached

B2. Sampling Methods, General Procedures

Refer to SCDHEC Site Assessment Program Level QAPP.

B3. Sampling Handling and Custody

All samples will be handled and custody maintained in accordance with the SCDHEC Site Assessment Program Level QAPP

B4. Analytical Methods

SESD:	Suggested references are found at http://epa.gov/region4/sesd/asbsop/asb-loqam.pdf
CLP:	Suggested references are found at www.epa.gov/superfund/programs/clp.
Other:	Level 3 QA/QC will be used.

B5. Quality Control

Field:	Refer to SCDHEC Site Assessment Program Level QAPP
Laboratory:	Refer to SCDHEC Site Assessment Program Level QAPP and selected CLP QA/QC

B6. Instrument/Equipment Testing, Inspection and Maintenance

Refer to SCDHEC Site Assessment Program Level QAPP

B7. Instrument/Equipment Calibration and Frequency

Refer to SCDHEC Site Assessment Program Level QAPP

B8. Inspection/Acceptance for Supplies and Consumables

Refer to SCDHEC Site Assessment Program Level QAPP.

B9. Non-direct Measurements:

Refer to SCDHEC Site Assessment Program Level QAPP

B10. Data Management

The project manager will be responsible for ensuring that all requirements for data management are met. All data generated for this field investigation, whether hand-recorded or obtained using an electronic data logger will be recorded, stored and managed according to the following procedures:

SESD Operating Procedure for Control of Records, SESDPROC-002-R3.
SESD Operating Procedures for Logbooks, SESDPROC-010-R3.

Refer to SCDHEC Site Assessment Program Level QAPP

SECTION C: Assessment/Oversight

C1. Assessments and Response Actions

Assessments will be conducted during the field investigation according to the *SESD Operating Procedure for Project Planning*, SESDPROC-016-R1 to ensure the QAPP is being implemented as approved. The Project Manager is responsible for all corrective actions while in the field.

Refer to SCDHEC Site Assessment Program Level QAPP.

C2. Reports to Management

The SCDHEC Project Manager (PM), Greg Cassidy, will be responsible for notifying the appropriate SCDHEC Program Manager if any circumstances arise during the field investigation that may adversely impact the quality of the data collected. SCDHEC PM will prepare said report and send to Program Manager for review.

SECTION D: Data Validation and Usability

D1. Data Review, Verification, and Validation

Refer to SCDHEC Site Assessment Program Level QAPP

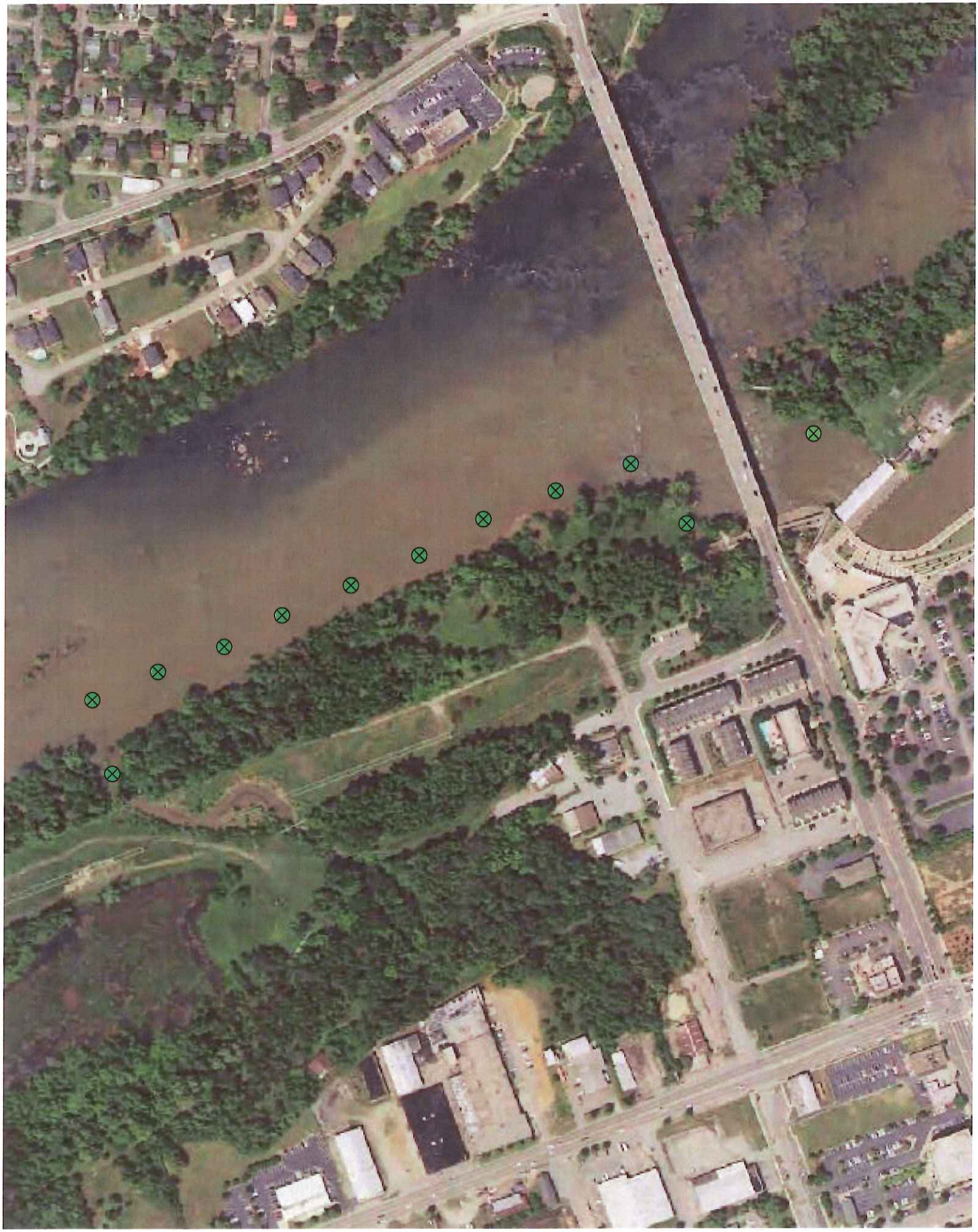
D2. Verification and Validation Methods

Refer to SCDHEC Site Assessment Program Level QAPP

D3. Reconciliation with User Requirements

Refer to SCDHEC Site Assessment Program Level QAPP.

**Footnotes: This Quality Assurance Project Plan (QAPP) has been prepared and approved according to the EPA *Requirements for Quality Assurance Project Plans (EPA QA/R5 EPA/240/B-01/003)*, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March 2001(USEPA, 2001). This document will be used to ensure that the environmental data collected for this project are of the type and quality for the intended purposes.



A-3

Excerpts from the SCDHEC Macroinvertebrate Bioassessment, July 7, 2017

dhec
Healthy People. Healthy Communities.

August 9, 2017

Mr. Paul Biery
Senior Project Manager
SCANA
100 SCANA Parkway
Cayce, SC 29033

RE: Aquatic Macroinvertebrate Bioassessment
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Biery,

On June 15, 2017, staff of the Aquatic Biology Section within the Bureau of Water of DHEC conducted an aquatic macroinvertebrate bioassessment of the Congaree River in Columbia, South Carolina. The goal of the study was to determine if sediment contaminated with coal tar in the Congaree River is having an adverse impact to the indigenous invertebrate fauna near the sediment plume.

The results of the June 2017 study indicated that the aquatic macroinvertebrate community at the Blossom Street Bridge was comparable to the upriver control, both receiving a bioclassification score of 4.5 (Excellent) on the Carolina Biocondition Scale. The community structure at both sites showed that there is a diverse and balanced community of invertebrates, with the presence of numerous pollution sensitive species.

At the time of this investigation, any current or potential harm to the aquatic invertebrate community near the contaminated site was not suggested. Test results indicated a balanced and indigenous community of aquatic invertebrate species that are indicative of a healthy river.

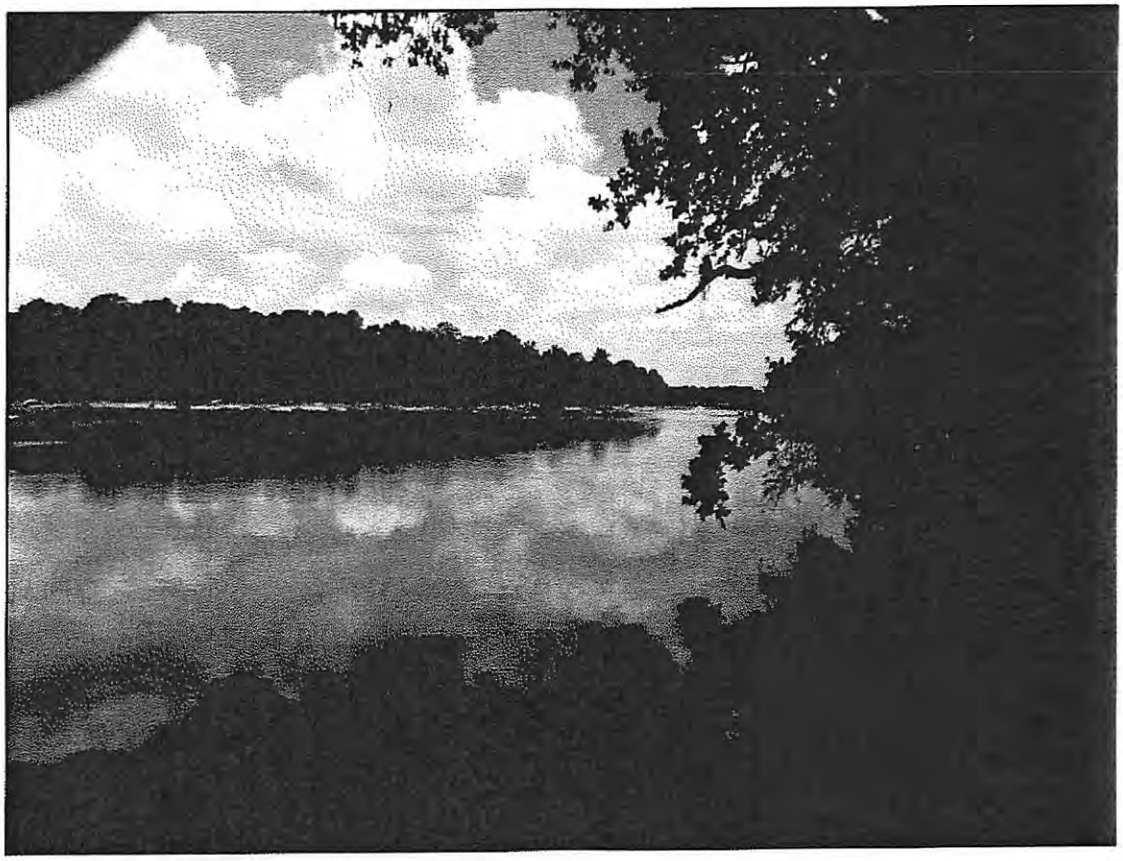
The full report, "An Investigation into the Potential Impacts of Coal Tar Contamination on the Invertebrate Community of the Congaree River near the City of Columbia, Richland County, SC", by Dr. James B. Glover is attached. If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Ken Taylor, BLWM
Al Peeples, Midlands EA Region

An Investigation into the Potential Impacts of Coal Tar Contamination on the Invertebrate Community of the Congaree River near the City of Columbia, Richland County, SC



By James B. Glover, Ph.D.

Bureau of Water
Aquatic Biology Section
07/07/2017

2600 Bull Street
Columbia, SC 29201

Technical Report Number 0804-17

dhec
S.C. Department of Health and Environmental Control

Suggested Citation

Glover, J.B. 2017. An investigation into the potential impacts of coal tar contamination on the invertebrate community of the Congaree River near the City of Columbia, Richland County, SC. The South Carolina Department of Health and Environmental Control Technical Report No. 0804-17. Bureau of Water, Columbia, SC.

Summary

On 15 June 2017, staff of the Aquatic Biology Section within the Bureau of Water of DHEC conducted an aquatic macroinvertebrate bioassessment of the Congaree River near Columbia, SC. The goal of the study was to determine if sediment contaminated with coal tar in the Congaree River was having an adverse impact to the indigenous invertebrate fauna near the sediment plume. The contamination was a waste by-product of a former manufactured gas plant, which was in operation during the first half of the 20th century.

The extent of contaminated sediment had been well characterized previously by South Carolina Electric and Gas (SCE&G) through a voluntary cleanup agreement with DHEC. Much of the contaminated sediment had been covered with tons of sediment in 2015, after severe flooding resulted in a breach of a canal. This sediment also covered much of the natural invertebrate habitat in this section of river. Two stations were established to evaluate the potential effects of the contamination of the biotic health of the river. A control site was located immediately upstream of the Gervais Street Bridge and a test site was established at the Blossom Street Bridge, directly downriver from the region with the highest levels of coal tar contamination.

The results of the June 2017 study indicated that the aquatic macroinvertebrate community at the Blossom Street Bridge was comparable to the upriver control, both receiving a bioclassification score of 4.5 (Excellent) on the Carolina Biocondition Scale. The community structure at both sites showed that there was a diverse and balanced community of invertebrates, with the presence of numerous pollution sensitive species. The EPT index, which quantifies the number of pollution sensitive mayflies, stoneflies, and caddisflies, respectively, was 22 at both the control and test site. These values were similar to those recorded in the recent past by DHEC on the lower Broad River and other locations on the Congaree River. The biotic condition on the Broad and Congaree Rivers, as measured by macroinvertebrate bioassessments, were much better than on the lower Saluda River, where bioclassifications ranged from Poor to Fair in the recent past. These lower ratings on the Saluda River are likely a result of numerous factors common to rivers located directly below large dams. These conditions are well studied and include flashy flows, altered water chemistry, and the disruption of the continuum of energy transfer in lotic waters.

At the time of this investigation, any current or potential harm to the aquatic invertebrate community near the contaminated site was not suggested. Rather the results indicated a balanced and indigenous community of aquatic invertebrate species that are indicative of a healthy river. The study does not address the potential of the tar contamination to effect other environmental end points such bioaccumulation, the potential of toxicity in the region of the higher tar contamination, or chronic impacts that may occur in other assemblages such as in fish. The study addresses, in part, environmental risk and thus is not intended to address the risk to human health from direct exposure to the contaminated sediment, which has been evaluated in other reports.

Street Bridge location (Figure 5). The unionid mussels that were documented at the Blossom Street site included *Elliptio roanokensis* (Roanoke Slabshell), *Elliptio congarea* (Carolina Slabshell), *Lampsilis cariosa* (Yellow Lamp mussel), and *Elliptio complanata* (Eastern Eliptio). Differences in species composition is likely due to natural variability rather than significant differences in water quality. The presence of the relatively immobile unionid mussels, some of which are up to 5 years of age, further suggests that the contaminated sediment has not impacted the native invertebrate fauna of the Congaree River at the Blossom Street Bridge. The presence of a very young Yellow Lamp mussel also demonstrates ongoing recruitment to this area.

Bioassessment results for the Saluda, Broad, and Congaree Rivers conducted in previous years are reported here to add context and insight into the results of this investigation (Figure 6). Results from the Saluda River were gathered in 2006 by Carnagey Biological Services (2006), which was conducted during a FERC Relicensing process of the Lake Murray Dam. There were 6 sites collected by DHEC in 2014 as part of the ambient monitoring program: 2 on the lower Saluda River, 2 on the Lower Broad River, and 2 on the Congaree River. As shown in Figure 6, stations on the Lower Broad River and the Congaree River are comparable and indicate a Good to Excellent biocondition. By contrast, the invertebrate fauna on the Saluda River near the Lake Murray Dam resulted in a score of Poor (1.0 - 1.5) in 2006. Conditions progressively improved moving away from the dam with a biocondition of Fair (2.0 - 2.2) being measured in the Saluda River near the Zoo. The values shown in Figure 6 for the Saluda are all from the year 2006. Not shown are two additional sampling sites from 2014, evaluated by DHEC, that indicated a bioclassification of 2.5 (Fair to Good-Fair) at S-1002, which is fairly close to the dam and also a score of 2.5 at S-298, a station slightly upriver of the zoo location. This suggests that conditions may have improved somewhat since 2006, although season, natural variability, or difference in local conditions at the sampling site could account for the differences. Regardless, the biotic condition of the Saluda River is not as good as those in the Broad and Congaree, likely because of numerous variables associated with the reservoir. The effects of large dams on rivers have been studied and reviewed extensively (see Poff 1997) and changes in aquatic biota are thought related to numerous conditions such as flashy flows, water chemistry alterations, and alterations of energy flows within lotic waterways.

Conclusion

The results of this study show that the Congaree River in the vicinity of a large section of river contaminated with coal tar contained a diverse community of aquatic macroinvertebrates, and this is indicative of a healthy river system. While the area immediately adjacent to both sampling locations is highly urbanized, the watershed itself remains relatively well forested. Both sites are below the confluence of the Saluda River, but on the east side of the river it appears the water remains highly stratified, with the Broad River likely dominating conditions in the river at that point. There are no indications that the contaminated sediment has contributed measureable acute or chronic toxicity to the benthic invertebrate fauna in the Congaree River near Blossom Street. It is unclear if results may have been different before the 2015 floods, in which the majority of the contaminated sediment was covered in heavy fresh sediment from upriver. It is unknown if future exposure or mobilization of tar might result in harm in aquatic invertebrates or prevent recolonization of the region where the sediment is most highly contaminated. However in June of 2017, the benthic community appeared healthy and comparable to other nearby sites that have been sampled in the recent past.

APPENDIX B

RIZZO ASSOCIATES CONCEPTUAL DESIGN OF SEDIMENT CAPPING OPTIONS

RIZZO ASSOCIATES

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www.rizzoassoc.com

March 23, 2016
Project No. 11-4708

Mr. William Zeli
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

via email: WZeli@apexcos.com

LETTER REPORT
CONCEPTUAL DESIGN OF SEDIMENT CAPPING OPTIONS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

Dear Mr. Zeli:

This Letter Report presents the results of RIZZO Associates (RIZZO) engineering evaluation and conceptual design of sediment capping options for the Congaree River Remediation Project. Our services for this Project were performed in accordance with our January 22, 2016 proposal submitted to Apex Companies, LLC (Apex).

1.0 PROJECT UNDERSTANDING

Apex is currently working with South Carolina Electric & Gas (SCE&G) on a sediment remediation project in Columbia, South Carolina. The area to be remediated is located on the left bank of the Congaree River immediately downstream of the Gervais Street Bridge. A test program for evaluating the presence of metal anomalies was performed during fall 2015 and Apex is currently evaluating options for capping contaminated sediment in-place. Challenges with the Project include an uneven river bottom with boulders and rock outcrops, variable water levels, and swift currents in the Project area.

If any of the Project information described in this Letter Report is incorrect or has changed, please contact RIZZO immediately so that we can revise or amend the recommendations provided within, if appropriate.

2.0 DESIGN CRITERIA

Design Criteria were established for the conceptual design in RIZZO's February 5, 2016 (RIZZO Letter L38) letter to Apex. The following design criteria were considered during the development of the conceptual design options:

1. Flow Velocity: Previous HEC-RAS one-dimensional modeling of the existing river channel performed by RIZZO was reviewed to estimate the maximum water velocity in the area of remediation. Previous analysis considered the 100-year, 50-year, and 10-year floods, as well as several lower flow conditions. ***Table 2-1*** shows the maximum velocity in the area of interest for different flow conditions analyzed. The maximum velocity in the remediation area is 15.2 feet per second (ft/s) with a water surface of 128 feet (ft), National Geodetic Vertical Datum 1929 (NGVD29). To ensure the cap can withstand expected velocities, an approximately 20 percent increase was considered for the conceptual design. The capping options were evaluated assuming a maximum water velocity of 18 ft/s.

TABLE 2-1
MAXIMUM WATER VELOCITY IN PROJECT AREA

FLOW CONDITIONS	MAX VELOCITY (FT/S)
100-year Flood	10.5
50-year Flood	9.6
10-year Flood	8.1
128-ft Water Elev.	15.2
123-ft Water Elev.	8.4
120-ft Water Elev.	5.4
116.6-ft Water Elev.	2.7

2. Design Life: The capping needs to be a permanent (50 years or more) installation with little or no maintenance required. Only remediation options that met this requirement were considered.

3. Area to Cap: The capped area is expected to be the area shown on the Apex drawing titled "Targeted Removal Area to Be Capped" dated December 30, 2015. The cap is intended for containment of contaminated sediment and not for erosion control; therefore it is not required to extend the cap up the embankment beyond the normal water surface. A top elevation of 116.0 ft has been selected for the limits of remediation. The conceptual design includes extending the cap beyond the 116.0 ft limit in the area of the boat ramp for added erosion protection.

4. Appearance and Functionality: The area being capped has been a popular fishing and boating area, and includes an existing boat launch. The cap needs to be aesthetically pleasing, including the portion of the cap that is exposed above water during normal flow conditions.

The following factors are not part of the design criteria for the Project but were evaluated as part of the conceptual design:

1. Ease of Installation: Installation methods and restrictions are considered in the conceptual design, including the amount of equipment and time that would be required in the river and the ability of the option to accommodate the hard, uneven river bottom. To satisfy U.S. Army Corps of Engineers (USACE) requirements, the length of time working in the river should be less than six months to be considered a temporary encroachment on the river.

2. Anchoring: The cap needs to be secured in place. Feasibility and cost of different anchoring methods were taken into consideration, as well as the variable river bottom conditions that may be encountered during installation.

3. Cost: Cost was considered in development of the conceptual design alternatives. Installation methods and associated cost were considered in addition to material cost. A budgetary cost estimate has been developed for each option.

3.0 EVALUATION OF CAPPING OPTIONS

3.1 CAPPING ALTERNATIVES

Two alternatives were considered for the conceptual design of the cap. They included capping the contaminated area with articulated concrete blocks (ACBs) or with an erosion control mat.

ACBs, such as Contech ArmorFlex, are a flexible matrix of concrete blocks of uniform size, shape, and weight. Though they can be hand placed, they are typically interconnected with steel or synthetic cables to provide ease of installation and allow for them to conform to variations in the surface where they are being applied. An open-cell design for ACBs allows for placement of soil and seeding, allowing for vegetative growth; or for filling with rockfill or gravel to promote underwater habitats. ACBs provide hard armor erosion control and are well suited for shoreline protection, channel lining, and boat ramps (***Photograph 3-1***).

PHOTOGRAPH 3-1
INSTALLATION OF ACBs ALONG SHORELINE

Source: Project Profile, "Lake Wabamum Shoreline Protection," Nilex Civil Environmental Group, February 2012.

Erosion protection mats are a flexible turf reinforcement mat (TRM) for scour and erosion protection and slope stabilization. ArmorMax, by Propex Operating Company, is a two-part system. It combines PyraMat, a woven three-dimensional high performance turf reinforcement mat (HPTRM), and Type B1 percussion driven earth anchors (PDEAs). The mat is flexible and has high tensile strength. The mat surface is specially designed to interlock with the soil substrate and promote vegetative growth. These systems are well suited for shoreline protection, channel lining, and surficial slope stabilization (***Photograph 3-2***).

PHOTOGRAPH 3-2
INSTALLATION OF EROSION PROTECTION MAT
ALONG CHANNEL SLOPE

Source: Propex Operating Co., LLC, <http://propexglobal.com/Geo-Solutions/Product-Tour/ArmorMax>, Date accessed: February 4, 2016.

3.2 ANALYSIS AND FINDINGS

3.2.1 ACB Evaluation

RIZZO performed an analysis, following guidelines established by the Federal Highway Administration (FHWA), to determine an appropriate size and style of ArmorFlex block. Failure condition for ACBs is described in the guidelines as the local loss of intimate contact between the revetment and the subgrade it protects. The loss of contact can result from one or more of the following destabilizing processes:

- Ingress of flow beneath the armor layer
- Loss of subgrade soil through gradual piping
- Enhanced potential for rapid saturation and liquefaction of subgrade soil
- Loss of block or group of blocks from the revetment

The design guidelines are based around the ACB's hydraulic stability performance. They utilize a discrete particle approach to evaluate a single block within the overall matrix. The single block

is evaluated for overturning, with the results being compared to a minimum factor of safety, which is based on the site conditions and intended application. A minimum factor of safety of 1.40 has been selected for the analysis. This value was selected based in part upon the low consequence of failure and the river conditions. Since HEC-RAS modeling has already been performed for the Site, a low degree of uncertainty in design values yields a lower recommended minimum factor of safety.

Two sizes of open-cell ArmorFlex block were evaluated based on the manufacturer's performance data: Class 50 (6-inch thick) and Class 70 (8.5-inch thick). Both blocks have a nominal area of 15.5-inch by 17.4-inch per block. The evaluation calculations are included in ***Attachment C***. It was determined from the analysis that the Class 50 block yielded a factor of safety of 1.34, which does not meet the minimum value. The Class 70 block yielded a factor of safety of 1.85, which does meet the minimum required value. Therefore, the conceptual design uses a Class 70 ArmorFlex block for the ACB mats.

3.2.2 Erosion Control Mat Evaluation

The initial selection of PyraMat and ArmorMax systems was determined using the Erosion Control Product Selection Guide from Contech engineering Solutions (Contech, 2012). The chosen option is based on the selection guide, a maximum velocity of 18 ft/sec, and a minimum design life of 50 years. From review of the manufacturer's data (Propex, 2015), the PyraMat system on its own is capable handling velocities up to 25 ft/sec and shear stress of 16 lb/ft^2 when in a fully vegetated state and there is good bonding with the substrate. Typical installation includes trenching and backfilling around the perimeter and the installation of 12-to-24 inch steel pins placed on 12-inch center over the entire area. When combined with the Type B1 percussion driven earth anchors to form the ArmorMax system, there are structural application benefits. Anchors are embedded up to 5 ft, and provide additional surficial slope stabilization. They do not, however, provide any performance improvement related to the maximum velocity.

According to manufacturer's data for PyraMat and ArmorMax systems, the channel surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that ArmorMax comes in direct, intimate contact with the channel surface. Based on manufacturer's data, the PyraMat and ArmorMax systems provide sufficient performance against design velocities, but they are not suited for the irregular and rocky conditions in portions of the Project area.

RIZZO has determined that the erosion control mats are not suited for capping the contaminated sediment along the river bed due to anchoring and bonding requirements. Neither the sediment layer nor the rocky bottom is sufficient for anchoring. There are also concerns with achieving the proper interlocking with the substrate to allow the erosion control mats to perform under the design velocities. Therefore, the conceptual design of the erosion control mats has not been developed further.

The erosion control mats could be installed above the normal water surface, in conjunction with the ACBs, if erosion protection of the river bank above the normal water surface elevation is required.

4.0 CONCEPTUAL DESIGN

A conceptual design has been developed for capping the contaminated sediment with ACBs. This design includes the placement of Class 70, open-cell, ArmorFlex ACB mats within the river channel to the extents of the proposed sediment capping area, provided in Apex's Drawing "Targeted Removal Area to be Capped" (CONG354, dated December 30, 2015). The ACB mats will cover the river bottom below elevation 116.0 ft. The ACB mats will also extend up the bank of the river to approximately elevation (EL) 124.0 ft in the area of the boat access ramp for protection in areas of prior erosion. ***Figure 1*** in ***Attachment A*** shows the limits of capping for the conceptual design.

The river bottom in the Project area includes rocky outcrops, boulders, and sediment. For proper placement of the ACB mats, rockfill will be used to fill in large holes or low spots within the remediation area as required, and geotextile fabric will be attached to the underside of the mats prior to placement. Large rocks or boulders may be temporarily moved to allow placement of the mats. In the event it is not practical to move or cover a rock outcrop or boulder, the feature will be left exposed and the ACB mat will be modified to fit around the feature. This may include the hand placement of ACBs, as needed. ***Figure 2*** in ***Attachment A*** shows a profile of the ACB mat installed along the embankment slope and river channel bottom. The design includes placement of rock in a portion of the capped area, following installation, to help promote sturgeon habitat.

4.1 ANCHORING

The ACB mats will be anchored at the shoreline edge with an anchor trench. A minimum of two blocks will be turned down in the trench and covered with soil. See ***Figure 3*** in ***Attachment A***

for a detail of the anchor trench installation. Soil is recommended for the trench backfill based on the relatively shallow slopes at the Site. The backfilled soil will be seeded for a clean and aesthetically pleasing transition between the ACB mats and the embankment. Blocks above and around the normal water level will also be filled in with soil and seeded.

The edges of the mat located upstream, downstream, and parallel to the river flow will not have any additional treatment or anchoring. The perimeter blocks do not require any anchoring based on the results of the ACB stability calculation.

4.2 INSTALLATION

It is expected that the ACB mats will be installed using a spreader bar as shown in ***Photograph 4-1***. The span for the spreader bars span can range from 16 feet to up to 40 feet and can be sized for the site specific conditions. A crane or excavator can be used to lift the spreader bar and ACB mats.

PHOTOGRAPH 4-1
INSTALLATION OF ACBs BY CRANE

Source: Contech Engineering Solutions, Project Profile, "Sunny Point Marina," Sunny Point, North Carolina, Installed June 2003.

For the Congaree site, a crane or excavator will likely install the mats near the shoreline and in shallow water while operating from the shore or from shallow water near the bank. The area to be capped extends a maximum of approximately 200 feet into the Congaree River, with depths up to 11 feet under normal conditions. Therefore, some of the installation will be performed using an excavator or crane operating from a portable platform or a temporary access road in the water.

We estimate that it would take approximately 12 to 16 weeks to complete the installation. This estimate is dependent on the contractor, the number of crews they operate, and favorable weather and river conditions.

5.0 QUANTITY AND BUDGETARY LEVEL COST ESTIMATES

A material quantity and cost estimate has been developed for the ACB mat option and is included in ***Attachment B***. We estimate the cost of an ACB mat capping system will be approximately $3.57 million with the estimate influenced by the type of placement as described below.

For the cost estimate we have estimated that approximately 50 percent of the installation will be done by land and/or in relatively shallow water and that approximately 50 percent will be done by portable platform or a temporary access road in the water. The cost for land placement was estimated at 1.25 the cost of the ACB product. The cost of placement from the water was estimated at 2 to 2.5 times as much as the cost of the ACB product, so this ratio has a significant impact on the overall cost of the Project.

6.0 REFERENCES

1. Propex, 2015, Propex, “Product Data, ArmorMax for Erosion Control,” Propex Operating Company, LLC, 2015.

2. Contech, 2012, Contech, “Erosion Control Product Selection Guide,” Contech Engineered Solutions LLC, 2012.

7.0 SUMMARY

An evaluation of two proposed capping options for the Congaree River Remediation was conducted and a conceptual design was developed. We recommend that the articulated concrete block mats be considered for the capping of the Congaree River sediment.

If you have any questions or require any additional information, please contact me at 412-825-2015 or email me at kevin.cass@rizzoassoc.com.

Respectfully submitted,
RIZZO Associates

Kevin Cass, P.E.
Senior Project Engineer

Attachments

KRC/JDD/sdr

ATTACHMENT A

FIGURES

DRAWN BY	TRD 2/22/16
CHECKED BY	KRC 3/23/16
APPROVED BY	JDD 3/23/16
SIGNATURES ON FILE	
CAD FILE NUMBER	11-4708-B4

ESTIMATED RIVERLINE

CLASS 70 ARMORFLEX BLOCK

2015 MODIFIED AREA OF CAPPING

REFERENCE:
APEX DRAWING, "OPTION 2, TARGETED REMOVAL OF AREA TO BE CAPPED, "CONG354, PREPARED FOR SOUTH CAROLINA ELECTRIC & GAS COMPANY, APEX COMPANIES, LLC, 12/30/15.

0' 80' 160'
(Feet Scale)

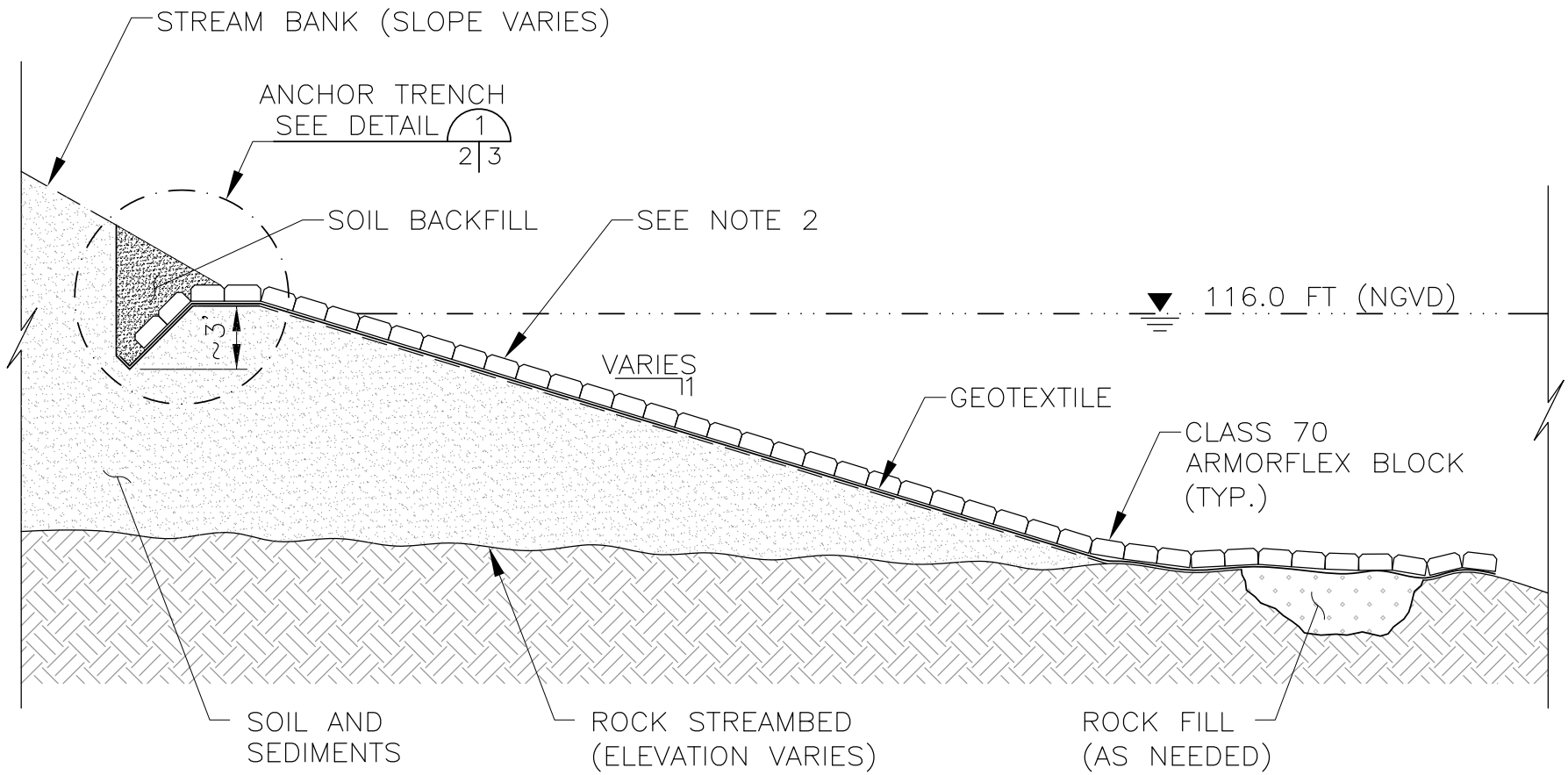
FIGURE 1

AREA TO BE CAPPED
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

PREPARED FOR

APEX CORPORATION
TRAFFORD, PA

RIZZO ASSOCIATES



NOTE:

1. ARTICULATED CONCRETE BLOCKS (ACBs) WILL BE AN ARMORFLEX, CLASS 70, OPEN-CELL BLOCK WITH A NOMINAL HEIGHT OF 8.5-INCHES OR APPROVED ALTERNATE.

2. ROCK TO BE PLACED IN A PORTION OF THE CAPPED AREA VOIDS (HOLES IN BLOCKS), FOLLOWING INSTALLATION OF THE ACB MAT. BLOCKS ABOVE OR NEAR THE WATER LINE SHALL BE FILLED WITH SOIL AND SEEDED. OTHER BLOCKS TO REMAIN AS INSTALLED.

(NOT TO SCALE)

FIGURE 2

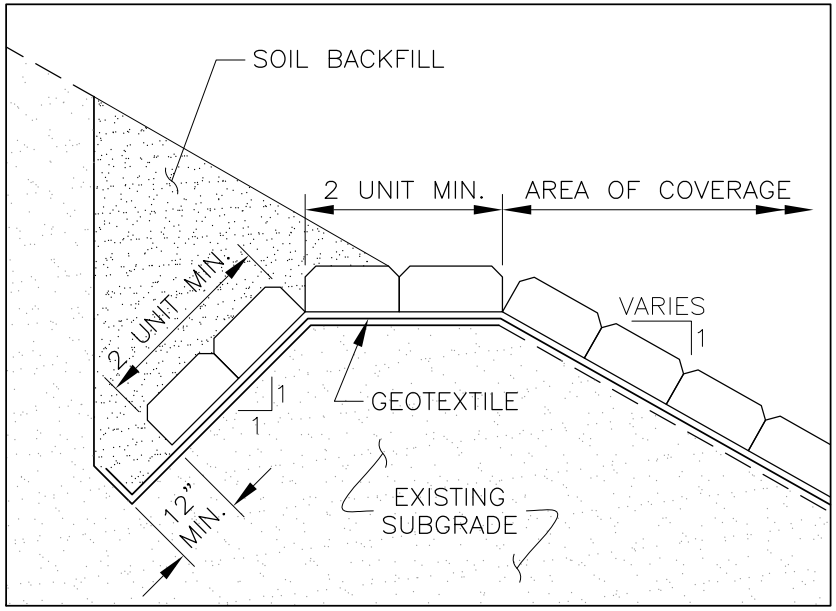
ACB MAT PROFILE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

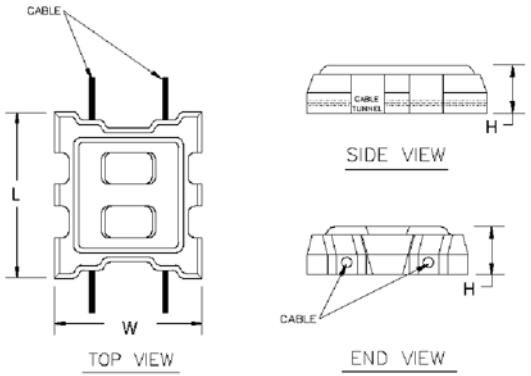
PLOT	DRAWN BY	TRD	CHECKED BY	KRC	3-23-16	CAD FILE NUMBER	114708A23
1:1	DATE	2-22-16	APPROVED BY	JDD	3-23-16		



DETAIL 1 (2|3)

ANCHOR TRENCH DETAIL

(NTS)



TYPICAL OPEN CELL BLOCK DETAIL

(NTS)

GENERAL NOTES:

1. ARTICULATED CONCRETE BLOCKS (ACBs) WILL BE AN ARMORFLEX, CLASS 70, OPEN-CELL BLOCK WITH A NOMINAL HEIGHT OF 8.5-INCHES OR APPROVED ALTERNATE.
2. PREPARE SUBGRADE PRIOR TO PLACEMENT OF THE ACB MAT. THIS INCLUDES CLEARING DEBRIS AND LARGER ROCKS AS REQUIRED AND FILLING LARGE HOLES WITH RIPRAP OR GRAVEL. FOR IMMOVABLE OBSTRUCTIONS THE MAT SHALL BE PLACED AROUND IT, WHILE MAXIMIZING COVERAGE.
3. A MINIMUM OF 2 UNITS SHALL BE ENTRENCHED FOR SECURING THE TOP EDGE OF THE ACB MAT. OTHER EDGES SHALL LAY FLAT, AS PLACED, WITH NO ADDITIONAL TREATMENT.

REFERENCE:
"ARMORTEC PRODUCT DETAILS", CONTECH ENGINEERING SOLUTIONS LLC, 2012.

(NOT TO SCALE)

FIGURE 3

ANCHOR TRENCH AND BLOCK DETAILS

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	TRD	CHECKED BY	KRC	3-23-16	CAD FILE NUMBER	114708A24
1:1	DATE	2-23-16	APPROVED BY	JDD	3-23-16		

ATTACHMENT B

COST ESTIMATE

ENGINEERS & CONSULTANTS

Congaree River Remediation
Conceptual Cost Estimate
Capping with ACB Mats

Item	Description	Estimated Quantity	Unit of Measure	Unit Cost	Total Estimated Cost (COMBO)
1.0	**Mobilization/Demobilization**				
1.1	Mobilization/Demobilization (10% of cost)	1	Lump Sum	$300,000.00	$300,000
	Sub Total 1.0				**$300,000**
2.0	**ACB Mat Installation**				
2.3	ACB Mat including Geotextile	104,400	SQ-ft	$8.60	$897,840
2.4A	50% Installation from Land (1.25 of product cost)	1.25	LS	$448,920.00	$561,150
2.4B	50% Installation from Water (2.5 of product cost)	2.50	LS	$448,920.00	$1,122,300
2.5	Rock Fill Placement (for low spots)	400	CY	$100.00	$40,000
2.6	Earthwork (Trench) and refill	389	CY	$40.00	$15,560
2.7	Soil Backfill and seeding	40	CY	$42.00	$1,680
2.8	Rock for habitat (based on 2-inch gravel in 50% of holes)	750	CY	$45.00	$33,750
	Sub Total 2.0				**$2,672,280**
				Sub Total	**$2,972,280**
				Contingency (20%)	**$594,456**
				Total	**$3,566,736**

ATTACHMENT C

CALCULATION

Part I – Completed by Originator:

Project Name: Congaree River

1. If this is a revision, explain reason for revision: N/A
2. Have superseded versions been VOIDED, or destroyed as required? ☒N/A ☐No ☐Yes
3. Has design or analysis software been used for this Calculation? ☒No ☐Yes
   - 3.1. If Yes, provide the following information:
   - 3.2. Software Name: _____ Version Number: _____
   - 3.3. Computer Serial Number of computer used for this Calculation: _____
   - 3.4. Confirm that software is listed on Form QP-7-13. ☐No ☐Yes
   - 3.5. Confirm that Software Usage Log has been updated to include this calculation. ☐No ☐Yes
4. Has a thorough Self-Check of this Calculation been completed and accurate? ☐No ☒Yes
5. Is this calculation nuclear safety related? ☒No ☐Yes
   - 5.1. Has In-Use Test been performed on the computer used for this calculation? ☒N/A ☐No ☐Yes
   - 5.2. If "No" or "N/A," explain Non-nuclear safety related project

Part II – Completed by Verifier(s)–The Independent Reviewer shall address the following:

1. Calculation inputs were correctly selected. ☐N/A ☐No ☒Yes
2. Significant assumptions are adequately identified, described, justified, reasonable? ☐N/A ☐No ☒Yes
3. Any assumptions identified for re-verification are completed? ☐N/A ☐No ☒Yes
4. Calculation inputs were correctly incorporated into the design? ☐N/A ☐No ☒Yes
5. Numerical calculations correct, and documented? ☐N/A ☐No ☒Yes
6. Calculation outputs were reasonable compared to inputs ☐N/A ☐No ☒Yes
7. Calculation input and verification requirements for interfaces are identified (e.g., specified in the Work Plan, supporting procedures, or instructions) ☐N/A ☐No ☒Yes
8. Suitable materials, parts, processes, inspection and testing criteria specified? (e.g., may be applicable to design calculations, field activities, etc..) ☐N/A ☐No ☒Yes
9. Hand-annotated changes are made correctly (single line strike through, initialed, dated)? ☒N/A ☐No ☐Yes
10. All pages are legible, references identified and appropriate; document identifier and revision assigned; and acceptable with respect to grammar, spelling and punctuation ☐N/A ☐No ☒Yes
11. Each calculation input, Information and equations from external sources referenced? ☐N/A ☐No ☒Yes
12. Calculation Report contains the required information? ☐N/A ☐No ☒Yes

REVIEW COMMENTS:

Part III – Approval for Calculations:

Originator(s) Print Name	**Signature/Date**	
Kevin R. Cass		Kevin R. Cass, Senior Engineer, RIZZO Associates
Verifier(s)	**Signature/Date**	**Verification: Independent Design Review**
Jennifer Mead		Jennifer M. Mead, Engineering Associate, RIZZO Associates
Project Manager	**Signature/Date**	
Jared Deible		Jared Deible, Senior Director, Dams & Water Resources, RIZZO Associates

Approval of the Project Manager signifies that the document and all required reviews are complete, and the document is released for use.

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1.0 STATEMENT OF PURPOSE

The purpose of this calculation is to evaluate two different options for the capping of contaminated sediment in the Congaree River, just downstream of the Gervais Street Bridge, in Columbia, SC. From previously determined design criteria, articulated concrete block systems (ACBs) and erosion control mats have been chosen for evaluation. The ACBs are evaluated based on manufacturer's data and design guidelines in the Federal Highway Administration's (FHWA) Hydraulic Engineering Circular (HEC) No. 23 (***FHWA, 2009***). For conceptual design purposes, the erosion control mats are evaluated based on manufacturer's performance data only.

2.0 DESCRIPTION OF METHODOLOGY USED

The total contaminated sediment area runs approximately 1,650 feet along the east bank, starting downstream of the Gervais Street Bridge, and terminating at the inlet of a small unnamed tributary (referred to as Tributary No. 2). The area of interest for this evaluation is between river station 267750 (Section N) and river station 265610 (Section EX-5) of the previous HEC-RAS model (***RIZZO, 2014***). Several design criteria influence the selection of capping solutions, including maximum velocity and service life.

Previous HEC-RAS one-dimensional modeling of the existing river channel performed by RIZZO was reviewed to estimate the maximum water velocity in the area of remediation. Previous analyses considered the 100-year, 50-year, and 10-year floods (***RIZZO, 2014***), as well as several other lower flow conditions (***RIZZO, 2015***). The maximum velocity in the remediation area was determined to be 15.2 feet per second (ft/sec) for a water surface elevation of 128 feet, National Geodetic Vertical Datum 1929 (NGVD29). To ensure that the cap can withstand the expected velocities, an approximate 20% increase in velocity is applied to the design. Therefore, the cap is designed to withstand a maximum water velocity of 18 ft/sec.

The capping is required to be a permanent (50 years or more) installation with little or no maintenance required. Therefore, only capping solutions that meet this minimum requirement have been considered. For the evaluation of the ACBs, ArmorFlex by Armortec Erosion Control Solutions has been selected. Two sizes of ACBs were selected for initial evaluation. The ACBs are evaluated using design equations from HEC No. 23 (***FHWA, 2009***). For the evaluation of the erosion control mats, ArmorMax by Propex Operating Company has been selected. Erosion control mats are evaluated based on the manufacturer's data.

2.1 EVALUATION OF ARMORFLEX ACB

2.1.1 Initial Block Selection

ACBs are a flexible matrix of concrete blocks of uniform size, shape, and weight. Though ACBs can be hand placed, they are typically interconnected with steel or synthetic

cables to provide ease of installation and to allow for the matrix of blocks to conform to variations in the application surface. The initial selection of ArmorFlex block is determined using the Erosion Control Product Selection Guide from Contech engineered Solutions (***Contech, 2012b***). Based on the selection guide and a maximum velocity of 18 ft/sec, the Class 50 (6-inch thick) and Class 70 (8.5-inch thick) ArmorFlex blocks are evaluated. The open-cell variation has a smaller mass and is therefore conservatively considered for evaluation.

2.1.2 Evaluation using HEC No. 23

The FHWA has established guidelines and equations for the design of articulated concrete block systems (***FHWA, 2009***). The design guidelines are based around the ACBs hydraulic stability performance. Failure condition for ACBs is described in the guidelines as, "*the local loss of intimate contact between the revetment and the subgrade it protects*." The loss of contact can result in one or more of the following destabilizing processes:

- Ingress of flow beneath the armor layer
- Loss of subgrade soil through gradual piping
- Enhanced potential for rapid saturation and liquefaction of subgrade soil
- Loss of block or group of blocks from the revetment

FHWA (2009) provides design guidance and equations for two types of applications: bank revetment (or bed armor) and pier scour. The procedures for bank revetment are followed for this evaluation. The design guidelines utilize a discrete particle approach to evaluate a single block within the overall matrix. The single block is evaluated for overturning and compared to a minimum Factor of safety (SF), which is determined based on the application. A minimum SF of 1.40 has been selected for this evaluation for channel bed or bank protection. Armortec has published design guidance (***Armortec, 2002***) that is based on HEC No. 23 (***FHWA, 2009***) and was reviewed during the evaluation.

The evaluation of ACBs can be outlined in the following steps from ***FHWA, 2009***:

1. Determine a Target Factor of Safety
2. Calculate Design Shear Stress
3. Obtain ACB Properties
4. Calculate Drag and Lift force due to protrusion
5. Calculate Stability Number for Block on a Horizontal Surface
6. Calculate Angle between Side Slope projection of Submerged Block Weight and the Vertical

7. Calculate projection of Submerged Block Weight
8. Calculate Angle between Block Motion and the Vertical
9. Calculate Angle between Drag Force and Block Motion
10. Calculate Stability number for a Block on a Sloped Surface
11. Calculate the Submerged Weight of each Block
12. Calculate the Factor of Safety for each Block

Design inputs are summarized in ***Section 4.0*** and the equations are presented in ***Appendix A***. The numerical calculations were performed using Microsoft Excel. The Excel worksheets and detailed numerical calculations are presented in ***Appendix A***.

2.2 EVALUATION OF EROSION CONTROL MATS

Erosion control mats provide scour and erosion protection and slope stabilization. ArmorMax, by Propex Operating Company, is a two-part system comprised of PyraMat, a woven three-dimensional High Performance Turf Reinforcement Mat (HPTRM), and Type B1 percussion driven earth anchors (PDEAs). The mat is flexible and has high tensile strength. The mat surface is specially designed to interlock with the soil substrate and promote vegetative growth.

The initial selection was determined using the Erosion Control Product Selection Guide from Contech engineering Solutions (***Contech, 2012b***). The chosen option is based on the selection guide, a maximum velocity of 18 ft/sec, and a minimum design life of 50 years. This evaluation will also consider the PyraMat on its own, without anchors.

3.0 ASSUMPTIONS AND JUSTIFICATION

1. All elevations are referenced to the National geodetic Vertical Datum of 1929 (NVGD29).
2. The design life of the capping solution should be permanent (minimum 50 years).
3. Maximum velocity is determined based on existing hydraulic analysis of the reach with an applied 20% increase to ensure that the cap can withstand the expected velocities.
4. A channel bed slope of 0.05 ft/ft is assumed for the area of evaluation for the Congaree River.
5. A value of 0.5-inch is assumed for the height of block protrusion above the ACB mat. This is based of design examples from the HEC No. 23 guidelines (***FWHA, 2009***).

6. The channel side slopes and maximum depth are estimated issuing cross-section data from previous HEC-RAS analyses, and are determined assuming capping will be applied up to an elevation of 116.0 ft.

4.0 CALCULATION INPUT

The evaluation of ACBs will consider ArmorFlex open-cell Class 50 (6-inch height) and Class 70 (8.5-inch height) blocks. ***Table 4-1*** summarizes the design inputs used for this evaluation and the reference sources.

TABLE 4-1: DESIGN INPUTS

Input	Value	Reference Source
Design Velocity	18 ft/sec	***RIZZO, 2015***
Maximum Depth	26.4 ft	***RIZZO, 2015***
Side Slope	3.8H:1V	***RIZZO, 2014***
Channel Bed Slope	0.05 ft/ft	***Assumption 4***
Slope of Energy Grade Line	0.0007624	***RIZZO, 2015***
Channel Top Width	1062.58 ft	***RIZZO, 2015***
ACB Dimensions	*see Appendix A*	***Contech, 2012a***
Critical Shear Stress on Horizontal	*see Appendix A*	***Contech, 2012b***
Submerged Weight of each Block	*see Appendix A*	***Contech, 2012b***
Height of Block protrusion above ACB Mat	*0.5 in*	***FHWA, 2009***

Design Velocity – based on a maximum velocity of 15.2 ft/sec with an approximate 20% increase.

Maximum Depth – the maximum channel depth within the area of analysis from the existing conditions cross-sections.

Side Slope – the maximum side slope within the area of analysis from the existing conditions cross-sections.

Channel Bed Slope – the slope of the channel bed along the area of analysis.

Slope of Energy Grade Line – the energy grade line slope at the cross-section where the maximum velocity was determined.

Channel Top Width – the average channel top width from within the area of analysis from the existing conditions cross-sections.

ACB Dimensions – The length, width and height of the ArmorFlex blocks.

Critical Shear Stress on Horizontal – the critical shear stress for a given ACB on a horizontal surface, provided by Armortec.

Submerged Weight – the submerged weight of a given ACB, provided by Armortec.

Height of Block Protrusion above ACB Mat – the height that a single block may protrude from the ACB mat. Used for the calculation of additional drag force. Estimated from FHWA guidelines.

5.0 NUMERICAL CALCULATIONS

See ***Appendix A*** for the ACB evaluation Excel worksheets.

6.0 CALCULATION OUTPUT

Not Applicable

7.0 RESULTS

7.1 ACB RESULTS

Table 7-1 summarizes the results of the ACB evaluation.

7-1: ARMORFLEX ACB EVALUATION RESULTS

Input	Value
Target Factor of Safety	1.40
Factor of Safety for Class 50 Block (6-inch)	1.34
Factor of Safety for Class 70 Block (8.5-inch)	1.85

7.2 EROSION CONTROL MAT FINDINGS

From review of the manufacturer's data (***Propex, 2015***), the PyraMat system on its own is capable handling velocities up to 25 ft/sec and shear stress of 16 lb/ft^2, when in a fully vegetated state and there is good bonding with the substrate. When combined with the Type B1 percussion driven earth anchors to form the ArmorMax system, there are structural application benefits. Anchors are embedded up to 5 feet, and provide surficial slope stabilization. They do not provide any improvement to the maximum velocity.

PyraMat has a design life of up to 50 years. The ArmorMax system has a design life of up to 50 years or greater. These erosion control mats are intended for application on soil substrates and are not suited for installation on rocky surfaces.

8.0 CONCLUSION/SUMMARY

The results in ***Table 7-1*** show the Class 70 block meets and exceeds the target factor of safety of 1.40. The Class 50 block does not meet the target factor of safety under the design conditions. According to manufacturer's data for PyraMat and ArmorMax systems, the channel surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that Armormax comes in direct, intimate

contact with the channel surface. Based on manufacturer's data, the PyraMat and ArmorMax systems provide sufficient performance against design velocities, but they are not suited for the irregular or rocky conditions of the Congaree River.

Therefore, the initial conceptual design should be performed using the Class 70, open-cell ArmorFlex ACB mats. Erosion control mats, such as PyraMat or ArmorMax, may still be suited for the river bank, above the waterline, where sufficient soil may exist for proper anchoring and bonding.

9.0 REFERENCES

1. ***FHWA, 2009***: FHWA, "Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition," Hydraulic Engineering Circular No. 23, Publication No. FHWA-NHI-09-112 Volume 2, National Highway Institute, U.S. Department of Transportation, Federal Highway Administration, September 2009.
2. ***RIZZO, 2014***: RIZZO, "Congaree Backwater Analysis," Calculation No. 114708-F2, Rev. 1, Paul C. Rizzo Associates, 4/15/2014.
3. ***RIZZO, 2015***: RIZZO, "Cofferdam Berm Height Evaluation," Letter No. 35 to William Zeli, Apex Companies, Rizzo Associates, 7/1/2015.
4. ***Armortec, 2002***: Armortec, "ArmorFlex Design Manual, Abridged Version 2002, Design Manual for ArmorFlex Articulating Concrete Blocks," Armortec Erosion Control Solutions, 2002.
5. ***Propex, 2015***: Propex, "Product Data, Armormax for Erosion Control," Propex Operating Company, LLC, 2015.
6. ***Contech, 2012a***: Contech, "Armortec Product Details," Contech Engineered Solutions LLC, 2012.
7. ***Contech, 2012b***: Contech, "Erosion Control Product Selection Guide," Contech Engineered Solutions LLC, 2012.

APPENDIX A

ARMORFLEX ACB EVALUATION EXCEL WORKSHEETS

Inputs and Known Design Conditions		
Channel discharge, Q (cfs)	148000	*Not used, for information only*
Cross section average velocity, V_{ave} (ft/s)	8.7	*Not used, for information only*
Maximum velocity, V_{des} (ft/s)	18.0	
Maximum depth, y (ft)	26.4	
Side slope, H:V	3.8	
deg	14.74	
Bed slope, S_o (ft/ft)	0.05	*assumed channel slope for area of evaluation*
deg	2.86	
Slope of energy grade line, S_f (ft/ft)	0.0007624	
[average] Channel top width, T (ft)	1062.58	
Radius of curvature, R_c (ft)	N/A	*Section of reach is fairly straight*
density of concrete, γ_c (pcf)	140	*Not used, for information only*
mass density of water, ρ (slug/ft^3)	1.94	
density of water, γ_w (pcf)	62.4	

1. Target Factor of Safety		
Base Factor of Safety, SF_B	1.4	*assumed based on high velocities (figure 8.2, **FHWA, 2009**)*
multiplier based on consequence of failure, X_C	1	*assumed based on low risk from failure (figure 8.2, **FHWA, 2009**)*
multiplier based on model uncertainty, X_M	1	*assumed based on model geometry (figure 8.2, **FHWA, 2009**)*
$SF_T = (SF_B)(X_C)(X_M)$	1.4	

2. Calculate Design Shear Stress		
R_c/T	>>10	*Section of reach is fairly straight, therefore radius is assumed to greatly exceed the top width of the channel*
for $R_c/T \geq 10$ $K_b = 1.05$	1.05	
$\tau_{des} = K_b(\gamma)(y)(S_f)$ (psf)	1.32	

3. Obtain ACB Properties		
ArmorFlex Open Cell Block	**Class 50**	**Class 70**
length, l (in)	17.4	17.4
width, w (in)	15.5	15.5
height, h (in)	6.0	8.5
submerged weight, W(lb)	47.8	75.3
[1/2 block height] moment arm, ℓ_1 (in)	3.0	4.3
[distance center to corner] moment arm, ℓ_2 (in)	11.7	11.7
[8/10 block height] moment arm, ℓ_3 (in)	4.8	6.8
[distance center to corner] moment arm, ℓ_4 (in)	11.7	11.7
Critical shear stress for block on horiz surface, τ_c (psf)	26.6	35.5

4. Calculate Drag and Lift force due to protrusion, F_L' and F_D'		
height of block protusion above ACB mat, Δz (in)	0.5	0.5
block width normal to flow, b (in)	23.3	23.3
$F_L' = F_D' = 0.5\rho b(\Delta z)(V_{des})^2$ (lb)	25.43	25.43

5. Calculate Stability Number for Block on a Horizontal Surface, η_0		
$\eta_0 = \frac{\tau_{des}}{\tau_C}$	0.049520528	0.0371055

6. Calculate Angle between Side Slope projection of Submerged Block Weight and the Vertical, θ		
$\theta = \arctan\left(\frac{\tan\theta_0}{\tan\theta_1}\right)$	10.76	10.76

7. Calculate projection of Submerged Block Weight, a_θ		
$a_\theta = \sqrt{(\cos\theta_1)^2 - (\sin\theta_0)^2}$	0.97	0.97

8. Calculate Angle between Block Motion and the Vertical, β		
$\beta = \arctan\left(\frac{\cos(\theta_0+\theta)}{\left(\frac{\ell_4}{\ell_3}+1\right)\left(\frac{\sqrt{1-a_\theta{}^2}}{\eta_0(\ell_2/\ell_1)}\right)+\sin(\theta_0+\theta)}\right)$	11.31	7.74

9. Calculate Angle between Drag Force and Block Motion, δ		
$\delta = 90^o - \beta - \theta$	67.93	71.51

10. Calculate Stability number for a Block on a Sloped Surface, η_1		
$\eta_1 = \eta_0\left(\frac{(\ell_4/\ell_3)+\sin(\theta_0+\theta+\beta)}{(\ell_4/\ell_3)+1}\right)$	0.04	0.03

11. Calculate the Submerged Weight of each Block, W_S			
$W_s = W\left(\frac{\gamma_c - \gamma_w}{\gamma_c}\right)$	47.80	75.30	*previously provided by* ***Armortec, 2002***

12. Calculate the Factor of Safety for each Block		
$SF = \frac{(\ell_2/\ell_1)a_\theta}{\cos\beta\sqrt{1-a_\theta^2}+\eta_1(\ell_2/\ell_1)+\frac{(\ell_3 F_D'\cos\delta+\ell_4 F_L')}{\ell_1 W_S}}$		
SF=	**1.34**	**1.85**

APPENDIX B

REFERENCES

FHWA, 2009

ASTM Standard D-6684 also specifies minimum strength properties of geotextiles according to the severity of the conditions during installation. Harsh installation conditions (vehicular traffic, repeated lifting, realignment, and replacement of mattress sections, etc.) require stronger geotextiles.

8.3 APPLICATION 1: HYDRAULIC DESIGN PROCEDURE FOR ACB SYSTEMS FOR BANK REVETMENT OR BED ARMOR

8.3.1 Hydraulic Stability Design Procedure

The hydraulic stability of ACB systems is analyzed using a "discrete particle" approach. The design approach is similar to that introduced by Stevens and Simons (1971) as modified by Julien (1995) in the derivation of the "Factor of Safety" method for sizing rock riprap. In that method, a calculated factor of safety of 1.0 or greater indicates that the particles will be stable under the given hydraulic conditions and site geometry (e.g., side slope and bed slope). For ACBs, the Factor of Safety force balance has been recomputed considering the weight and geometry of the blocks, and the Shields relationship for estimating the particle's critical shear stress is replaced with actual test results (Clopper 1992).

Considerations are also incorporated into the design procedure to account for the additional forces generated on a block that protrudes above the surrounding matrix due to subgrade irregularities or imprecise placement. The analysis methodology purposely omits any restraining forces due to cables, because any possible benefit that cables might provide are reflected in the performance testing of the block. Cables may prevent blocks from being lost entirely, but they do not prevent a block system from failing through loss of intimate contact with the subgrade. Similarly, the additional stability afforded by vegetative root anchorage or mechanical anchoring devices, while recognized as potentially significant, is ignored in the stability analysis procedure for the sake of conservatism in block selection and design.

A drainage layer may be used in conjunction with an ACB system. A drainage layer lies between the blocks and the geotextile and/or granular filter. This layer allows "free" flow of water beneath the block system while still holding the filter material to the subsoil surface under the force of the block weight. This free flow of water can relieve sub-block pressure and has appeared to significantly increase the hydraulic stability of ACB systems based on full-scale performance testing conducted since the mid 1990s.

Drainage layers can be comprised of coarse, uniformly sized granular material, or can be synthetic mats that are specifically manufactured to permit flow within the plane of the mat. Granular drainage layers are typically comprised of 1- to 2-inch crushed rock in a layer 4 inches or more in thickness. The uniformity of the rock provides significant void space for flow of water. Synthetic drainage nets typically range in thickness from 0.25 to 0.75 inches and are manufactured using stiff nylon fibers or high density polyethylene (HDPE) material. The stiffness of the fibers supports the weight of the blocks, thus providing large hydraulic conductivity within the plane of the drainage net.

Many full-scale laboratory performance tests have been conducted with a drainage layer in place. When evaluating a block system, for which performance testing was conducted with a drainage layer, a drainage layer must also be used in the design. This recommendation is based on the improvement in the hydraulic stability of systems that have incorporated a drainage layer in the performance testing.

8.3.2 Selecting a Target Factor of Safety

The designer must determine what factor of safety should be used for a particular application. Typically, a minimum allowable factor of safety of 1.2 is used for revetment (bank protection) when the project hydraulic conditions are well known and the installation can be conducted under well-controlled conditions. Higher factors of safety are typically used for protection at bridge piers, abutments, and at channel bends due to the complexity in computing hydraulic conditions at these locations.

The Harris County Flood Control District, Texas (HCFCD 2001) has developed a simple flowchart approach that considers the type of application, uncertainty in the hydraulic and hydrologic models used to calculate design conditions, and consequences of failure to select an appropriate target factor of safety to use when designing an ACB installation. In this approach, the minimum allowable factor of safety is recommended based on the type of application (e.g., bank protection, bridge scour protection, dam overtopping, etc). This base value is then multiplied by two factors, each greater than 1.0, to account for risk and uncertainty. Figure 8.2 shows the Harris County flow chart method for determining the target factor of safety.

8.3.3 Design Method

Factor of Safety Method: The stability of a single block is a function of the applied hydraulic conditions (velocity and shear stress), the angle of the inclined surface on which it rests, and the weight and geometry of the block. Considering flow along a channel bank as shown in Figure 8.3, the forces acting on a concrete block are the lift force F_L, the drag force F_D, and the components of the submerged weight of the block, W_S, both into and along the plane of the slope. Block stability is determined by evaluating the moments about the point O about which rotation can take place. The components of these forces are shown in Figure 8.3.

The safety factor (SF) for a single block in an ACB matrix is defined as the ratio of restraining moments to overturning moments:

$$SF = \frac{\ell_2 W_S a_\theta}{\ell_1 W_S \sqrt{1-a_\theta^2}\cos\beta + \ell_3 F_D \cos\delta + \ell_4 F_L + \ell_3 F_D' \cos\delta + \ell_4 F_L'} \quad (8.1)$$

Note that additional lift and drag forces F'_L and F'_D are included to account for protruding blocks that incur larger forces due to impact. The design implications regarding a protruding block are discussed in detail later in this section.

The moment arms ℓ_1, ℓ_2, ℓ_3, and ℓ_4 are determined from the block dimensions shown in Figure 8.4. In the general case, the pivot point of overturning will be at the downstream corner of the block; therefore, the distance from the center of the block to the corner should be used for both ℓ_2 and ℓ_4. Since the weight vector acts through the center of gravity, one half the block height should be used for ℓ_1. The drag force acts both on the top surface of the block (shear drag) and on the body of the block (form drag). Considering both elements of drag, eight-tenths the height of the block is considered a reasonable estimate of ℓ_3.

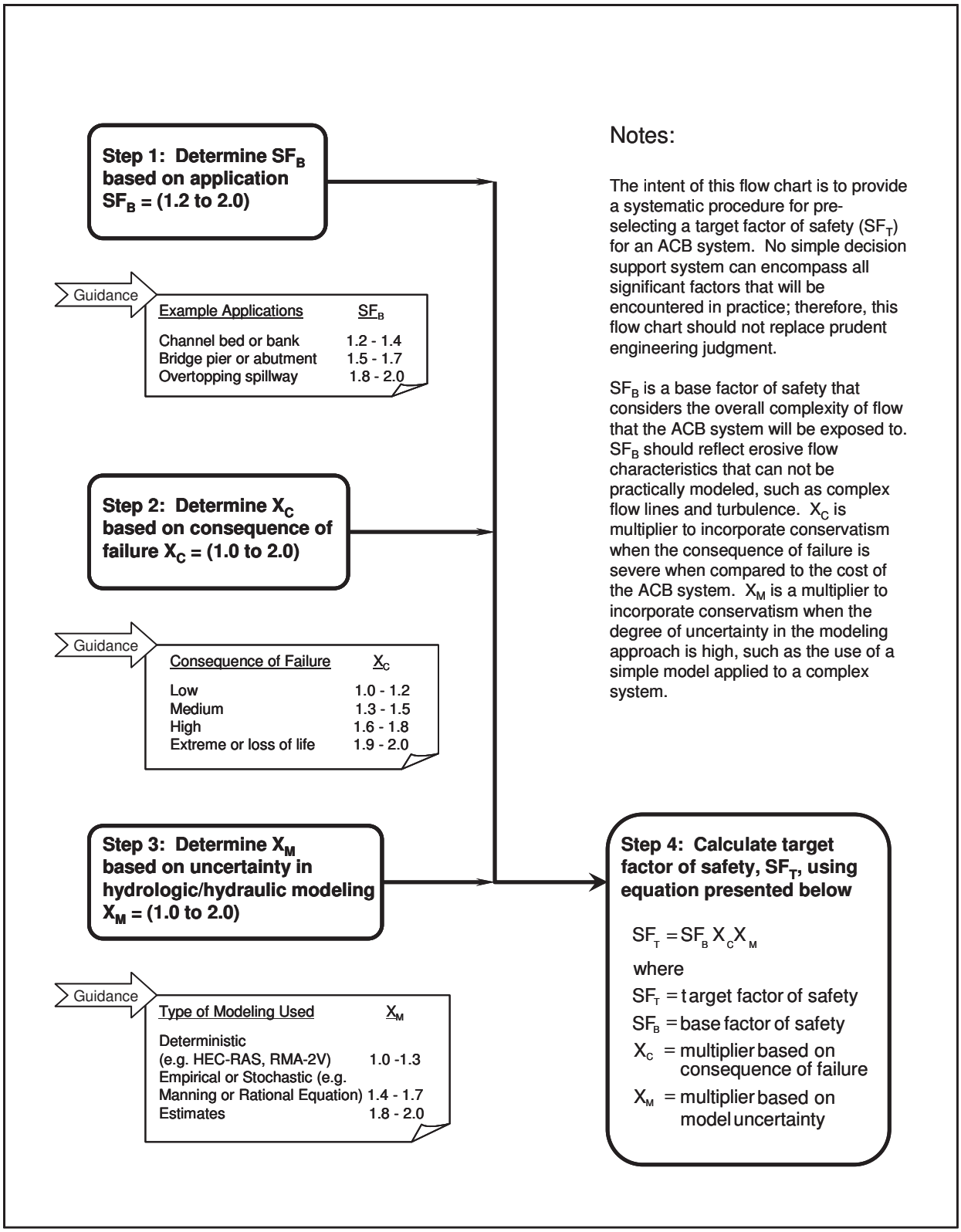

Figure 8.2. Selecting a target factor of safety (HCFCD 2001).

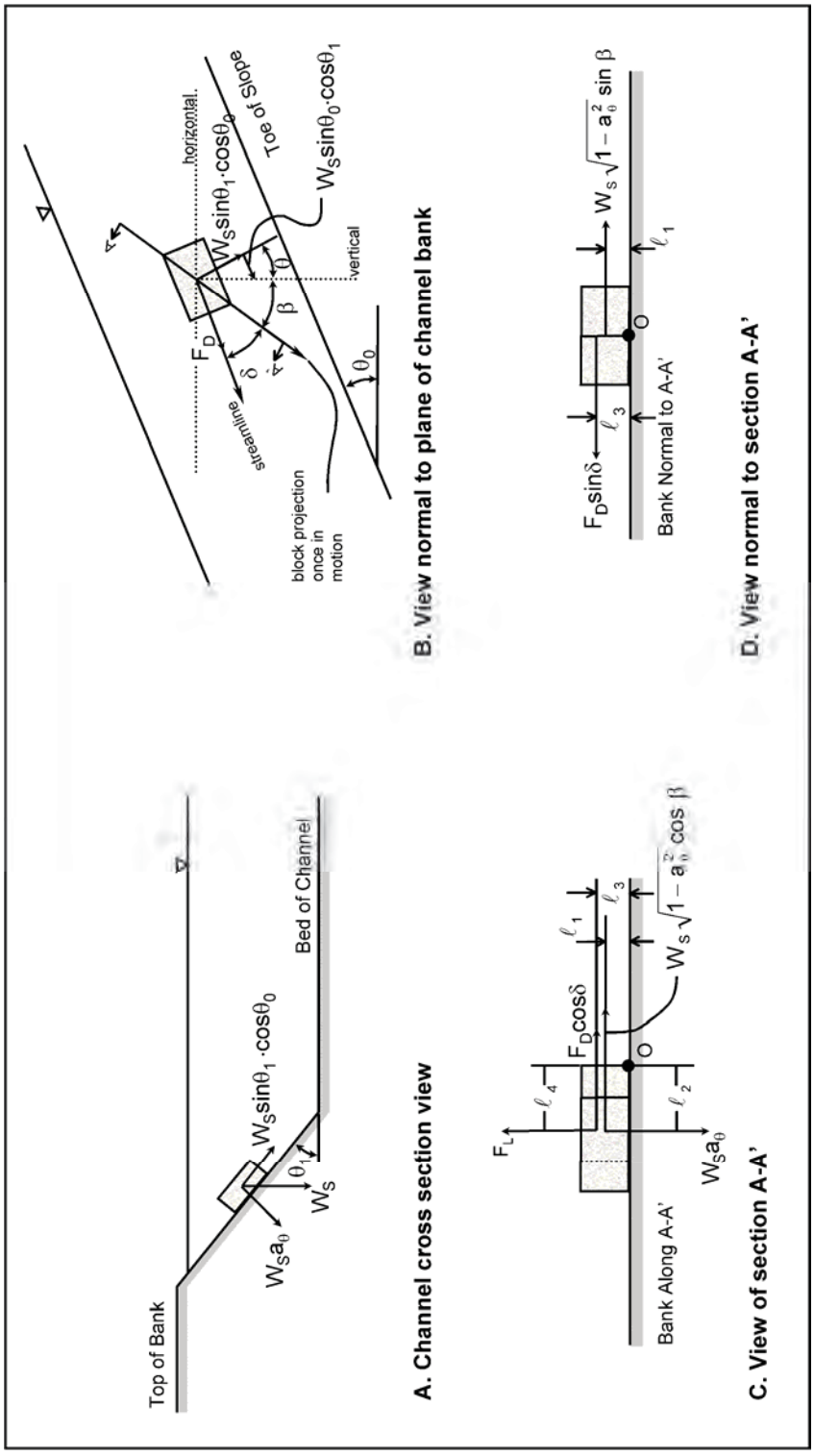

Figure 8.3. Single block on a channel side slope with factor of safety variables defined.

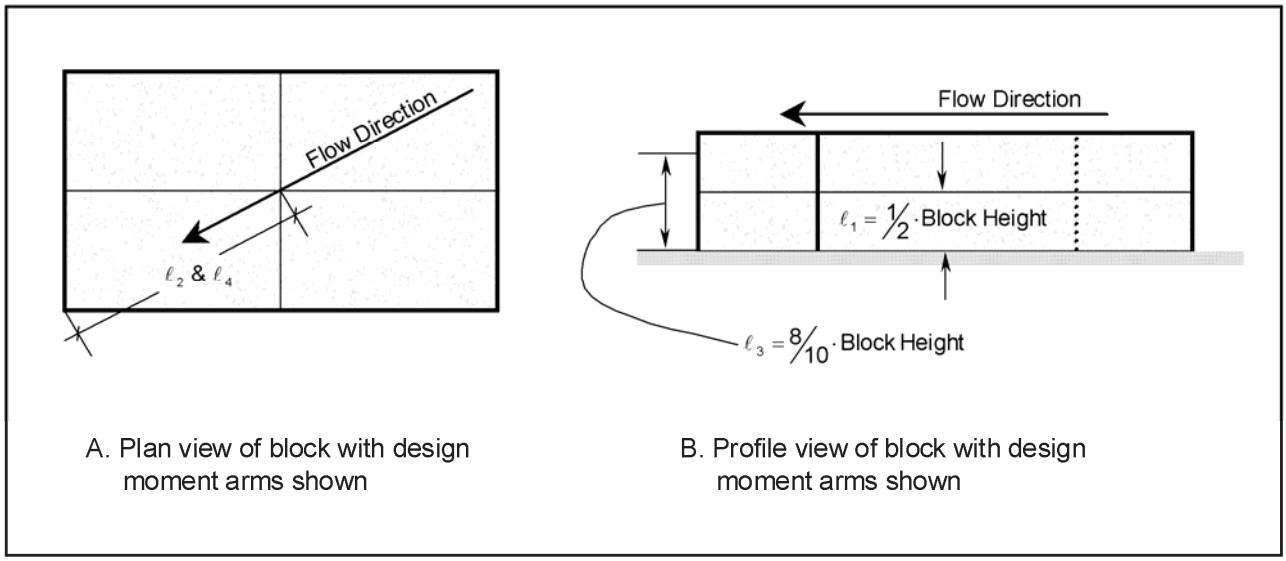

Figure 8.4. Schematic diagram of a block showing moment arms ℓ_1, ℓ_2, ℓ_3, and ℓ_4.

The shear stress on the block is calculated as follows:

$$\tau_{des} = K_b \gamma y S_f \tag{8.2}$$

where:

τ_{des}	=	Design shear stress, lb/ft^2
K_b	=	Bend coefficient (dimensionless)
γ	=	Unit weight of water, lb/ft^3
y	=	Maximum depth of flow on revetment, ft
S_f	=	Slope of the energy grade line, ft/ft

The bend coefficient K_b is used to calculate the increased shear stress on the outside of a bend. This coefficient ranges from 1.05 to 2.0, depending on the severity of the bend. The bend coefficient is a function of the radius of curvature R_c divided by the top width of the channel T, as follows:

$$K_b = 2.0 \qquad \text{for } 2 \geq R_c/T$$

$$K_b = 2.38 - 0.206\left(\frac{R_c}{T}\right) + 0.0073\left(\frac{R_c}{T}\right)^2 \qquad \text{for } 10 > R_c/T > 2 \tag{8.3}$$

$$K_b = 1.05 \qquad \text{for } R_c/T \geq 10$$

Protruding Blocks: While some manufacturers developed design charts to aid in the design of ACB systems, those charts generally are based on the assumption of a "perfect" installation (i.e., no individual blocks protrude into the flow). In reality, some placement tolerance must be anticipated and the factor of safety equation modified to account for protruding blocks, illustrated in Figure 8.5. Because poor installation, or differential settlement over time, can cause blocks to exceed the design placement tolerance, the actual factor of safety can be greatly reduced and may lead to failure. Therefore, subgrade preparation and construction inspection become critical to successful performance of ACB systems. Blocks must not be placed directly on an irregular surface such as cobbles or rubble. A suitably smooth subgrade can often be achieved by removing the largest blocky materials and placing imported sand or road base material prior to placing the geotextile.

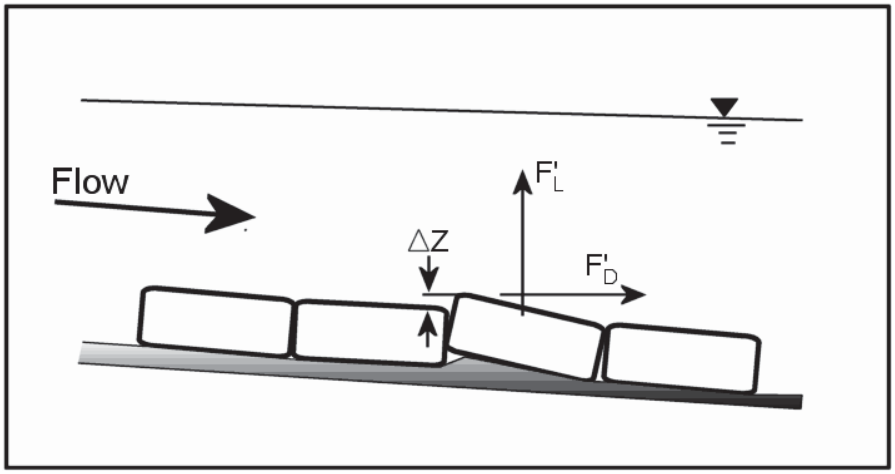

Figure 8.5. Sketch showing additional lift and drag forces on a protruding block.

The additional drag force on the block created by the protrusion is calculated as follows:

$$F_D' = \frac{1}{2} C \left[(\Delta z) b \rho \left(V_{des}^{\ 2} \right) \right] \qquad (8.4)$$

where:

F'_D	=	Drag force due to protrusion, lb
C	=	Drag coefficient assumed equal to 1.0
Δz	=	Protrusion height, ft
b	=	Projected block width, ft *(Note: This width is typically taken as 2 times the moment arm L_2; see Figure 8.4)*
ρ	=	Mass density of water, slugs/ft^3
V_{des}	=	Design velocity, ft/s

For typical revetment applications, the design velocity V_{des} is taken as the cross sectional average velocity. If a detailed hydraulic analysis has been performed, a more representative local velocity can be used for V_{des}.

Lastly, the additional lift force due to the protrusion F'_L is assumed equal to the drag force F'_D. Both of these forces create additional destabilizing moments associated with a protruding block.

Dividing Equation 8.1 by $\ell_1 W_S$ and substituting terms yields the final form of the factor of safety equations as summarized in Table 8.1. The equations can be used with any consistent set of units; however, variables are indicated here in U.S. customary (English) units.

8.3.4 Layout Details for ACB Bank Revetment and Bed Armor

Longitudinal Extent: The revetment armor should be continuous for a distance which extends both upstream and downstream of the region which experiences hydraulic forces severe enough to cause dislodging and/or transport of bed or bank material. The minimum distances recommended are an upstream distance of 1.0 channel width and a downstream distance of 1.5 channel widths. The channel reach which experiences severe hydraulic forces is usually identified by site inspection, examination of aerial photography, hydraulic modeling, or a combination of these methods.

Many site-specific factors have an influence on the actual length of channel that should be protected. Factors that control local channel width (such as bridge abutments) may produce local areas of relatively high velocity and shear stress due to channel constriction, but may also create areas of ineffective flow further upstream and downstream in "shadow zone" areas of slack water. In straight reaches, field reconnaissance may reveal erosion scars on the channel banks that will assist in determining the protection length required.

In meandering reaches, since the natural progression of bank erosion is in the downstream direction, the present limit of erosion may not necessarily define the ultimate downstream limit. FHWA's Hydraulic Engineering Circular No. 20, "Stream Stability at Highway Structures" (Lagasse et al. 2001) provides guidance for the assessment of lateral migration. The design engineer is encouraged to review this reference for proper implementation.

Vertical Extent. The vertical extent of the revetment should provide freeboard above the design water surface. A minimum freeboard of 1 to 2 ft should be used for unconstricted reaches and 2 to 3 ft for constricted reaches. If the flow is supercritical, the freeboard should be based on height above the energy grade line rather than the water surface. **The revetment system should either cover the entire channel bottom or, in the case of unlined channel beds, extend below the bed far enough so that the revetment is not undermined by the maximum scour which for this application is considered to be toe scour, contraction scour, and long-term degradation (Figure 8.7)**.

Recommended revetment termination at the top and toe of the bank slope are provided in Figures 8.6 and 8.7 for armored-bed and soft-bottom channel applications, respectively. Similar termination trenches are recommended for the upstream and downstream limits of the ACB revetment.

Table 8.1. Factor of Safety Design Equations for ACB Systems.

$F_L' = F_D' = 0.5\rho b(\Delta z)(V_{des})^2$	(8.5)	a_θ = Projection of W_S into plane of subgrade b = Block width normal to flow (ft) F'_D, F'_L = added drag and lift forces due to protruding block (lb) ℓ_x = Block moment arms (ft) γ_c = Concrete density, lb/ft^3 γ_w = Density of water, lb/ft^3 V_{des} = Design velocity (ft/s) W = Weight of block in air (lb) W_S = Submerged block weight (lb) Δz = Height of block protrusion above ACB matrix (ft) β = Angle between block motion and the vertical δ = Angle between drag force and block motion η_0 = Stability number for a block on a horizontal surface η_1 = Stability number for a block on a sloped surface θ = Angle between side slope projection of W_S and the vertical θ_0 = Channel bed slope (degrees) θ_1 = Side slope of block installation (degrees) ρ = Mass density of water (slugs/ft^3) τ_c = Critical shear stress for block on a horizontal surface (lb/ft^2) τ_{des} = Design shear stress (lb/ft^2) SF = Calculated factor of safety
$\eta_0 = \frac{\tau_{des}}{\tau_C}$	(8.6)	
$\theta = \arctan\left(\frac{\tan\theta_0}{\tan\theta_1}\right)$	(8.7)	
$a_\theta = \sqrt{(\cos\theta_1)^2 - (\sin\theta_0)^2}$	(8.8)	
$\beta = \arctan\left(\frac{\cos(\theta_0+\theta)}{\left(\frac{\ell_4}{\ell_3}+1\right)\left(\frac{\sqrt{1-a_\theta{}^2}}{\eta_0(\ell_2/\ell_1)}\right)+\sin(\theta_0+\theta)}\right)$	(8.9)	
$\delta = 90^o - \beta - \theta$	(8.10)	
$\eta_1 = \eta_0\left(\frac{(\ell_4/\ell_3)+\sin(\theta_0+\theta+\beta)}{(\ell_4/\ell_3)+1}\right)$	(8.11)	
$W_s = W\left(\frac{\gamma_c-\gamma_w}{\gamma_c}\right)$	(8.12)	
$SF = \frac{(\ell_2/\ell_1)a_\theta}{\cos\beta\sqrt{(1-a_\theta)^2}+\eta_1(\ell_2/\ell_1)+\frac{(\ell_3 F'_D\cos\delta+\ell_4 F'_L)}{\ell_1 W_s}}$	(8.13)	

Note: The equations cannot be solved for $\theta_1 = 0$ (i.e., division by 0 in Equation 8.7); therefore, a very small but non-zero side slope must be entered for the case of $\theta_1 = 0$.

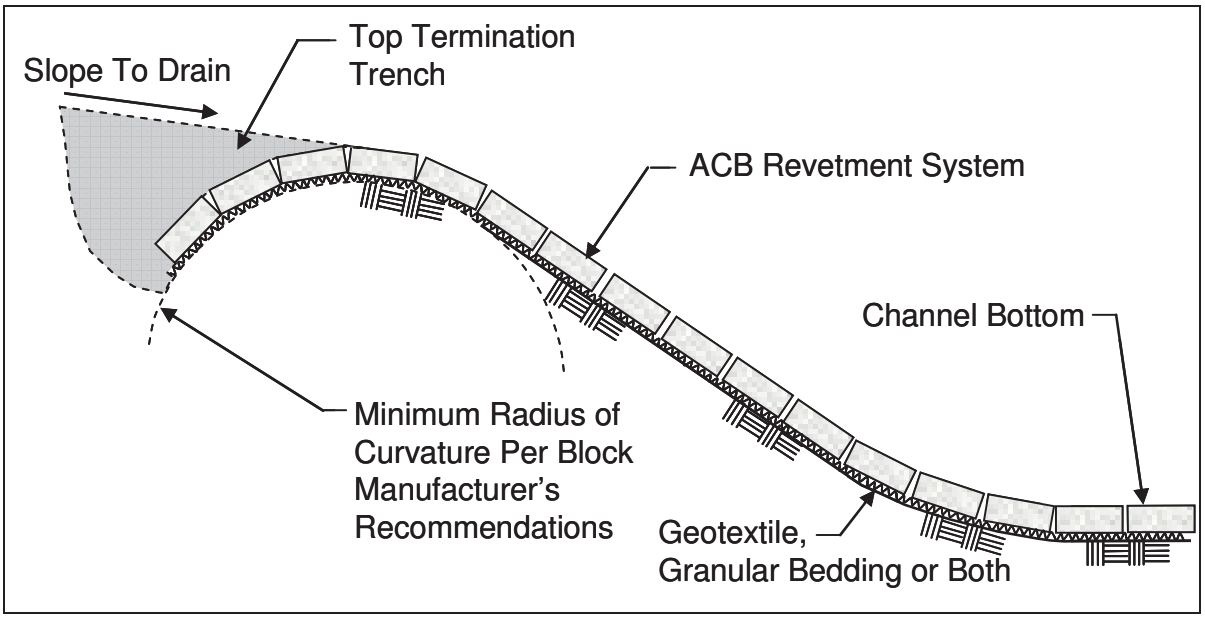

Figure 8.6. Recommended layout detail for bank and bed armor.

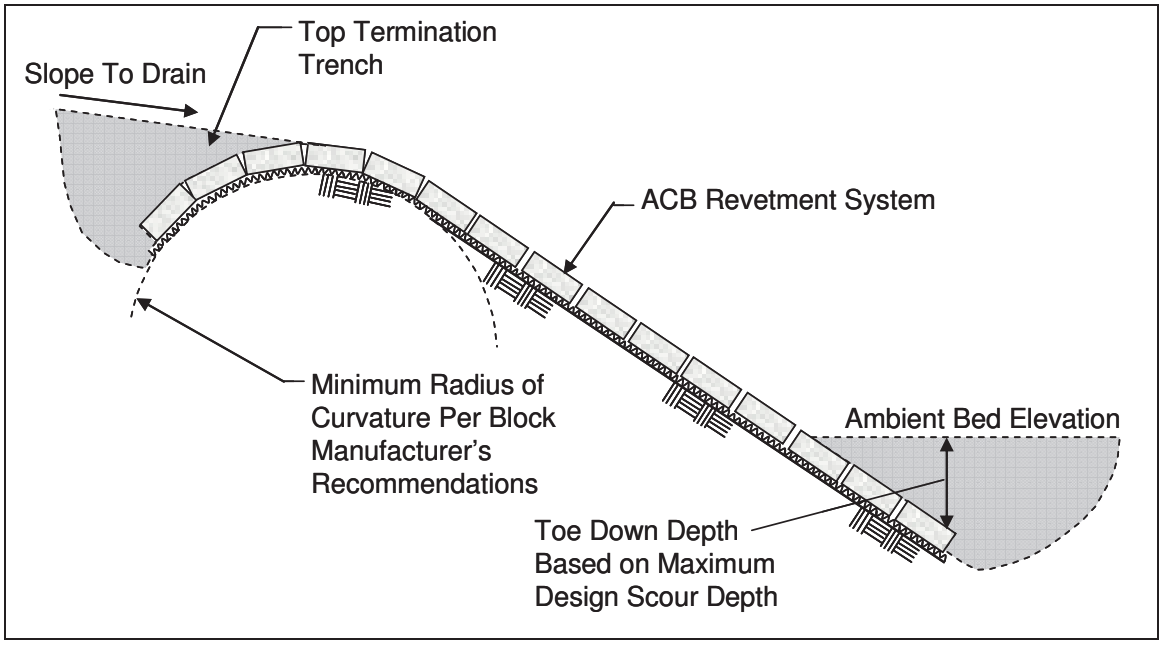

Figure 8.7. Recommended layout detail for bank revetment where no bed armor is required.

8.3.5 Filter Requirements

The importance of the filter component of an articulating concrete block installation should not be underestimated. Geotextile filters are most commonly used with ACBs, although coarse granular filters may be used where native soils are coarse and the particle size of the filter is large enough to prevent winnowing through the cells and joints of the ACB system. When using a granular stone filter, the layer should have a minimum thickness of 4 times the d_{50} of the filter stone or 6 inches, whichever is greater. The d_{50} size of the granular filter should be greater than one half the smallest dimension of the open cells of the system. When placing a granular filter under water, its thickness should be increased by 50%.

The filter must retain the coarser particles of the subgrade while remaining permeable enough to allow infiltration and exfiltration to occur freely. It is not necessary to retain all the particle sizes in the subgrade; in fact, it is beneficial to allow the smaller particles to pass through the filter, leaving a coarser substrate behind. Detailed aspects of filter design are presented in Design Guide 16 of this document.

Some situations call for a composite filter consisting of both a granular layer and a geotextile. The specific characteristics of the base soil determine the need for, and design considerations of the filter layer. ***In cases where dune-type bedforms may be present at the toe of a bank slope protected with an ACB system, it is strongly recommended that only a geotextile filter be considered.***

8.3.6 ACB Design Example

The following example illustrates the ACB design procedure using the Factor of Safety equations presented in Table 8.1. The example is presented in a series of steps that can be followed by the designer in order to select the appropriate ACB system based on a pre-selected target factor of safety. The primary criterion for product selection is if the computed factor of safety for the ACB system meets or exceeds the pre-selected target value. The example assumes that hydraulic testing has been performed to quantify a critical shear stress for that particular system. This problem is presented in English units only because ACB systems in the U.S. are manufactured and specified in units of inches and pounds.

Problem Statement:

Meandering River has a history of channel instability, both vertically and laterally. A quantitative assessment of channel stability has been conducted using the multi-level analysis from Hydraulic Engineering Circular No. 20, "Stream Stability at Highway Structures" (Lagasse et al. 2001). A drop structure has been designed at the downstream end of a bendway reach to control bed elevation changes. However, there is concern that lateral channel migration will threaten the integrity of the drop structure. An ACB system is proposed to arrest lateral migration. Figure 8.8 presents a definition sketch for this example problem.

The design procedure assumes that appropriate assessment of hydraulic and geomorphic conditions has been made prior to the design process. The US Army Corps of Engineers' HEC-RAS model has been used to determine the design hydraulic conditions for the project reach. A velocity distribution across the cross section was calculated at River Mile 23.4 using HEC-RAS. Figure 8.9 presents the velocity distribution as determined using 9 flow subsections across the main channel. The velocity distribution indicates that the maximum velocity expected at the outside of the bend is 11.0 ft/s, which will be used as the design value in the factor of safety calculations. The corresponding depth at this location, which is the channel thalweg depth at the toe of the bank slope, is 8.4 feet.

ARMORTECH, 2002

Table 2.3. Factor of Safety Equation Variables.					
Block Class	Submerged Weight (Lbs)	ℓ_1 (ft)	ℓ_2 & ℓ_4 (ft)	ℓ_3 (ft)	τ_c @ 0 degrees (psf)
30-S	19.80	0.198	0.726	0.317	14.40
50-S	28.60	0.250	0.726	0.400	19.00
45-S	24.50	0.198	0.726	0.317	17.90
55-S	33.30	0.250	0.726	0.400	22.10
40	37.30	0.198	0.971	0.317	22.40
50	47.80	0.250	0.971	0.400	26.60
60	60.60	0.313	0.971	0.500	31.00
70	75.30	0.375	0.971	0.600	35.50
45	45.50	0.198	0.971	0.317	27.30
55	58.30	0.250	0.971	0.400	32.80
75	74.60	0.313	0.971	0.500	38.20
85	91.00	0.375	0.971	0.600	43.00
40-L	46.80	0.198	1.222	0.317	25.80
50-L	60.30	0.250	1.222	0.400	30.50
60-L	74.90	0.313	1.222	0.500	35.60
70-L	90.00	0.375	1.222	0.600	40.80
45-L	56.20	0.198	1.222	0.317	31.00
55-L	72.30	0.250	1.222	0.400	37.20
75-L	90.00	0.313	1.222	0.500	43.20
85-L	108.70	0.375	1.222	0.600	48.70
40-T	35.50	0.198	0.971	0.317	31.80
50-T	44.80	0.250	0.971	0.400	36.90
60-T	56.00	0.313	0.971	0.500	42.10
70-T	67.20	0.375	0.971	0.600	46.50

NOTE: Moment arms and critical shear stresses assume block orientation of the block with the long axis parallel to flow.

PROPEX, 2015

ARMORMAX®
BY PROPEX

Product Data

ARMORMAX® FOR EROSION CONTROL

The ARMORMAX® Anchor Reinforced Vegetation System (ARVS) for Erosion Control is an engineered solution used for permanent erosion protection in vegetated and unvegetated applications. It is composed of two components: PYRAMAT® High Performance Turf Reinforcement Mat (HPTRM) and Type B1 Percussion Driven Earth Anchors (PDEAs). ArmorMax is available in green or tan to provide for an aesthetically pleasing solution with proven performance. The PDEA component is specifically designed and tested for compatibility and performance with PYRAMAT® to provide a system solution. Propex offers several PDEA options to provide the ARMORMAX® system designed for specific challenges and needs. The expected design life of ARMORMAX® is 50 years because of its superior UV resistance, resistance to corrosion, strength, and durability in the most demanding environments.

The PYRAMAT® component of ARMORMAX® has been tested and conforms to the property values listed below[1] while manufactured at a Propex facility having achieved ISO 9001:2000 certification. Propex also performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

The Type B1 Anchor model is used for permanent erosion protection applications and has a working load of up to 800 lbs. The Type B1 Anchor consists a die cast aluminum anchor head, zinc-aluminum coated carbon steel cable, a die cast zinc load-locking mechanism with a ceramic roller, and two aluminum ferrules. The bullet nose design of the anchor head allows the anchor to penetrate PYRAMAT® resulting in minimal installation damage. The Type B1 Anchor is also designed with a recessed cavity so the top of the cable can be cut below the surface being protected.

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ARMORMAX®
BY PROPEX

Product Data

ARMORMAX® FOR EROSION CONTROL

PYRAMAT® PROPERTIES

PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
PHYSICAL			
Thickness [2]	ASTM D-6525	0.40 in	10.2 mm
Light Penetration (% Passing) [3]	ASTM D-6567	10%	10%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	4000 x 3000 lbs/ft	58.4 x 43.8 kN/m
Elongation [2]	ASTM D-6818	40 x 35 %	40 x 35 %
Resiliency [2]	ASTM D-6524	80%	80%
Flexibility [4]	ASTM D-6575	0.534 in-lb	616,154 mg-cm
ENDURANCE			
UV Resistance % Retained at 6,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 10,000 hrs [4]	ASTM D-4355	85%	85%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	25 ft/sec	7.6 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	16 lb/ft^2	766 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028
Seedling Emergence [4]	ASTM D-7322	296%	296%
ROLL SIZES		8.5 ft x 90 ft 15.0 ft x MR	2.6 m x 27.4 m 4.6 m x MR

TYPE B1 ANCHOR PROPERTIES

PHYSICAL		ENDURANCE/ COMPONENT MATERIALS	
Anchor Head Length	3.4 in	Anchor Head	Die cast aluminum
Anchor Head Width	1.0 in	Cable Tendon	Zinc-aluminum carbon steel
Anchor Head Bearing Area	2.5 in^2	Load Bearing Plate	Die cast zinc
Anchor Head Weight	0.1 lbs	Load-Lock Mechanism	Die cast zinc w/ceramic roller
PERFORMANCE		Crimped Ferrule	Aluminum
		MECHANICAL	
Load Range (Cohesive through Non Cohesive Soils)	Up to 500 lbs	Ultimate Strength	1,100 lbs
Embedment Depth	Up to 5 ft	Working Load	800 lbs

NOTES:
1. The property values listed above are effective 07/13/2015 and are subject to change without notice.
2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

Propex™ Geotextile Systems

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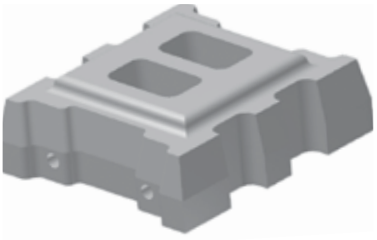
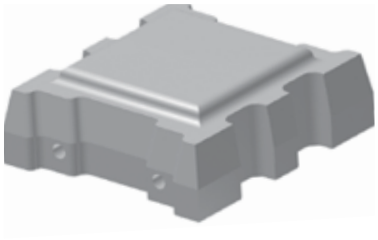
CONTECH, 2012a

CONTECH® ENGINEERED SOLUTIONS

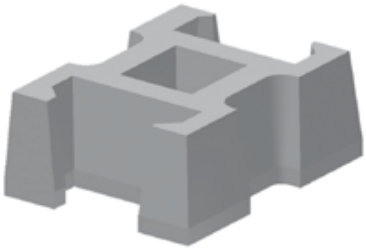
ARMORTEC® Product Details



ArmorFlex® - Open Cell



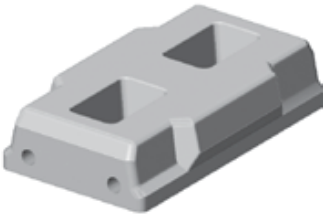
ArmorFlex® - Close Cell



ArmorLoc®

ArmorWedge®

A-Jacks®



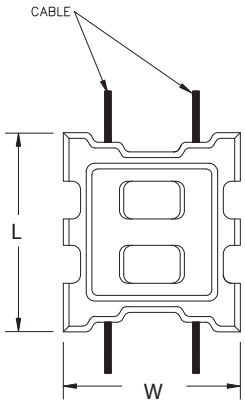
ArmorStone®

ArmorRoad®

MANUFACTURING SPECIFICATION
ASTM D6684-04

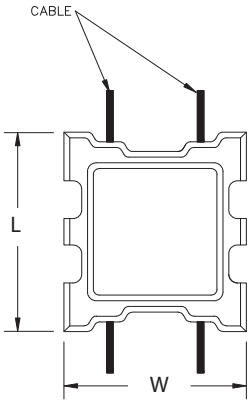
ARMORTEC Erosion Control Solutions

ArmorFlex® (not to scale)



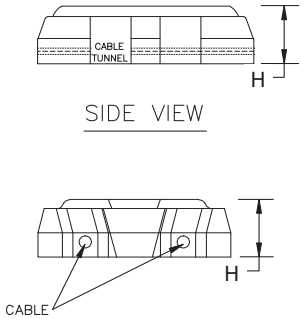
TOP VIEW

Open Cell Block

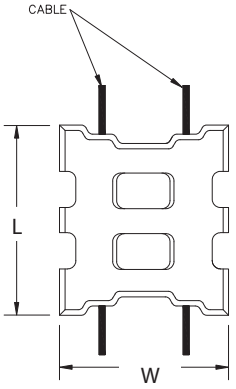


TOP VIEW

Close Cell Block

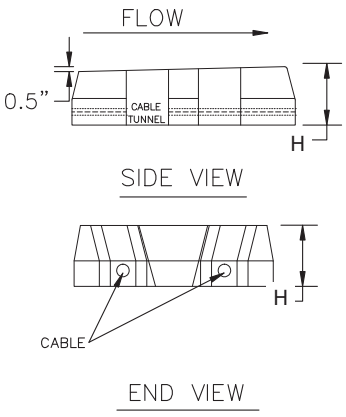


END VIEW



TOP VIEW

Tapered Series



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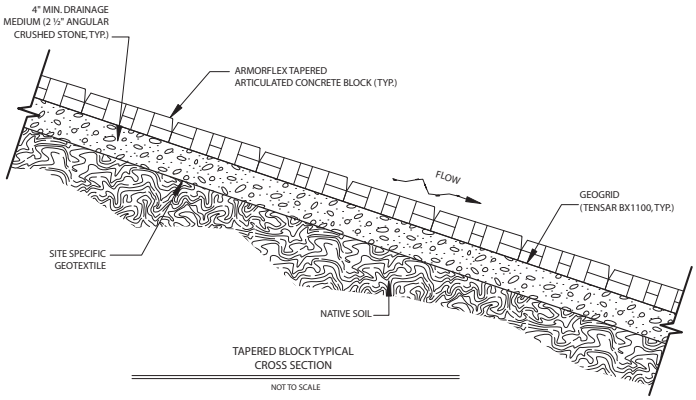
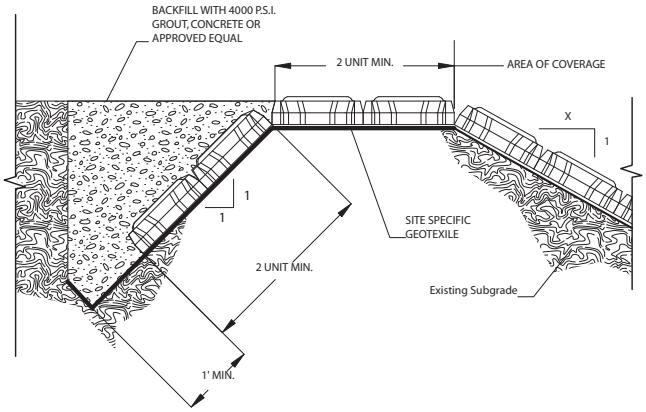


Tapered Series - Cross Section



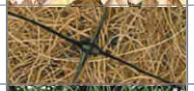
Top of Slope - Standard Detail

ArmorFlex Unit Specification

Concrete Block Class	Open/Closed Cell	Nominal Dimensions			Gross Area/ (sq. ft.)	Block Weight		Open Area %
		L	W	H		lbs	lbs/sq. ft.	
30s	Open	13.0	11.6	4.75	0.98	33-35	34-36	20
50s	Open	13.0	11.6	6.00	0.98	42-45	43-46	20
40	Open	17.4	15.5	4.75	1.77	59-64	33-36	20
50	Open	17.4	15.5	6.00	1.77	76-82	43-46	20
70	Open	17.4	15.5	8.50	1.77	108-117	61-66	20
40L	Open	17.4	23.6	4.75	2.58	97-105	38-41	20
70L	Open	17.4	23.6	8.50	2.58	174-188	68-73	20
45s	Closed	13.0	11.6	4.75	0.98	39-42	38-43	10
55s	Closed	13.0	11.6	6.00	0.98	50-54	49-55	10
45	Closed	17.4	15.5	4.75	1.77	71-77	40-43	10
55	Closed	17.4	15.5	6.00	1.77	91-98	52-56	10
85	Closed	17.4	15.5	8.50	1.77	136-146	77-83	10
45L	Closed	17.4	23.6	4.75	2.58	109-118	42-46	10
85L	Closed	17.4	23.6	8.50	2.58	207-223	80-87	10
High Velocity Application Block Classes								
40-T	Open	17.4	15.5	4.75	1.77	58-63	33-35	20
50-T	Open	17.4	15.5	6.00	1.77	75-81	43-46	20
70-T	Open	17.4	15.5	8.50	1.77	116-124	65-70	20

CONTECH® ENGINEERED SOLUTIONS

EROSION CONTROL PRODUCT SELECTION GUIDE [1]

	PRODUCT		Functional Longevity	Slopes			Channels		Bank/Shoreline Stabilization		Culvert Outlets	Installed Costs[2] ($/SY)
				≤1:1[3]	≤2:1	≤3:1	Typical Velocity (ft/s)	Typical Shear Stress (lb/ft²)	Wave Potential	No Wave Potential		
TEMPORARY BLANKETS	**Landlok** (S1)		12 months			✔	5-6	2.0				1.00 to 1.75
	Landlok (S2)		18 months			✔	5-6	1.5				1.25 to 1.75
	Landlok (CS2)		24 months		✔		5-6	2.0				1.75 to 2.25
	Landlok (C2)		36 months		✔ (≤1.5:1)		5-6	2.3				2.00 to 2.75
PERMANENT TURF REINFORCEMENT MATS	**Landlok 450**		Permanent	✔			8 to 18	2 to 10				6.00 to 8.00
	Landlok 300		Permanent	✔			6 to 20	2 to 12		✔	✔	10.00 to 15.00
	Pyramat		Permanent (up to 50 years)	✔			6 to 25	2 to 15		✔	✔	15.00 to 20.00
	ArmorMax Anchored Reinforced System		Permanent (up to 50 years)	✔			6 to 25	2 to 18		✔	✔	20.00 to 25.00
HARD ARMOR	**Armorflex** ACB Revetment System		Permanent	✔			4″ - 11 - 15 6″ - 13 - 29 9″ - 17 - 37	4″ - 14 - 31 6″ - 19 - 37 9″ - 22 - 48	✔		✔	82.50 to 112.50 90.00 to 127.50 97.50 to 135.00
	Armorloc Hand Placed ACB Revetment System		Permanent	✔			4″ - 10 6″ - 12	4″ - 8 6″ - 11	✔		✔	52.50 to 82.50 75.00 to 97.50
	A-Jacks		Permanent	✔			24″ - 22.0 48″ - 31.1 72″ - 38.1 96″ - 44.0	24″ - 38 48″ - 76 72″ - 114 96″ - 152	✔		✔	30 to 45/ea. 375 to 525/ea. 900 to 1350/ea. 1650 to 2250/ea.
	Gabions		Permanent	✔			16	20	✔		✔	Basket:: 100 to 125/cy. Mattress:: 30 to 60/cy.

NOTES: 1. The above design recommendations should only be used as a "quick" reference tool for general project situations. Final selection of an appropriate product should be done by an experienced engineer and should consider site-specific parameters such as climate, soil, geometry, vegetation selection, irrigation, and installation conditions.
2. Installed cost estimates range from large to small projects according to material quantity. The estimates include E.C. material, seed, labor and equipment.
3. For slopes steeper than 2H:1V, mechanical anchoring should be investigated

APPENDIX C

CAP MATERIALS SPECIFICATIONS

SHORETEC®

SHORETEC, LLC
510 O' Neal Lane
Baton Rouge, LA 70819

225-408-1444 (phone)
225-408-1445 (fax)
shoretec.com (web)

DISTRIBUTED BY:

SHORETEC®

SHOREBLOCK®
SD SERIES
Concrete Revetment Block

PROTECTING OUR NATURAL RESOURCES

SHOREBLOCK® SD blocks of different heights and weights can be assembled to provide a castellated cover layer for a higher coefficient of hydraulic friction or improved wave energy absorption and retention.

SHOREBLOCK® SD is a flexible, interlocking matrix of concrete blocks of uniform size, shape and weight connected by a series of cables which pass longitudinally through preformed ducts in each block. SHOREBLOCK® SD revetment systems combine the favorable aspects of lightweight blankets and meshes, such as porosity, flexibility, vegetation encouragement and habitat enhancement with non-erodible, self-weight and high tractive force resistance of a rigid lining.

SHOREBLOCK® SD has proven to be an aesthetic and functional alternative to rip-rap, poured in place concrete and other heavy-duty, erosion protection systems. SHOREBLOCK® SD is easy to install, therefore, can dramatically reduce overall project costs. More specifically, when compared to other systems, life-cycle costs have been reduced because SHOREBLOCK® SD is a permanent system and saves on subsequent maintenance expenses.

Research and Design

SHOREBLOCK® SD is the most durable, effective and environmentally-friendly erosion control revetment method of fighting severe erosion problems. SHOREBLOCK® SD mats are available in eight foot widths in lengths up to 40 feet. Mats can be joined to achieve greater lengths. Different sizes of SHOREBLOCK® SD are available depending on the severity of the application. In most markets, Articulated Concrete Blocks (ACBs) are competitive in cost to 12" diameter (or greater) rock (or rip-rap) placed in an 18" or greater blanket thickness, are competitive with gabion mattresses and ACBs are typically more economical than poured in place concrete.

ACBs were successfully tested by the U.S. Bureau of Reclamation and U.S. Federal Highway Administration (FHWA-RD-89-199). The Corps of Engineers has used ACBs on numerous designs for both channel and shoreline stability. Comprehensive wave tank testing was evaluated in 1983 at Oregon State University. ACB installations have been performing successfully since 1980.

SHOREBLOCK® SD DESIGN ADVANTAGES

- Each block has an open area of up to 20% to allow for superior hydrostatic pressure relief and ecologically pleasing vegetative cover.
- Interlocking cabling allow greater flexibility through the axes of articulation — conforms better to ground contours and settlement.
- Prefabricated mats offer quick installation, even underwater.
- Tests have shown that the force needed to remove a block from a revegetated cover layer may be equal to 20 times the weight of the block.

SHOREBLOCK® SD has been successfully tested by Colorado State University, in accordance with the hydraulic performance testing protocol established by the U.S. Federal Highway Administration. (FHWA-RD-89-199).

MIN. DENSITY (IN AIR) (Lbs./Ft.³)		MIN. COMPRESSIVE STRENGTH (PSI)		MAX. WATER ABSORPTION (Lbs./Ft.³)	
AVE. OF 3 UNITS	INDIVIDUAL UNIT	AVE. OF 3 UNITS	INDIVIDUAL UNIT	AVE. OF 3 UNITS	INDIVIDUAL UNIT
130	125	4,000	3,500	9.1	11.7

* Unit weight and density values may vary due to availability of local materials.

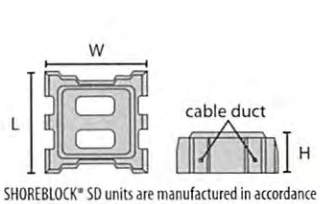
Specifications

Fabrication of a SHOREBLOCK® SD mat is accomplished by threading corrosive resistant steel or special synthetic cable in one direction through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to ensure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring. The open cells of SHOREBLOCK® SD comprise about 20% of the mat area.

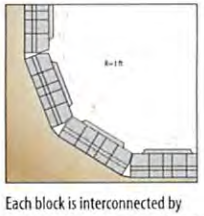
OPEN CELL								
BLOCK CLASS	DIMENSIONS IN.			BLOCK		UNIT COVERAGE Sq. Ft.	OPEN AREA
	H	W	L	Unit Weight Lbs	System Weight Lbs./Sq. Ft.		
SD-400 OC	4.00	15.50	17.40	50-57	28-32	1.78	20%
SD-475 OC	4.75	15.50	17.40	62-71	35-40	1.78	20%
SD-600 OC	6.00	15.50	17.40	81-94	46-53	1.78	20%
SD-800 OC	8.00	15.50	17.40	108-118	61-67	1.78	20%
SD-900 OC	9.00	15.50	17.40	120-138	68-78	1.78	20%

CLOSED CELL							
BLOCK CLASS	DIMENSIONS IN.			BLOCK		UNIT COVERAGE Sq. Ft.	OPEN AREA
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq. Ft.		
SD-400 CC	4.00	15.50	17.40	66-73	37-41	1.78	10%
SD-475 CC	4.75	15.50	17.40	78-89	43-50	1.78	10%
SD-600 CC	6.00	15.50	17.40	94-108	53-61	1.78	10%
SD-800 OC	8.00	15.50	17.40	125-135	71-76	1.78	10%
SD-900 CC	9.00	15.50	17.40	145-167	82-98	1.78	10%

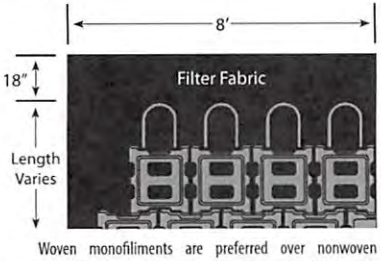
*The SD Series denotes Single Directional Cable System. Note: Additional block styles may be available in some areas. Check with your local SHORETEC® representative for product availability.



SHOREBLOCK® SD units are manufactured in accordance with ASTM C90, C140 and D6684-04.



Each block is interconnected by flexible cables, providing articulation between adjacent blocks.



Woven monofiliments are preferred over nonwoven geotextiles. The soil's particle size (among other factors) will ultimately determine the fabric selection.

Features & Benefits

DURABILITY
SHOREBLOCK® SD will not suffer loss of function due to chemical degradation, UV degradation, biological degradation, vandalism or aging throughout its design life.

STABILITY
SHOREBLOCK® SD has the necessary strength characteristics to resist displacement due to imposed tractive forces and wave loads and the necessary strength to resist both lateral displacement and vertical uplift.

ACCEPTABILITY
SHOREBLOCK® SD becomes part of the landscape and the local ecosystem. Its construction is free of hazardous projections thus offering opportunities for recreation as native grasses are quick to germinate in the soil-filled cells.

AFFORDABILITY
The SHOREBLOCK® SD System is engineered to ensure comprehensive project design, and high quality components at 20-50% lower than alternative erosion control methods.

SHORETEC®

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Performance Testing
Project Specifications
NCMA TEK Note 11-9A
Geotextile Selection Guidelines
Installation Guidelines
CAD Details

Contact Us

Let us quote your next project!
Whether you have a spec or an idea, our team can assist in all phases of your project requirements.

Request a Lunch 'n Earn and Receive PDH's

Signup Online!

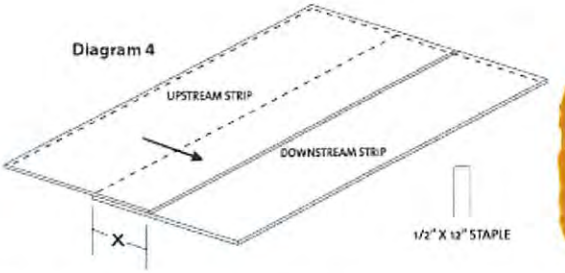
Installation Guidelines

Geotextile Installation

The geotextile should be placed on the prepared slope or other surface to be protected. All folds and wrinkles should be removed from the geotextile before the block is placed on top of it.

Place the geotextile so that there is sufficient overlap to seal the seams for intrusion of water and ensure minimal stretch of the geotextile material. Upstream strips of material must overlap the downstream strips and upslope strips overlap down-slope strips. The amount of overlap (X) is usually specified by the engineering firm and may be a minimum of 3 feet for wet installations and a minimum of 1.5 feet for dry installations.

The upstream strips of material must overlap the downstream strips and upslope strips overlap down-slope strips. (See Diagram 4)



There should be no voids or airspace between the subgrade and the geotextile so intimate contact can be maintained with the two surfaces. Once the geotextile is placed, the work area should not be disturbed. This is necessary to avoid any contact loss between the ACBs and the geotextile and the geotextile and the subgrade. (See Diagram 5)

Spreader Bar | Subgrade Preparation | Geotextile Installation | Loading and Unloading Cabled Mattresses
Placement of ACBs | Cabling Anchoring and Crimping | Grouting | Bibliography

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Products
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Whether you have a spec or an idea, our team can assist in all phases of your project requirements.

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Signup Online!

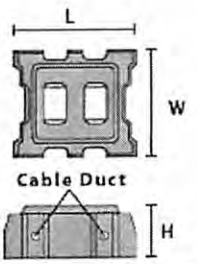
Shoreblock® SD

Fabrication of a Shoreblock SD mat is accomplished by threading corrosive resistant steel or special synthetic cable in one direction through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to insure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring. In most markets, ACBs are competitive in cost to 12" diameter (or greater) rock (or riprap) placed in an 18" or greater blanket thickness. In most markets, ACBs are competitive with gabion mattresses and ACBs are typically cheaper than cast in place concrete.

Shoreblock SD mats are assembled according to the size required for a particular project. Each individual block is inspected prior to being incorporated into a revetment mat. Fabrication of a Shoreblock concrete mat is accomplished by threading corrosive resistant steel or special synthetic cable through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to insure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring.

Shoreblock Units are manufactured in accordance with ASTM C90, D6684-04 and C140 and the following criteria:

1. Concrete Unit Weight 130-150 lbs./CF
   A. Minimum Compression Strength 4,000 PSI
   B. Maximum Absorption 7%
   C. Dimensional Tolerance + 1/8"
2. Galvanized or Polyester Cabling



Shoreblock® SD Series
Mat Sizes and Weights

OPEN CELL UNITS	Dimensions In.			Block		Unit Coverage Sq. Ft.	Open Area %
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq. Ft.		
SD-400 OC	4.00	15.50	17.40	51-57	29-32	1.78	20
SD-475 OC	4.75	15.50	17.40	62-67	35-38	1.78	20
SD-600 OC	6.00	15.50	17.40	81-88	46-50	1.78	20
SD-800 OC	8.00	15.50	17.40	108-118	61-67	1.78	20
SD-900 OC	9.00	15.50	17.40	120-129	68-73	1.78	20

CLOSED CELL UNITS	Dimensions In.			Block		Unit Coverage Sq. Ft.	Open Area %
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq.Ft.		
SD-400 CC	4.00	15.50	17.40	66-73	37-41	1.78	10
SD-475 CC	4.75	15.50	17.40	78-84	44-48	1.78	10
SD-60 CC	6.00	15.50	17.40	94-101	53-57	1.78	10
SD-800 CC	8.00	15.50	17.40	125-135	71-76	1.78	10
SD-900 CC	9.00	15.50	17.40	145-156	82-88	1.78	10

Construction Geosynthetics

US 205NW

NTPEP APPROVED - GTX-2016-01-100. US 205NW is a nonwoven needlepunched geotextile made of 100% polypropylene staple filaments. US 205NW resists ultraviolet and biological deterioration, rotting, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. US 205NW will satisfy the requirements as outlined in AASHTO M-288-06 for Class 1 applications and meets the following M.A.R.V. values except where noted:

Property	Test Method	English	Metric
Weight - Typical	ASTM D-5261	8.0 oz/sy	271 g/sm
Tensile Strength	ASTM D-4632	205 lbs	912 N
Elongation @ Break	ASTM D-4632	50%	50%
Mullen Burst*	ASTM D-3786*	350 psi	2,413 kPa
Puncture Strength*	ASTM D-4833*	130 lbs	579 N
CBR Puncture	ASTM D-6241	535 lbs	2,381 N
Trapezoidal Tear	ASTM D-4533	85 lbs	378 N
Apparent Opening Size	ASTM D-4751	80 US Sieve	0.180 mm
Permittivity	ASTM D-4491	1.35 Sec-1	1.35 Sec-1
Water Flow Rate	ASTM D-4491	90 g/min/sf	3,657 l/min/sm
UV Resistance @ 500 Hours	ASTM D-4355	70%	70%

Roll Size	Roll Diameter	Area	Weight
12.5' x 360'	16.0 in	500 sys	270 lbs
15' x 300'	16.0 in	500 sys	270 lbs

* Historical averages (current values not available): Mullen Burst Strength ASTM D3786 is no longer recognized by ASTM D-35 on Geosynthetics as an acceptable test method. Puncture Strength ASTM D4833 is not recognized by AASHTO M288 and has been replaced with CBR Puncture ASTM D6241.

US Fabrics, Inc. | 3904 Virginia Avenue | Cincinnati, OH 45227

Phone: (800) 518-2290 | Fax: (513) 217-4420 | email: info@usfabrics.com

Construction Geosynthetics

Underwater Polypropylene Geotextile Installation Guide

1.0 General

1) This guideline covers general installation of polypropylene geotextiles in underwater applications.
2) Where contradictions occur follow the instructions of the project engineer.

2.0 Geotextiles Float

1) All woven and most needle-punched nonwoven geotextiles are made from 100% polypropylene.
   a) Polypropylene has a density of 0.91.
      i) As such, geotextiles will float in water and require a ballast.

3.0 Shallow Slope Projects

1) When a machine can reach the full extent of the geotextile placement:
   a) Place a steel pole with a buoy attached at one end through the geotextile roll core.
   b) Anchor the geotextile at the top of the slope by unrolling a portion and carefully driving the excavator onto it.
   c) Lower the geotextile into place.
   d) Immediately place a layer of rock on the geotextile to ballast it.
   e) Retrieve the pole by pulling on buoy ropes.

4.0 Larger Slope Projects

1) Create larger sewn panels on site with a portable sewing machine.
   a) Use a prayer seem.
   b) They achieve 60% of the geotextile's tensile strength.
2) Slope Installation.
   a) Lay sewn panel on level ground and attach sacrificial ballast.
      i) Typically scrap 20 mm rebar pieces attached along geotextile length at 6 foot centers.
      ii) Cable ties, wire or tape are attachment options.
      iii) Holes are made in fabric with a push rod the same diameter as the fastener.
   b) Place a steel core at one end of the panel.
   c) Attach two lengths of rope to the core and lay the rope along the geotextile.
   d) Roll the fabric, rebar and ropes onto the core and transport it to the installation area.

e) The rolled geotextile panel can now be lowered into position by unwinding the ropes.
    i) On long slopes, it may be more effective to place the roll on the slope shoulder and have the ropes hauled on board from a barge.
3) Immediately place a layer of rock on the geotextile to ballast it.

5.0 Anchoring

4) If required, use key trenches or aprons at the crest and toe of the slope to anchor the ends of the geotextile.
    a) The anchor trench should be backfilled with soil and compacted on completion of the geotextile installation.
    b) It is recommended that the front of anchor trenches are rounded and smooth to reduce stress on the geotextile.

6.0 Deep Water Installation

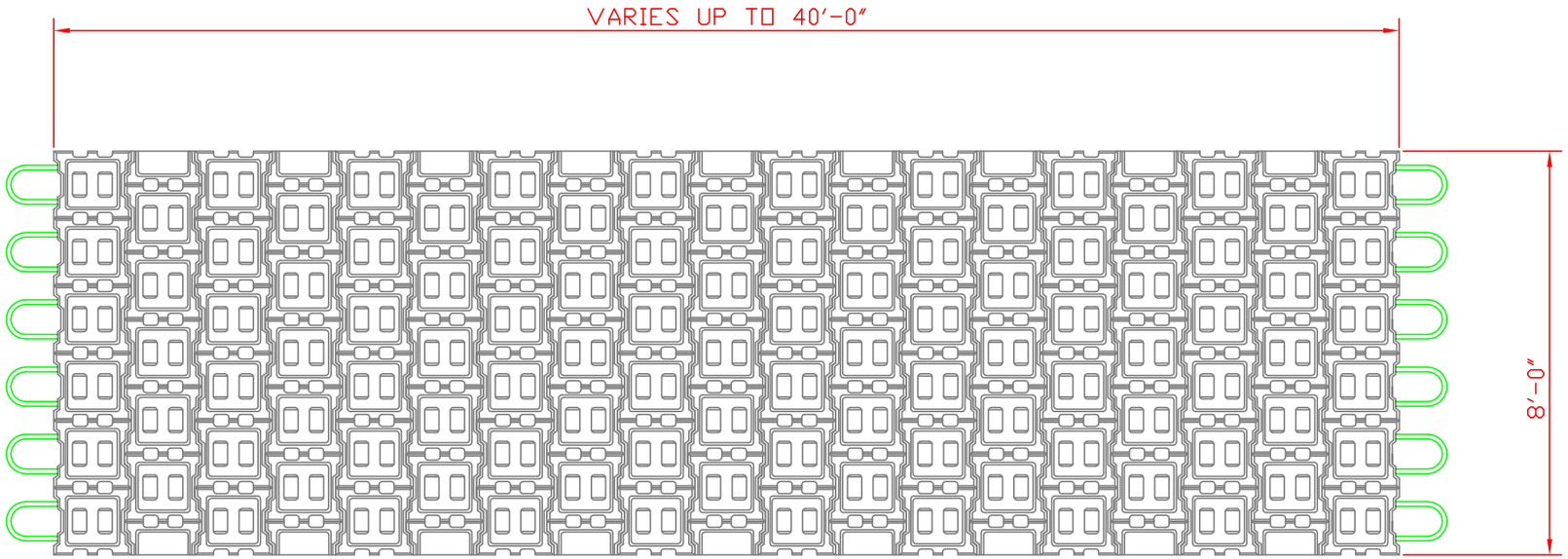
1) Float the prefabricated panel out to sea.
2) Ballast it into position on the seabed by dropping rock from a barge onto the floating panel as it sinks.
3) Prefabricated straps and weight pocket options.
    a) Geotextiles can be manufactured with special straps sewn into the fabric to assist with connection to installation rafts or similar.
        i) Folds or pockets can also be sewn in the fabric to contain weights such as sinking poles.
        ii) Contact US Fabrics for more information.
            (1) (800)518-2290
            (2) info@usfabrics.com
4) Immediately place a layer of rock on the geotextile to ballast it.

7.0 Overlapping

1) Panel overlap widths are site specific and generally at the discretion of the site engineer.
    a) A minimum overlap of 3 feet is recommended for under water geotextile placement.
2) Overlaps are required to ensure that all of the underlying soils are fully covered.
    a) Keep in mind the geotextile can move during placement of the rock.
3) Marking the ends of the geotextile.
    a) Spraying white lines on the fabric where the overlap occurs may be useful in some waters.
        i) For example, 3 feet in from the edge of the panels.
    c) Attaching floats to the edges of the rolled geotextile panel is another option.

8.0 Storage

1) Geotextile rolls are wrapped in a UV protective cover.
2) If stored outdoors for a prolonged period, the geotextile should be elevated from the ground and covered with a tarpaulin or opaque plastic.
    a) Contractor should insure rolls are adequately protected from:
        i) Moisture
        ii) Ultraviolet radiation
        iii) Chemicals that are strong acids or bases
        iv) Temperatures in excess of 140°F
        v) Animal destruction



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Client:	Title:			
	SHOREBLOCK® SD SERIES TYPICAL MAT			
Scale: N.T.S.	Drawn By: A. CASE	File Name:	Project No:	Drawing No: 3

No.	Date	Revision	By

APPENDIX G

MUSSEL RELOCATION PLAN

MUSSEL RELOCATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

Elliptio complanata

Elliptio roanokensis

September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

MUSSEL RELOCATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former manufactured gas plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach.

PROJECT AREA PREVIOUS MUSSEL SURVEY RESULTS

In 2006 a reconnaissance survey was conducted by Alderman Environmental Services, Inc. to assess the freshwater mussel populations within Lake Murray and the lower Saluda and upper Congaree Rivers in support of the Saluda Hydroelectric Project (FERC No. 516). The findings of the survey were summarized in the "Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006). The survey included two locations in the upper Congaree River that were within or directly adjacent to (downstream) the planned project area. Figure 2 shows these locations and Attachment A provides the applicable survey report excerpts taken from the Alderman Report.

The first survey area (Station: 20060711.5) was located in the vicinity of the Senate Street alluvial fan, which is centrally located within the planned area to be capped. This location will be impacted by project operations. The second survey area (Station: 20060712.5) was located directly south (downstream) and outside of the project area and is not expected to be impacted by the planned project activities.

Table 1 provides a summary of the live mussels encountered at these two locations and their current global and state NatureServe ranks as listed on the South Carolina Department of Natural Resources (SCDNR) Heritage Trust Program Rare, Threatened and Endangered Species and Communities List (Attachment B). No federal or state threatened, endangered or candidate mussel species were identified within the Congaree River during completion of the survey. A combined total of three mussel species classified as rare by the SCDNR Heritage Trust Program were identified at the two survey locations that were within or adjacent to the project area. These rare species have no legal protection under the federal

or state endangered species laws but are tracked by the SCDNR Heritage Trust Program at the request of the Program's biologists.

A total of 33 live mussels of four different species were observed at the first location (Station: 20060711.5). Of the four species, two (*Elliptio congaraea* and *Elliptio angustata*) are considered rare by SCDNR. The most abundant species identified at this location (*Elliptio complananta*) is not on the Heritage Trust list.

A total of 21 live mussels of six different species were observed at the second location (Station: 20060712.5). Three of the six species observed (*Elliptio angustata, Elliptio congaraea, Lampsilis splendida*) are designated as rare by SCDNR. Again, the unlisted *Elliptio complananta* was also identified. As were the unlisted, *Elliptio icterina* and *Elliptio roanokensis*.

MUSSEL RELOCATION PLAN

As a result of the previous findings from the Alderman survey conducted in 2006, SCE&G recognizes that no threatened or endangered mussels are likely present within the project area. However, a number of sensitive mussel species are likely present. In order to complete the project with as minimal of a negative impact to the Congaree River resources as practicable, SCE&G plans to conduct mussel relocation operations prior to initiating "in-river" construction activities. The mussel relocation activities will include:

- Utilizing qualified personnel to conduct mussel survey activities, finalize project details and complete/supervise the relocation field work;
- Conducting an initial reconnaissance and assessment of the planned project area (the planned footprint of the cap plus a small buffer zone) and immediately downstream;
- Locating a suitable relocation area(s) with acceptable habitat characteristics within the Congaree River as near as possible to the project site;
- Collecting and relocating the mussels identified within the planned footprint of the capping area, to the extent practical; and
- Providing a summary of completed mussel relocation activities in the final report for the project.

The assessment and relocation activities will be conducted as close to the actual beginning of the intrusive activities as feasible to reduce the potential for repopulation of the area prior to initiation of construction.

Consultant Selection

SCE&G will procure the services of a qualified consultant with proven experience in successfully completing freshwater mussel surveys, habitat assessment and relocation activities. Once selected, this consultant will review project details and finalize the overall plan for mussel relocation.

Initial Reconnaissance and Assessment of the Project Area

The selected consultant will conduct an initial assessment of the project area to determine the approximate number, species and other characteristics of the mussels that can be realistically relocated prior to initiation of "in-river" construction activities. The surveyed project area will include the cap area

footprint and a small buffer along the outer perimeter of the cap. This buffer will account for small changes in the final placement of the cap and for minor changes in river currents and hydraulic characteristics that are expected to result from placement of the capping materials.

The information gathered from the assessment will be utilized to determine appropriate relocation areas and other logistical components associated with the collection/relocation phase of the project.

Determine Suitable Relocation Areas

The relocation site(s) will be within the Congaree River and as near to the project area as possible. Selection will be based on a number of criteria, including:

- The presence and abundance of other mussels;
- Specific habitat characteristics such as substrate and adjacent land uses;
- Flow and gradient characteristics; and
- Potential for future threats.

The Alderman survey area (Station: 20060712.5) located directly downstream of the project area contains the same species of mussels found within the project area and may be a suitable relocation point for some or all of the project area mussels. This location would be ideal, if suitable, due to its close proximity to the project area.

Collect and Relocate Mussels

As currently envisioned, the mussel collection and relocation activities will likely be completed in one mobilization, unless unsuitable river conditions (high and/or turbid flows) are encountered. A combination of wading and diving will be necessary to adequately survey the majority of the project area.

The warmer months of the year are preferred for relocation and the mussel relocation expert will determine the appropriate timeframe for completion of these operations based on the specific requirements of the mussels identified in the project area. Spawning and glochidia release timeframes will be avoided.

SCE&G plans to conduct as complete of a relocation effort as possible. Several factors may limit the potential relocation activities. They include:

- The presence of significant TLM in the substrate surrounding mussel locations may necessitate not disturbing these locations;
- Mussels that are coated with TLM will most likely be left in place because adequate decontamination may not be feasible or will overly stress the animal. Tar coated mussels can not be relocated to new unimpacted areas; and
- Other project related constraints (logistical, safety, etc.) may limit the overall relocation effort.

The mussel relocation expert will conduct and supervise the collection of the mussels from within the specified area. An effort will be made to adequately survey all areas that will be impacted by the project.

More than one pass will likely be conducted depending on the expert's recommendations and other project constraints.

The mussels will be gently removed, kept cool and moist and quickly transported to the relocation area. Extreme fluctuations in temperature or other environmental factors will be avoided. Mussels will be correctly placed within the relocation area. The number and species of mussels will be documented for inclusion in the final report.

Reporting

The details of the mussel relocation activities will be provided in the final project report, which will document the entire sediment capping operation. The documented activities will include:

- Results of the initial project area surveying activities;
- The relocation area characteristics and details from the relocation area decision process;
- Mussel collection, transport and relocation activities; and
- Limiting factors, if any.

REFERENCES

Alderman Environmental Services, Inc. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries. Alderman Survey Report.

Luzier, C. and S. Miller. 2009. Pacific Northwest Native Freshwater Mussel Workgroup. Freshwater Mussel Relocation Guidelines.

U.S. Fish and Wildlife Services and Virginia Dept. of Game and Inland Fisheries. 2013. Freshwater Mussel Guidelines for Virginia.

TABLE 1

2006 FRESHWATER MUSSEL SURVEY RESULTS FOR PROJECT AREA*

Congaree River Sediments
Columbia, South Carolina

Station	Species	Common Name	Number Identified	NatureServe Ranking	
				Global Rank	State Rank
20060711.5	*Elliptio complanata*	Common Elliptio	23	G5 - Secure	--
	Elliptio congaraea	Carolina Slabshell	1	G3 - Vulnerable	S3 - Vulnerable
	Elliptio roanokensis	Roanoke Slabshell	1	G3 - Vulnerable	--
	Elliptio angustata	Carolina Lance	8	G4 - Apparently Secure	S3 - Vulnerable
20060712.5	*Elliptio angustata*	Carolina Lance	2	G4 - Apparently Secure	S3 - Vulnerable
	Elliptio congaraea	Carolina Slabshell	1	G3 - Vulnerable	S3 - Vulnerable
	Elliptio icterina	Variable Spike	1	G5Q - Secure	--
	Elliptio complanata	Common Elliptio	3	G5 - Secure	--
	Lampsilis splendida	Rayed Pink Fatmucket	1	G3 - Vulnerable	S2 - Imperiled
	Elliptio roanokensis	Roanoke Slabshell	13	G3 - Vulnerable	--

Notes:

* - Information obtained from Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray and Selected Tributaries by John M. Alderman, Alderman Environmental Services, Inc. (October 2006)
- NatureServe Ranks taken from Rare, Threatened and Endangered Species Communities Tracked by the SCDNR Heritage Trust Program.
- No federal or state threatened, endangered or candidate species were identified in the Congaree River during the survey.
- Elliptio complanata is not included on the SCDNR Heritage Trust Program list.
- The "Q" qualifier for Elliptio icterina represents "questionable taxonomy that may reduce conservation priority."

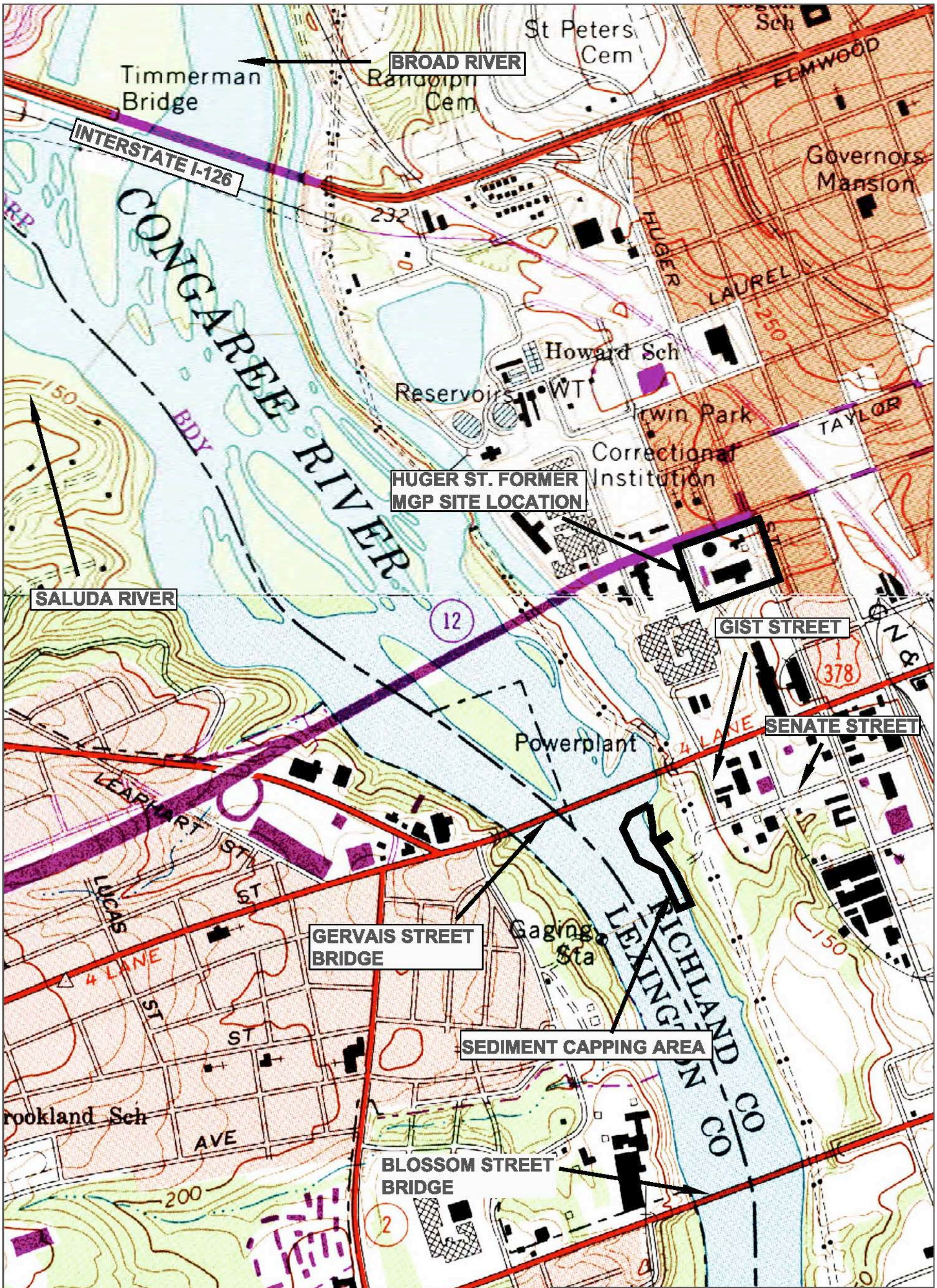

FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

FIGURE 2

SOUTH CAROLINA ELECTRIC & GAS COMPANY

CAPPING AREA WITH MUSSEL SURVEY LOCATIONS

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 12/21/2016 FILE NAME: MUSSEL SURVEY LOCATIONS - CAP

APEX COMPANIES, LLC

Attachment A

(Excerpts taken from "Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006)

Table 3. Freshwater mussels of the Saluda River (below L. Murray Dam), lower Broad River, and upper Congaree River

Station	Latitude Longitude	Species	Live, Shells	Substrate*
20060711.1 Saluda R.	34.05037 N 81.20573 W	None		sa,g,Co,Bo
20060711.2 Saluda R.	34.04843 N 81.19653 W	None		s,Sa,G,co,bo,b
20060711.3 Saluda R.	34.02978 N 81.13944 W	None		s,Sa,G,co,bo
20060711.4 Saluda R.	34.00969 N 81.07800 W	None		s,sa,g,co,bo,b
20060712.1 Saluda R.	34.00639 N 81.06508 W	None		s,sa,g,co
20060712.2 Broad R.	34.00714 N 81.06232 W	*Elliptio roanokensis* *Elliptio complanata* *Villosa delumbis* *Elliptio angustata* *Lampsilis cariosa*	0,2 0,5 0,1 1,1 1,0	s,sa,g,co,bo,b
20060712.3 Saluda R. (Broad R. washout area)	34.00541 N 81.06282 W	*Elliptio angustata* *Villosa delumbis* *Strophitus undulatus*	1,2 0,2 0,1	s,Sa,g
20060712.4 Congaree R. (Saluda R. side)	33.98949 N 81.04859 W	*Elliptio complanata*	1,0	s,sa,g,co,bo,b
20060711.5 Congaree R. (Broad R. side)	33.99461 N 81.04913 W	*Elliptio complanata* *Elliptio congaraea* *Elliptio roanokensis* *Villosa delumbis* *Elliptio angustata*	23,-- 1,0 1,0 0,1 8,--	s,sa,g,co,bo

Table 3 (continued). Freshwater mussels of the Saluda River (below L. Murray Dam), lower Broad River, and upper Congaree River

Station	Latitude Longitude	Species	Live, Shells	Substrate*
20060712.5 Congaree R. (Broad R. side)	33.99111 N 81.04692 W	*Elliptio angustata* *Elliptio congaraea* *Elliptio icterina* *Elliptio complanata* *Lampsilis splendida* *Elliptio roanokensis*	2,0 1,0 1,0 3,0 1,0 13,0	s,sa,go,co,bo,b
20060712.6 Congaree R. (Saluda R. side)	33.97967 N 81.04757 W	*Elliptio roanokensis* *Elliptio angustata*	2,0 1,0	s,Sa,G,co,bo
20060712.7 Congaree R. (Borad R. side)	33.98031 N 81.04546 W	*Elliptio complanata* *Elliptio congaraea* *Strophitus undulatus* *Elliptio roanokensis* *Elliptio angustata* *Lampsilis splendida* *Lampsilis cariosa* *Villosa delumbis*	5,0 2,0 1,0 19,0 9,0 1,0 2,0 0,1	S,Sa,G,co,bo
20060712.8 Congaree R. (Saluda R. side)	33.96535 N 81.03777 W	None	--	s,sa,g
20060804.1 Saluda R.	34.02287 N 81.10009 W	None	--	s,sa,g,co,bo,B
20060804.2 Saluda R.	34.01835 N 81.09807 W	None	--	s,sa,g,co,bo,b
20060804.3 Rawls Cr.	34.07949 N 81.20251 W	None	--	c,s,sa,g,co,bo,b
20060804.4 12 Mile Cr.	34.03275 N 81.16173 W	None	--	s,sa,g,co,bo

* s-silt, sa- sand, c-clay, co-cobble, b-bedrock, bo-boulder, g-gravel, r-roots, v-vegetation, d-detritus, m-mud

PROJECT: Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree River, Lake Murray, and Selected Tributaries

STATION: 20060711.5jma

BIOLOGISTS: John M. Alderman
Joseph D. Alderman
Jennifer M. Summerlin

U.S. FISH AND WILDLIFE SERVICE ES PERMIT: TE065756-0

S.C. DEPARTMENT OF NATURAL RESOURCES AUTHORIZATION: November 25, 2002

LOCATION: Congaree River, Lexington/Richland county line, South Carolina; 33.99461 N, 81.04913 W; **see Figure 4**

SURVEY DATE: July 11, 2006

SITE COMMENTS: -

HABITAT:

WATERBODY TYPE:	River
FLOW:	Run, slack, pool
RELATIVE DEPTH:	Very shallow
DEPTH (%<2 FEET):	90
SUBSTRATE:	Silt, sand, gravel, cobble, boulder
COMPACTNESS:	Compact and normal
SAND/GRAVEL BARS:	Present
WOODY DEBRIS:	Low
BEAVER ACTIVITY:	None
WINDTHROW:	Low
TEMPORARY POOLS:	None
CHANNEL WIDTH:	300+ meters
BANK HEIGHT:	Varies

HABITAT (cont.):

BANK STABILITY:	Very stable
BUFFER WIDTH:	Narrow to moderate
RIPARIAN VEGETATION:	Wooded, shrub-brush, grass
LAND USE:	Urban
PERCENT COVER:	0
WOODLAND EXTENT:	Not extensive
NATURAL LEVEES:	-
VISIBILITY:	Slightly turbid
WATER LEVEL:	Low
WEATHER:	Sun-Cloud, hot

TECHNIQUES AND SURVEY TIME:

TECHNIQUES:	Visual
SURVEY TIME:	0.5 person-hours

FRESHWATER MUSSELS:

Elliptio roanokensis – 1 live (93 mm)
Elliptio complanata – 23 live (78, 74, 71, 53, 66, 76, 60, 58, 63, 56, 55, 61, 62, 53, 55, 59, 58, 56, 58, 62, 48, 50, 36 mm)
Elliptio congaraea – 1 live (55 mm)
Elliptio angustata – 8 live (80, 69, 58, 67, 67, 58, 57, 58 mm)
Villosa delumbis – 1 old shell

OTHER DOCUMENTED TAXA:

Elimia catenaria - common
Corbicula fluminea

PROJECT: Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree River, Lake Murray, and Selected Tributaries

STATION: 20060712.5jma

BIOLOGISTS: John M. Alderman
Jeffrey West
Joseph D. Alderman
Christopher S. Boring
Jennifer M. Summerlin

U.S. FISH AND WILDLIFE SERVICE ES PERMIT: TE065756-0

S.C. DEPARTMENT OF NATURAL RESOURCES AUTHORIZATION: November 25, 2002

LOCATION: Congaree River, Lexington/Richland county line, South Carolina; 33.99111 N, 81.04692 W; **see Figure 4**

SURVEY DATE: July 12, 2006

SITE COMMENTS: Broad River side of Congaree River

HABITAT:

WATERBODY TYPE:	River
FLOW:	Run, slack
RELATIVE DEPTH:	Very shallow
DEPTH (%<2 FEET):	75
SUBSTRATE:	Silt, sand, gravel, cobble, boulder, bedrock
COMPACTNESS:	Normal
SAND/GRAVEL BARS:	Present
WOODY DEBRIS:	Low
BEAVER ACTIVITY:	Evidence (gnawed sticks)
WINDTHROW:	Low
TEMPORARY POOLS:	-
CHANNEL WIDTH:	300+ meters
BANK HEIGHT:	2.5+ meters

HABITAT (cont.):

BANK STABILITY:	Very stable
BUFFER WIDTH:	Moderate to wide
RIPARIAN VEGETATION:	Wooded, shrub-brush
LAND USE:	Urban
PERCENT COVER:	1
WOODLAND EXTENT:	Intermediate
NATURAL LEVEES:	-
VISIBILITY:	Slightly turbid
WATER LEVEL:	Low
WEATHER:	Sun-Cloud, hot

TECHNIQUES AND SURVEY TIME:

TECHNIQUES:	Visual
SURVEY TIME:	0.83 person-hours

FRESHWATER MUSSELS:

Elliptio roanokensis – 13 live (100, 111, 89, 91, 95, 108, 105, 95, 102, 107, 110, 89, 91 mm)
Elliptio complanata –3 live (93, 78, 73 mm)
Elliptio congaraea – 1 live (61 mm)
Elliptio angustata –2 live (63, 66 mm)
Elliptio icterina – 1 live (72 mm)
Lampsilis splendida – 1 live male (67 mm)
Villosa delumbis – 1 old shell

OTHER DOCUMENTED TAXA:

Elimia catenaria - common
Corbicula fluminea

Attachment B

Tracked Rare, Threatened and Endangered Species Communities List

Rare, Threatened, and Endangered Species and Communities Known to Occur in South Carolina
June 11, 2014

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Vertebrate Animals					
Accipiter cooperii	Cooper's Hawk			G5	S3?
Acipenser brevirostrum	Shortnose Sturgeon	LE: Endangered	SE: Endangered	G3	S3
Acris crepitans	Northern Cricket Frog			G5	S5
Aimophila aestivalis	Bachman's Sparrow			G3	S3
Ambystoma cingulatum	Flatwoods Salamander	LT: Threatened	SE: Endangered	G2	S1
Ambystoma tigrinum tigrinum	Eastern Tiger Salamander			G5	S2S3
Aneides aeneus	Green Salamander			G3G4	S1
Apalone ferox	Florida Softshell			G5	SNR
Caretta caretta	Loggerhead	LT: Threatened	ST: Threatened	G3	S3
Charadrius wilsonia	Wilson's Plover		ST: Threatened	G5	S3?
Clemmys guttata	Spotted Turtle		ST: Threatened	G5	S5
Condylura cristata	Star-nosed Mole			G5	S3?
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat		SE: Endangered	G3G4	S2?
Crotalus adamanteus	Eastern Diamondback Rattlesnake			G4	S3
Crotalus horridus	Timber Rattlesnake			G4	SNR
Cryptobranchus alleganiensis	Hellbender			G3G4	SNR
Dendroica virens	Black-throated Green Warbler			G5	S4
Desmognathus aeneus	Seepage Salamander			G3G4	SNR
Desmognathus marmoratus	Shovelnose Salamander			G4	S2
Egretta caerulea	Little Blue Heron			G5	SNRB,SNRN
Elanoides forficatus	American Swallow-tailed Kite	SC: Sp. of Concern	SE: Endangered	G5	S2
Elassoma boehlkei	Carolina Pygmy Sunfish	SC: Sp. of Concern	ST: Threatened	G2	S1
Elassoma okatie	Bluebarred Pygmy Sunfish			G2G3	SNR
Etheostoma brevispinum	Carolina Fantail Darter			G4	S1
Etheostoma collis	Carolina Darter			G3	SNR
Etheostoma flabellare	Fantail Darter			G5	S1
Etheostoma hopkinsi	Christmas Darter			G4G5	S4
Etheostoma zonale	Banded Darter			G5	S1?
Eumeces anthracinus pluvialis	Southern Coal Skink		ST: Threatened	G5T5	SNR
Falco peregrinus anatum	American Peregrine Falcon		ST: Threatened	G4T4	SNR
Fundulus diaphanus	Banded Killifish			G5	S1
Glyptemys muhlenbergii	Bog Turtle		ST-Threatened	G3	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Gopherus polyphemus	Gopher Tortoise	C: Candidate	SE: Endangered	G3	S1
Haliaeetus leucocephalus	Bald Eagle		ST: Threatened	G5	S2
Heterodon simus	Southern Hognose Snake			G2	SNR
Hyla andersonii	Pine Barrens Treefrog		ST: Threatened	G4	S2S3
Hyla avivoca	Bird-voiced Treefrog			G5	S5
Ictinia mississippiensis	Mississippi Kite			G5	S4
Kinosternon baurii	Striped Mud Turtle			G5	SNR
Kogia breviceps	Pygmy Sperm Whale			G4	SNA
Lampropeltis triangulum	Milk Snake			G5	S2
Lanius ludovicianus	Loggerhead Shrike			G4	S3
Lasiurus cinereus	Hoary Bat			G5	SNR
Lasiurus intermedius	Northern Yellow Bat			G4G5	SNR
Limnothlypis swainsonii	Swainson's Warbler			G4	S4
Melanerpes erythrocephalus	Red-headed Woodpecker			G5	SNR
Microtus pennsylvanicus	Meadow Vole			G5	SNR
Micrurus fulvius	Eastern Coral Snake			G5	S2
Mycteria americana	Wood Stork	LE: Endangered	SE: Endangered	G4	S1S2
Myodes gapperi carolinensis	Carolina Red-backed Vole			G5T4	S2S3
Myotis austroriparius	Southeastern Bat			G3G4	S1
Myotis leibii	Eastern Small-footed Myotis		ST: Threatened	G1G3	S1
Myotis lucifugus	Little Brown Myotis			G3	S3?
Myotis septentrionalis	Northern Long-eared Bat			G2G3	S4
Myotis sodalis	Indiana Myotis	LE: Endangered	SE: Endangered	G2	S1
Napaeozapus insignis	Woodland Jumping Mouse			G5	S4?
Neotoma floridana	Eastern Woodrat			G5	S3S4
Neotoma floridana floridana	Eastern Woodrat			G5T5	S3S4
Nerodia floridana	Florida Green Water Snake			G5	S2
Notropis chiliticus	Redlip Shiner			G4	S1?
Ophisaurus compressus	Island Glass Lizard			G3G4	S1S2
Ophisaurus mimicus	Mimic Glass Lizard			G3	SNR
Parascalops breweri	Hairy-tailed Mole			G5	SNR
Pelecanus occidentalis	Brown Pelican			G4	S1S2
Phoca vitulina	Harbor Seal			G5	SNA
Picoides borealis	Red-cockaded Woodpecker	LE: Endangered	SE: Endangered	G3	S2
Pituophis melanoleucus	Pine or Gopher Snake			G4	S3S4
Pituophis melanoleucus mugitus	Florida Pine Snake			G4T3	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Plegadis falcinellus	Glossy Ibis			G5	SHB,SNRN
Plethodon websteri	Webster's Salamander		SE: Endangered	G3G4	S2
Pseudacris feriarum	Upland Chorus Frog			G5	S5
Pseudobranchus striatus	Dwarf Siren		ST: Threatened	G5	S2
Pseudotriton montanus flavissimus	Gulf Coast Mud Salamander			G5T4	S3S4
Puma concolor	Mountain Lion			G5	SX
Puma concolor couguar	Eastern Cougar	LE: Endangered	SE: Endangered	G5THQ	SX
Rana capito	Gopher Frog		SE: Endangered	G3	S1
Rana palustris	Pickerel Frog			G5	SNR
Rana sylvatica	Wood Frog			G5	S3
Rhinichthys obtusus	Blacknose Dace			G5	S1
Sciurus niger	Eastern Fox Squirrel			G5	S4
Seminatrix pygaea	Black Swamp Snake			G5	SNR
Semotilus lumbee	Sandhills Chub			G3G4	S2
Sorex cinereus	Masked Shrew			G5	SNR
Sorex fumeus	Smoky Shrew			G5	S4
Sorex hoyi	Southern Pygmy Shrew			G5	S3S4
Spilogale putorius	Eastern Spotted Skunk			G4	S4
Sterna antillarum	Least Tern		ST: Threatened	G4	S3
Sylvilagus aquaticus	Swamp Rabbit			G5	S2S3
Sylvilagus obscurus	Appalachian Cottontail			G4	S3
Tamiasciurus hudsonicus	Red Squirrel			G5	S3?
Thryomanes bewickii	Bewick's Wren		ST: Threatened	G5	S1?
Trichechus manatus	Florida Manatee	LE: Endangered	SE: Endangered	G2	S1S2
Tyto alba	Barn-owl			G5	S4
Ursus americanus	Black Bear			G5	S3?
Vermivora bachmanii	Bachman's Warbler	LE: Endangered	SE: Endangered	GH	SX
Zapus hudsonius	Meadow Jumping Mouse			G5	SNR
Invertebrate Animals					
Alasmidonta varicosa	Brook Floater			G3	SNR
Amblyscirtes reversa	Reversed Roadside Skipper			G3G4	SNR
Anodonta couperiana	Barrel Floater			G4	S1
Atrytone arogos	Arogos Skipper			G3	SNR
Autochton cellus	Golden-banded Skipper			G4	S2S4
Distocambarus youngineri	Newberry Burrowing Crayfish			G1	S1
Elimia catenaria	Gravel Elimia			G4	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Elliptio "angustata-producta" complex	Carolina Lance-Atlantic Spike complex			G3	S3
Elliptio congaraea	Carolina Slabshell			G3	S3
Lampsilis cariosa	Yellow Lampmussel			G3G4	S2
Lampsilis splendida	Rayed Pink Fatmucket			G3	S2
Lasmigona decorata	Carolina Heelsplitter	LE: Endangered	SE: Endangered	G1	S1
Macromia margarita	Margaret's River Cruiser			G3	SNR
Polycentropus carlsoni	Carlson's Polycentropus Caddisfly			G2G3	S1S3
Pyganodon cataracta	Eastern Floater			G5	SNR
Speyeria diana	Diana Fritillary			G3G4	S3?
Strophitus undulatus	Creeper			G5	S2
Toxolasma pullus	Savannah Lilliput			G2	S1
Utterbackia imbecillis	Paper Pondshell			G5	SNR
Villosa constricta	Notched Rainbow			G3	S1
Villosa delumbis	Eastern Creekshell			G4	S4
Villosa vibex	Southern Rainbow			G5Q	S2
Animal Assemblage					
Waterbird Colony				GNR	SNR
Vascular Plants					
Acer pensylvanicum	Striped Maple			G5	S2
Aconitum uncinatum	Blue Monkshood			G4	S2
Aesculus parviflora	Small-flowered Buckeye			G3	S1
Agalinis aphylla	Coastal Plain False-foxglove			G3G4	S1
Agalinis auriculata	Earleaf Foxglove			G3	S1
Agalinis linifolia	Flax Leaf False-foxglove			G4?	SNR
Agalinis maritima	Salt-marsh False-foxglove			G5	S1
Agalinis tenella				G4Q	SNR
Agarista populifolia	Carolina Dog-hobble			G4G5	S1
Agrimonia incisa	Incised Groovebur			G3	S2
Agrimonia pubescens	Soft Groovebur			G5	S1
Aletris obovata	White Colicroot			G4G5	S1
Allium cernuum	Nodding Onion			G5	S2
Allium cuthbertii	Striped Garlic			G4	S2
Amaranthus pumilus	Seabeach Amaranth	LT: Threatened		G2	S1
Amorpha georgiana var. *georgiana*	Georgia Leadplant			G3T2	S1
Amorpha glabra	Smooth Indigobush			G4?	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Amorpha schwerinii	Schwerin Indigobush			G3G4	S1
Amphianthus pusillus	Pool Sprite	LT: Threatened		G2	S1
Amphicarpum muehlenbergianum	Blue Maiden-cane			G4	S2S3
Andropogon brachystachyus	Short-spike Bluestem			G4	S1
Andropogon gyrans var. *stenophyllus*	Elliott's Bluestem			G5T4	S1
Andropogon mohrii	Broomsedge			G4?	S2
Anemone berlandieri	Southern Thimble-weed			G4?	S1
Anemone caroliniana	Carolina Anemone			G5	SH
Anthaenantia rufa	Purple Silkyscale			G5	S2
Arabis missouriensis	Missouri Rock-cress			G5	S1
Arethusa bulbosa	Bog Rose			G4	SH
Aristida beyrichiana	Beyrich's Three-awn			G5?	SNR
Aristida condensata	Piedmont Three-awned Grass			G4?	S2
Aristida spiciformis	Pine Barren Three-awned Grass			G4	S2
Aristolochia macrophylla	Pipevine			G5	S2
Aristolochia tomentosa	Woolly Dutchman's-pipe			G5	S1
Arnoglossum muehlenbergii	Great Indian Plantain			G4	S1
Asclepias connivens	Large-flower Milkweed			G4?	S1
Asclepias pedicellata	Savannah Milkweed			G4	S2
Asplenium bradleyi	Bradley's Spleenwort			G4	S1
Asplenium heteroresiliens	Wagner's Spleenwort			G2	S1
Asplenium monanthes	Single-sorus Spleenwort			G4	S1
Asplenium pinnatifidum	Lobed Spleenwort			G4	S1
Asplenium resiliens	Black-stem Spleenwort			G5	S1
Asplenium rhizophyllum	Walking-fern Spleenwort			G5	S2
Asplenium trichomanes	Maidenhair Spleenwort			G5	S2
Astragalus michauxii	Sandhills Milkvetch			G3	S3
Astragalus villosus	Bearded Milk-vetch			G4	S1
Bacopa cyclophylla	Coastal-plain Water-hyssop			G3G5	S1
Balduina atropurpurea	Purple Balduina			G2	S1
Balduina uniflora	One-flower Balduina			G4	S2
Baptisia lanceolata	Lance-leaf Wild-indigo			G4	S3
Betula alleghaniensis	Yellow Birch			G5	S1
Botrychium lunarioides	Winter Grape-fern			G4?	S1
Boykinia aconitifolia	Brook Saxifrage			G4	S2
Burmannia biflora	Northern Burmannia			G4G5	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Calamovilfa brevipilis	Pine-barrens Reed-grass			G4	S1
Calopogon barbatus	Bearded Grass-pink			G4?	S2
Calopogon multiflorus	Many-flower Grass-pink			G2G3	S1
Camassia scilloides	Wild Hyacinth			G4G5	S2
Campanulastrum americanum	Tall Bellflower			G5	S1
Canna flaccida	Bandana-of-the-everglades			G4?	S2
Cardamine dissecta	Divided Toothwort			G4?	SNR
Cardamine flagellifera	Blue-Ridge Bittercress			G3	S2
Carex amphibola	Narrowleaf Sedge			G5	SNR
Carex appalachica	Appalachian Sedge			G4	S1
Carex austrocaroliniana	South Carolina Sedge			G4	S3
Carex basiantha	Widow Sedge			G5	S2
Carex biltmoreana	Biltmore Sedge			G3	S1
Carex canescens ssp. *disjuncta*	Silvery Sedge			G5T5	SNR
Carex chapmanii	Chapman's Sedge			G3	S1
Carex cherokeensis	Cherokee Sedge			G4G5	S2
Carex collinsii	Collins' Sedge			G4	S2
Carex communis var. *amplisquama*	Fort Mountain Sedge			G5T3	S2
Carex crus-corvi	Ravenfoot Sedge			G5	S2
Carex decomposita	Cypress-knee Sedge			G3G4	S2
Carex elliottii	Elliott's Sedge			G4?	S1
Carex folliculata	Long Sedge			G4G5	S1
Carex gracilescens	Slender Sedge			G5?	S1
Carex gracillima	Graceful Sedge			G5	S2
Carex granularis	Meadow Sedge			G5	S2
Carex hyalinolepis	Shore-line Sedge			G4G5	S2
Carex jamesii	James' Sedge			G5	S1
Carex manhartii	Manhart Sedge			G3G4	S2
Carex oligocarpa	Eastern Few-fruit Sedge			G4	SNR
Carex pedunculata	Longstalk Sedge			G5	S1
Carex plantaginea	Plantain-leaved Sedge			G5	S2
Carex prasina	Drooping Sedge			G4	S2
Carex projecta	Necklace Sedge			G5	SH
Carex radfordii	Radford's Sedge			G2	S3
Carex scabrata	Rough Sedge			G5	S2
Carex socialis	Social Sedge			G4	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Carex stricta	Tussock Sedge			G5	S1
Carex woodii	Pretty Sedge			G4	S1
Carya myristiciformis	Nutmeg Hickory			G4	S2
Castilleja coccinea	Scarlet Indian-paintbrush			G5	S2
Caulophyllum thalictroides	Blue Cohosh			G4G5	S2
Cayaponia quinqueloba	Cayaponia			G4	S1?
Ceratiola ericoides	Sandhills Rosemary			G4	S1
Chamaedaphne calyculata	Leatherleaf			G5	SNR
Chasmanthium nitidum	Shiny Spikegrass			G3G4	S1
Chelone lyonii	Pink Turtlehead			G4	S2?
Chrysoma pauciflosculosa	Woody Goldenrod			G4G5	S1S2
Chrysosplenium americanum	American Golden-saxifrage			G5	S1
Cimicifuga americana	Mountain Bugbane			G4	SNR
Circaea lutetiana	Southern Broadleaf Enchanter's Nightshade			G5	SNR
Circaea lutetiana ssp. *canadensis*	Enchanter's Nightshade			G5T5	S3
Cladium mariscoides	Twig Rush			G5	S1
Cladrastis kentukea	Yellowwood			G4	S1
Cliftonia monophylla	Buckwheat-tree			G4G5	SH
Collinsonia serotina	Southern Horse-balm			G3G4	S1
Collinsonia verticillata	Whorled Horse-balm			G3G4	S3
Comptonia peregrina	Sweet Fern			G5	S1
Convallaria majuscula	American Lily-of-the-valley			G4?	S1
Coreopsis gladiata	Southeastern Tickseed			G4G5	SNR
Coreopsis integrifolia	Ciliate-leaf Tickseed			G1G2	S1
Coreopsis latifolia	Broad-leaved Tickseed			G3	S1
Coreopsis rosea	Rose Coreopsis			G3	S2
Cornus racemosa	Stiff Dogwood			G5?	S1?
Croton elliottii	Elliott's Croton			G2G3	S2S3
Crotonopsis linearis	Narrowleaf Rushfoil			G5	SNR
Cuscuta cephalanthi	Dodder			G5	SNR
Cynanchum scoparium	Leafless Swallow-wort			G4	S1
Cyperus distinctus	Marshland Flatsedge			G4	S1
Cyperus granitophilus	Granite-loving Flatsedge			G3G4Q	S1?
Cyperus lecontei	Leconte Flatsedge			G4?	S1
Cyperus tetragonus	Piedmont Flatsedge			G4?	S2

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Cypripedium pubescens	Large Yellow Lady's-slipper			G5	S3
Cystopteris bulbifera	Bulblet Fern			G5	S1
Cystopteris protrusa	Lowland Brittle Fern			G5	S2
Danthonia epilis	Bog Oat-grass			G3G4	S2
Dasistoma macrophylla	Mullein Foxglove			G4	S1
Delphinium carolinianum	Carolina Larkspur			G5	S1
Deschampsia flexuosa	Crinkled Hairgrass			G5	S1
Dicentra cucullaria	Dutchman's Breeches			G5	S1
Dicentra eximia	Wild Bleeding-heart			G4	S1
Dicerandra odoratissima	Rose Balm			G4G5	S1
Dichanthelium aciculare	Broomsedge			G4G5	SNR
Dionaea muscipula	Venus' Fly-trap			G3	S3
Diphylleia cymosa	Umbrella-leaf			G4	S2
Diplazium pycnocarpon	Glade Fern			G5	S1
Dirca palustris	Eastern Leatherwood			G4	S2
Dodecatheon meadia	Shooting-star			G5	S1?
Draba aprica	Open-ground Whitlow-grass			G3	S1
Draba reptans	Carolina Whitlow-grass			G5	S1
Dryopteris carthusiana	Spinulose Shield Fern			G5	S1
Dryopteris goldiana	Goldie's Woodfern			G4G5	S1
Dryopteris intermedia	Evergreen Woodfern			G5	S2
Echinacea laevigata	Smooth Coneflower	LE: Endangered		G2G3	S3
Echinodorus tenellus	Dwarf Burhead			G5?	S2
Eleocharis palustris	Spike-rush			G5	S1?
Eleocharis robbinsii	Robbins Spikerush			G4G5	S2
Eleocharis tricostata	Three-angle Spikerush			G4	S2?
Eleocharis vivipara	Viviparous Spike-rush			G5	S1
Elliottia racemosa	Georgia Plume			G2G3	SX
Elymus riparius	Wild-rye			G5	SNR
Enemion biternatum	False Rue-anemone			G5	S1
Epidendrum conopseum	Green-fly Orchid			G4	S3?
Eriocaulon texense	Texas Pipewort			G4	S1
Eriochloa michauxii	Longleaf Cupgrass			G3G4	S1
Eryngium aquaticum var. *ravenelii*	Ravenel's Eryngo			G4T2T3	S1
Euonymus atropurpureus	Eastern Wahoo			G5	S1
Eupatorium anomalum	Florida Thorough-wort			G2G3	S1?

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Eupatorium fistulosum	Hollow Joe-pye Weed			G5?	SNR
Eupatorium recurvans	Coastal-plain Thorough-wort			G3G4Q	S1?
Eupatorium resinosum	Pine Barrens Boneset			G3	S1
Eupatorium scabridum	Rough Thoroughwort			G3G5	S1
Eupatorium sessilifolium				G5	SNR
Eupatorium sessilifolium var. *vaseyi*	Thoroughwort			G5T3T5	SNR
Eurybia avita	Alexander's Rock Aster			G3	S1
Eurybia spectabilis	Showy Aster			G5	SNR
Fimbristylis perpusilla	Harper's Fimbry			G2	S2
Fimbristylis vahlii	Vahl Fimbry			G5	S1
Forestiera godfreyi	Godfrey's Privet			G2	S1
Forestiera ligustrina	Upland Swamp Privet			G4G5	S2
Forestiera segregata	Southern Privet			G4	S1
Fothergilla major	Mountain Witch-alder			G3	S2
Frasera caroliniensis	Columbo			G5	S2
Galactia elliottii	Elliott's Milkpea			G5	S1
Galearis spectabilis	Showy Orchis			G5	S3
Gaultheria procumbens	Teaberry			G5	S3
Gaura biennis	Biennial Gaura			G5	S1
Gaylussacia baccata	Black Huckleberry			G5	S1
Gaylussacia mosieri	Woolly Huckleberry			G4	S1
Gentiana autumnalis	Pine Barren Gentian			G3	S2
Habenaria quinqueseta	Long-horn Orchid			G4G5	S1
Hackelia virginiana	Virginia Stickseed			G5	S1
Halesia diptera	Two-wing Silverbell			G5	S1
Halesia parviflora	Small-flowered Silverbell-tree			GNR	S2
Helenium brevifolium	Shortleaf Sneezeweed			G4	S1
Helenium pinnatifidum	Southeastern Sneezeweed			G4	S2
Helianthemum georgianum	Georgia Frostweed			G4	S2
Helianthus eggertii	Eggert's Sunflower			G3	S1
Helianthus glaucophyllus	White-leaved Sunflower			G3G4	S2
Helianthus laevigatus	Smooth Sunflower			G4	S2
Helianthus porteri	Porter's Goldeneye			G4	S1
Helianthus schweinitzii	Schweinitz's Sunflower	LE: Endangered		G3	S3
Helonias bullata	Swamp-pink	LT: Threatened		G3	S1
Hepatica nobilis var. *acuta*	Liverleaf			G5T5	S3

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Heteranthera reniformis	Kidneyleaf Mud-plantain			G5	S1
Heuchera parviflora	Little-leaved Alumroot			G4	S2
Hexastylis naniflora	Dwarf-flowered Heartleaf	LT: Threatened		G3	S3
Hexastylis sorriei	Sandhills Heartleaf			G1G2	S1
Hottonia inflata	Featherfoil			G4	S1
Hudsonia ericoides	Golden-heather			G4	S1
Hydrangea cinerea	Ashy-hydrangea			G4	S1
Hydrocotyle americana	American Water-pennywort			G5	S1
Hydrolea corymbosa	Corymb Fiddleleaf			G5	S1
Hydrophyllum canadense	Blunt-leaf Waterleaf			G5	S2
Hymenocallis coronaria	Shoals Spider-lily			G2Q	S2
Hymenophyllum tayloriae	Taylor's Fern			G2	S1
Hymenophyllum tunbrigense	Tunbridge Fern			G4G5	S1
Hypericum adpressum	Creeping St. John's-wort			G3	S2
Hypericum harperi	Harper's St. John's-wort			G3G4	S2
Hypericum nitidum	Carolina St. John's-wort			G4	S1
Ilex amelanchier	Sarvis Holly			G4	S3
Impatiens pallida	Pale Jewel-weed			G5	S1
Ipomoea macrorhiza	Large-stem Morning-glory			G3G5	S1
Ipomoea stolonifera	Beach Morning-glory			G5?	SNR
Ipomopsis rubra	Red Standing-cypress			G4G5	S2
Iris hexagona	Walter's Iris			G4G5	S1
Isoetes caroliniana	Engelmann's Quillwort			G3Q	S1
Isoetes melanospora	Black-spored Quillwort	LE: Endangered		G1	S1
Isoetes piedmontana	Piedmont Quillwort			G4	S2
Isoetes riparia	River Bank Quillwort			G5	S2
Isotria medeoloides	Small Whorled Pogonia	LT: Threatened		G2	S2
Juglans cinerea	Butternut			G4	S3
Juncus abortivus	Pinebarren Rush			G4G5	S2
Juncus georgianus	Georgia Rush			G4	S2
Juncus gymnocarpus	Naked-fruited Rush			G4	S3
Juncus subcaudatus	Woods-rush			G5	S1
Juniperus communis	Ground Juniper			G5	SNR
Kalmia cuneata	White-wicky			G3	S2
Krigia montana	False Dandelion			G3	S2
Lachnocaulon beyrichianum	Southern Bog-button			G4	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Lachnocaulon minus	Small's Bog Button			G3G4	S1
Lechea torreyi	Piedmont Pinweed			G4	SNR
Lepuropetalon spathulatum	Southern Lepuropetalon			G4G5	S2
Liatris gracilis	Slender Gayfeather			G5	S1
Liatris microcephala	Small-head Gayfeather			G3G4	S1
Licania michauxii	Gopher-apple			G4G5	S1
Lilaeopsis carolinensis	Carolina Lilaeopsis			G3G5	S2
Lilium canadense	Canada Lily			G5	S1
Lilium pyrophilum	Panhandle Lily			G2	S1
Lindera melissifolia	Pondberry	LE: Endangered		G2G3	S2
Lindera subcoriacea	Bog Spicebush			G2G3	S3
Liparis liliifolia	Large Twayblade			G5	S1
Lipocarpha micrantha	Dwarf Bulrush			G5	S2
Listera australis	Southern Twayblade			G4	S2
Listera smallii	Kidney-leaf Twayblade			G4	S1
Lithospermum tuberosum	Tuberous Gromwell			G4	S1
Litsea aestivalis	Pondspice			G3?	S3
Lobelia boykinii	Boykin's Lobelia			G2G3	S3
Lobelia sp. 1	Lobelia			G3	SNR
Lonicera flava	Yellow Honeysuckle			G5?	S2
Ludwigia lanceolata	Lance-leaf Seedbox			G3	S1
Ludwigia spathulata	Spatulate Seedbox			G2	S2
Lycopodium porophilum	Rock Clubmoss			G4	S1
Lycopodium tristachyum	Deep-root Clubmoss			G5	S1
Lycopus cokeri	Carolina Bugleweed			G3	S2
Lygodium palmatum	Climbing Fern			G4	S3
Lyonia ferruginea	Rusty Lyonia			G5	S1
Lysimachia asperulifolia	Rough-leaved Loosestrife	LE: Endangered		G3	S1
Lysimachia fraseri	Fraser Loosestrife			G3	S3
Lysimachia hybrida	Lance-leaf Loosestrife			G5	S1
Macbridea caroliniana	Carolina Bird-in-a-nest			G2G3	S3
Magnolia cordata	Piedmont Cucumber Tree			GNRQ	S1
Magnolia macrophylla	Bigleaf Magnolia			G5	S1
Magnolia pyramidata	Pyramid Magnolia			G4	S1
Melanthium virginicum	Virginia Bunchflower			G5	S2
Menispermum canadense	Canada Moonseed			G5	S2S3

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Minuartia godfreyi	Godfrey's Stitchwort			G1	SX
Minuartia uniflora	One-flower Stitchwort			G4	S3
Mitella diphylla	Two-leaf Bishop's-cap			G5	S1
Monarda didyma	Oswego Tea			G5	S2
Monotropsis odorata	Sweet Pinesap			G3	S2
Muhlenbergia filipes	Bentgrass			G5?Q	S3S4
Myriophyllum laxum	Piedmont Water-milfoil			G3	S2
Najas flexilis	Slender Naiad			G5	S1
Narthecium americanum	Bog Asphodel	C: Candidate		G2	SH
Nestronia umbellula	Nestronia			G4	S3
Nolina georgiana	Georgia Beargrass			G3G5	S3
Nyssa ogeche	Ogeechee Tupelo			G4G5	S1
Oenothera linifolia	Thread-leaf Sundrops			G5	S1
Oenothera perennis	Small Sundrops			G5	S1
Ophioglossum petiolatum	Longstem Adder's-tongue Fern			G5	S1
Ophioglossum vulgatum	Adder's-tongue			G5	S2
Orbexilum lupinellum	Sampson Snakeroot			G3G4	S1
Orobanche uniflora	One-flowered Broomrape			G5	S2
Osmorhiza claytonii	Hairy Sweet-cicely			G5	S2
Oxypolis canbyi	Canby's Dropwort	LE: Endangered		G2	S2
Oxypolis ternata	Piedmont Cowbane			G3	S1
Pachysandra procumbens	Allegheny-spurge			G4G5	S2
Panax quinquefolius	American Ginseng			G3G4	S4
Panicum webberianum	A Panicgrass			GNR	SNR
Parnassia asarifolia	Kidneyleaf Grass-of-parnassus			G4	S2
Parnassia caroliniana	Carolina Grass-of-parnassus			G3	S2
Parnassia grandifolia	Large-leaved Grass-of-parnassus			G3	S2
Paronychia americana	American Nailwort			G3G4	SNR
Paspalum bifidum	Bead-grass			G5	S2
Pellaea atropurpurea	Purple-stem Cliff-brake			G5	S1
Pellaea wrightiana	Cliff-brake Fern			G5	S1
Peltandra sagittifolia	Spoon-flower			G3G4	S2
Phacelia bipinnatifida	Fernleaf Phacelia			G5	S1
Philadelphus hirsutus	Streambank Mock-orange			G5	S2
Physostegia leptophylla	Slender-leaved Dragon-head			G4?	SNR
Pieris phillyreifolia	Climbing Fetter-bush			G3	S1

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Pilea fontana	Springs Clearweed			G5	SNR
Pinckneya pubens	Hairy Fever-tree			G4	S1
Pityopsis pinifolia	Pine-leaved Golden Aster			G4	S2
Plantago sparsiflora	Pineland Plantain			G3	S2
Platanthera integra	Yellow Fringeless Orchid			G3G4	S1
Platanthera integrilabia	White Fringeless Orchid	C: Candidate		G2G3	S1
Platanthera lacera	Green-fringe Orchis			G5	S2
Platanthera peramoena	Purple Fringeless Orchid			G5	SX
Pleea tenuifolia	Rush False-asphodel			G4	SX
Poa alsodes	Blue-grass			G4G5	S1?
Polygala hookeri	Hooker's Milkwort			G3	S1
Polygala nana	Dwarf Milkwort			G5	S1
Polygala paucifolia	Gay-wing Milkwort			G5	S2
Ponthieva racemosa	Shadow-witch Orchid			G4G5	S2
Portulaca smallii	Small's Purslane			G3	S1?
Portulaca umbraticola	Wing-podded Purslane			G5	S1
Potamogeton confervoides	Algae-like Pondweed			G4	S1
Potamogeton foliosus	Leafy Pondweed			G5	SNR
Prunus alabamensis	Alabama Black Cherry			G4	S1
Psilotum nudum	Whisk Fern			G5	S1
Pteroglossaspis ecristata	Crestless Plume Orchid			G2G3	S2
Ptilimnium nodosum	Harperella	LE: Endangered		G2	S1
Pycnanthemum montanum	Single-haired Mountain-mint			G3G5	S3
Pycnanthemum nudum	Pinelands Mountain Mint			G5?	S1
Pyxidanthera barbulata	Well's Pyxie Moss			G4	S2
Pyxidanthera brevifolia	Well's Pixie-moss			G3	S1
Quercus austrina	Bluff Oak			G4?	S1
Quercus bicolor	Swamp White Oak			G5	S1
Quercus georgiana	Georgia Oak			G3	S1
Quercus myrtifolia	Myrtle-leaf Oak			G5	S1
Quercus oglethorpensis	Oglethorpe's Oak			G3	S3
Quercus similis	Bottom-land Post Oak			G4	S1
Quercus sinuata	Durand's White Oak			G4G5	S2
Ranunculus fascicularis	Early Buttercup			G5	S1
Ratibida pinnata	Gray-head Prairie Coneflower			G5	S1
Rhapidophyllum hystrix	Needle Palm			G4	S1

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Rhexia aristosa	Awned Meadowbeauty			G3G4	S3
Rhexia cubensis	West Indian Meadow-beauty			G4G5	S1
Rhododendron catawbiense	Catawba Rhododendron			G5	S1
Rhododendron eastmanii	May White			G2	S2
Rhododendron flammeum	Piedmont Azalea			G3	S3
Rhus michauxii	Michaux's Sumac	LE: Endangered		G2G3	SX
Rhynchospora alba	White Beakrush			G5	S1
Rhynchospora breviseta	Short-bristle Baldrush			G3G4	S1
Rhynchospora careyana	Horned Beakrush			G4?Q	S3
Rhynchospora cephalantha var. *attenuata*	Pocosin Beaksedge			G5T3?	S1
Rhynchospora globularis var. *pinetorum*	Beakrush			G5?T3?	S1
Rhynchospora harperi	Harper Beakrush			G4?	S1
Rhynchospora inundata	Drowned Hornedrush			G4?	S2?
Rhynchospora leptocarpa	Narrow-fruited Beaksedge			G3	S1
Rhynchospora macra	Beak Rush			G3	S1
Rhynchospora oligantha	Few-flowered Beaked-rush			G4	S2
Rhynchospora pallida	Pale Beakrush			G3	S1
Rhynchospora pleiantha	Brown Beaked-rush			G2G3	S1
Rhynchospora scirpoides	Long-beaked Baldrush			G4	S1
Rhynchospora stenophylla	Chapman Beakrush			G4	S2
Rhynchospora tracyi	Tracy Beakrush			G4	S3
Ribes echinellum	Miccosukee Gooseberry	LT: Threatened		G1	S1
Rorippa sessiliflora	Stalkless Yellowcress			G5	SNR
Rudbeckia heliopsidis	Sun-facing Coneflower			G2	S1S2
Rudbeckia mollis	Soft-hair Coneflower			G3G5	S1
Ruellia caroliniensis ssp. *ciliosa*	Sandhills Wild Petunia			G5T3T5	S1
Ruellia pedunculata ssp. *pinetorum*	Stalked Wild Petunia			G5T3T4	SH
Sabatia bartramii	Bartram's Rose-gentian			G4G5	S1
Sabatia kennedyana	Plymouth Gentian			G3	S2
Sageretia minutiflora	Tiny-leaved Buckthorn			G4	S3
Sagittaria fasciculata	Bunched Arrowhead	LE: Endangered		G2	S2
Sagittaria graminea var. *weatherbiana*	Grassleaf Arrowhead			G5T3T4	S1
Sagittaria isoetiformis	Slender Arrow-head			G4?	S3

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Sanguisorba canadensis	Canada Burnet			G5	S1
Sanicula trifoliata	Large-fruited Sanicle			G4	S1
Sarracenia rubra	Sweet Pitcher-plant			G4	S3S4
Sarracenia rubra ssp. *jonesii*	Mountain Sweet Pitcher-plant	LE: Endangered		G4T2	S1S2
Saxifraga careyana	Carey Saxifrage			G3	S1
Saxifraga micranthidifolia	Lettuce-leaf Saxifrage			G5	S2
Schoenolirion croceum	Yellow Sunnybell			G4	S1
Schoenoplectus erectus ssp. *raynalii*	Sharp-scale Bulrush			G4G5T4T5	SNR
Schwalbea americana	Chaffseed	LE: Endangered		G2G3	S2
Scirpus cespitosus var. *callosus*	Tussock Bulrush			G5TNR	SNR
Scirpus etuberculatus	Canby Bulrush			G3G4	SNR
Scirpus subterminalis	Water Bulrush			G4G5	SNR
Scleria baldwinii	Baldwin Nutrush			G4	S2
Scleria reticularis	Reticulated Nutrush			G4	S1
Scutellaria parvula	Small Skullcap			G4	S2S3
Sedum pusillum	Granite Rock Stonecrop			G3	S2
Senecio millefolium	Piedmont Ragwort			G2	S2
Shortia galacifolia	Oconee-bells			G2G3	S3
Sideroxylon lanuginosum	Gum Bumelia			G4G5	S1
Sideroxylon reclinatum	Gum Bully			G4G5	S1
Silene ovata	Ovate Catchfly			G3	S1
Silphium terebinthinaceum	Prairie Rosinweed			G4G5	S1
Sisyrinchium dichotomum	Reflexed Blue-eyed Grass	LE: Endangered		G2	S1
Smilax biltmoreana	Biltmore Greenbrier			G4	S2
Solidago auriculata	Eared Goldenrod			G4	S1
Solidago bicolor	White Goldenrod			G5	S2
Solidago ptarmicoides	Prairie Goldenrod			G5	SNR
Solidago pulchra	Carolina Goldenrod			G3	S1
Solidago rigida	Prairie Goldenrod			G5	S1
Solidago verna	Spring-flowering Goldenrod			G3	S2
Spiranthes laciniata	Lace-lip Ladies'-tresses			G4G5	S1S2
Spiranthes longilabris	Giant Spiral Ladies'-tresses			G3	S1
Sporobolus curtissii	Pineland Dropseed			G3	S1
Sporobolus floridanus	Florida Dropseed			G3	S1
Sporobolus pinetorum	Carolina Dropseed			G3	S2
Sporobolus teretifolius	Wire-leaved Dropseed			G2	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Stachys clingmanii	Clingman's Hedge-nettle			G2	S1
Stachys latidens	Broad-toothed Hedge-nettle			G4G5	S2
Stachys tenuifolia	Smooth Hedge-nettle			G5	S1
Stewartia ovata	Mountain Camellia			G4	S2
Stillingia aquatica	Corkwood			G4G5	S2
Stylisma pickeringii var. *pickeringii*	Pickering's Morning-glory			G4T3	S1
Symphyotrichum elliotii	Elliott's Aster			G4	S3
Symphyotrichum georgianum	Georgia Aster	C: Candidate		G3	SNR
Symphyotrichum laeve	Smooth Blue Aster			G5	SNR
Symphyotrichum novae-angliae	New England Aster			G5	SNR
Syngonanthus flavidulus	Yellow Pipewort			G5	S2
Talinum mengesii	Menge's Fame-flower			G3	SNR
Thalia dealbata	Powdery Thalia			G4	S2
Thalictrum subrotundum	Reclined Meadow-rue			G1G2Q	S1S2
Thelypteris ovata var. *ovata*	Ovate Marsh Fern			G3G5T3T4	S1
Thermopsis mollis	Soft-haired Thermopsis			G4?	S1
Tiarella cordifolia	Heart-leaved Foam-flower			G5	SNR
Tiarella cordifolia var. *cordifolia*	Heart-leaved Foam Flower			G5T5	S2
Tofieldia glabra	White False-asphodel			G4	S1S2
Torreyochloa pallida	Pale Manna Grass			G5	S1
Tradescantia virginiana	Virginia Spiderwort			G5	S1
Trautvetteria caroliniensis	Carolina Tassel-rue			G5	S3
Trepocarpus aethusae	Aethusa-like Trepocarpus			G4G5	S1
Trichomanes boschianum	Bristle-fern			G4	S1
Trichomanes petersii	Dwarf Filmy-fern			G4G5	S2
Trichostema sp. 1	Dune Bluecurls			G2	SNR
Tridens carolinianus	Carolina Fluff Grass			G3G4	S1
Tridens chapmanii	Chapman's Redtop			G3	S1
Tridens strictus	Long-spike Fluff Grass			G5	S1
Trillium discolor	Faded Trillium			G4	S4
Trillium grandiflorum	Large-flower Trillium			G5	S1
Trillium lancifolium	Narrow-leaved Trillium			G3	S1
Trillium oostingii	Wateree Trillium			G1	S1
Trillium persistens	Persistent Trillium	LE: Endangered		G1	S1
Trillium pusillum var. *pusillum*	Least Trillium			G3T2	S1
Trillium reliquum	Relict Trillium	LE: Endangered		G3	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Trillium rugelii	Southern Nodding Trillium			G3	S2
Trillium simile	Sweet White Trillium			G3	S1S2
Trillium undulatum	Painted Trillium			G5	S2
Triphora trianthophora	Nodding Pogonia			G3G4	S2
Urtica chamaedryoides	Weak Nettle			G4G5	S2
Utricularia floridana	Florida Bladderwort			G3G5	S2
Utricularia macrorhiza	Greater Bladderwort			G5	S1
Utricularia olivacea	Piedmont Bladderwort			G4	S2
Vaccinium crassifolium	Creeping Blueberry			G4G5	SNR
Vaccinium crassifolium ssp. *sempervirens*	Rayner's Blueberry			G4G5T1	S1
Vallisneria americana	Eel-grass			G5	S1
Verbena simplex	Narrow-leaved Vervain			G5	S1
Veronicastrum virginicum	Culver's-root			G4	S1
Viola conspersa	American Bog Violet			G5	S1
Viola pubescens var. *leiocarpon*	Yellow Violet			G5T5	S2
Viola tripartita	Three-parted Violet			G5	SNR
Viola tripartita var. *glaberrima*	Smooth Three-parted Violet			G5T3?	S1
Viola tripartita var. *tripartita*	Three-parted Violet			G5T3	S3
Waldsteinia lobata	Piedmont Strawberry			G2G3	S3
Warea cuneifolia	Nuttall Warea			G4	S1
Xerophyllum asphodeloides	Eastern Turkeybeard			G4	S2
Xyris brevifolia	Short-leaved Yellow-eyed Grass			G4G5	S1
Xyris chapmanii	Chapman's Yellow-eyed Grass			G3	S1
Xyris difformis var. *floridana*	Florida Yellow-eyed Grass			G5T4T5	S2
Xyris elliottii	Elliott Yellow-eyed Grass			G4	S2
Xyris flabelliformis	Savannah Yellow-eyed Grass			G4	S1
Xyris scabrifolia	Harper's Yellow-eyed Grass			G3	S1
Xyris serotina	Acid-swamp Yellow-eyed Grass			G3G4	S1
Xyris stricta	Pineland Yellow-eyed Grass			G4	S1
Xyris torta	Twisted Yellow-eyed-grass			G5	S1
Nonvascular Plants					
Aneura maxima	Aneura			G4?	SNR
Cheilolejeunea evansii	Evan's Cheilolejeunea			G1G2	S1
Jungermannia fossombronioides	Jungermannia			G4	SNR
Lophocolea appalachiana	Appalachian Lophocolea			G1G2Q	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Pellia appalachiana	Appalachian Pellia			G4	S1
Plagiochila caduciloba	Gorge Leafy Liverwort			G2	S1
Plagiomnium carolinianum	Mountain Wavy-leaf Moss			G3	S1
Porella japonica ssp. *appalachiana*				G5?T1	S1
Rhizomnium appalachianum	Large-leaved Mnium			G5	SNR
Fungus					
Gymnoderma lineare	Rocky Gnome Lichen	LE: Endangered		G3	S1
Communities					
Atlantic coastal plain depression meadow	Depression Meadow			G5	SNR
Atlantic maritime dry grassland	Maritime Grassland			G3G4	SNR
Atlantic white cedar swamp				G2	S2
Bald cypress - swamp blackgum swamp	Bald Cypress - Tupelo Gum Swamp			G5	SNR
Bald cypress - tupelo gum swamp				G5	S4
Bald cypress - water tupelo swamp	Bald Cypress - Tupelo Gum Swamp			G5	SNR
Barrier island pond complex	Interdune Pond			G3	SNR
Basic forest				GNR	S2
Bay forest				G3G4	S3
Bay forest (allard)	Bay Forest			G5	SNR
Beech - magnolia forest	Beech - Magnolia Hammock			G4	SNR
Beech - magnolia hammock				G5?	S1?
Bottomland hardwoods				G5	S4
Brackish marsh				G5	S5
Brackish marsh (allard)	Brackish Marsh			G5	SNR
Carya glabra - tilia americana var. *caroliniana - acer barbatum / trillium maculatum* forest	Pignut Hickory - Southern Basswood - Southern Sugar Maple / Mottled Trillium Forest			G2G3	SNR
Celtis laevigata - tilia americana var. *caroliniana / aesculus pavia* forest	Sugarberry - Southern Basswood / Red Buckeye Forest			G1G3	SNR
Chestnut oak forest				G5	S4S5
Coastal plain small depression pond complex	Swamp Tupelo Pond and Pond Cypress Pond			G5	SNR
Cove forest				G5	S4
Depression meadow				G3	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Diamorpha smallii - Minuartia glabra - Minuartia uniflora - Cyperus granitophilus Herbaceous Vegetation	Piedmont Granitic Flatrock Glade, Annual Succulent Zone			GNR	SNR
Estuarine intertidal mud flat	Intertidal Mud/sand Flat			G5	SNR
Fagus grandifolia - (*liquidambar styraciflua*) / *oxydendrum arboreum* / *kalmia latifolia* forest	Piedmont/coastal Plain Beech - Mountain Laurel Slope Forest			G3?	SNR
Fagus grandifolia - quercus alba - (*acer barbatum*) / mixed herbs forest	Atlantic Coastal Plain Mesic Mixed Hardwood Forest			G4	SNR
Fagus grandifolia - quercus nigra forest	Coastal Plain Mesic Beech - Water Oak Forest			G3	SNR
Hemlock forest				G5	S4
High elevation seep				G3	S3
High pocosin	Pocosin			G3G4	SNR
Hillside herb bog				G1	S1
Interdune pond				G3	S1
Interior freshwater marsh				G3	SNR
Interior upland dry mesic oak - hickory forest	Oak - Hickory Forest			G5	SNR
Intertidal beach				G5	S3
Intertidal mud/sand flat				G5	S5
Juniperus virginiana var. *silicicola - zanthoxylum clava-herculis - quercus virginiana* - (*sabal palmetto*) / *sageretia minutiflora* - (*sideroxylon tenax*) woodland	South Atlantic Coastal Shell Midden Woodland			G2?	SNR
Limestone sink				G3	S1S2
Limestone sinkhole				GNR	SNR
Liriodendron tulipifera - tilia americana var. *heterophylla* - (*aesculus flava*)/*actaea racemosa* forest	Southern Appalachian Cove Forest			G4	SNR
Longleaf pine flatwoods				GNR	SNR
Magnolia forest				G2	S2
Maritime dune shrub thicket	Maritime Shrub Thicket			G4	SNR
Maritime forest				G2	S2
Maritime grassland				G3G4	S2

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Maritime shrub thicket				G4	S2S3
Marl forest				G1	S1
Mesic mixed hardwood forest				G5	S4
Middens				GNR	S3
Mollusk reef	Oyster Reef			G5	SNR
Monadnock forest				GNR	SNR
Montmorillonite forest				G3G4	S2
Non-alluvial swamp forest				G5	S4S5
Nonriverine swamp forest	Non-alluvial Swamp Forest			G5	SNR
Non-riverine wet hardwood forest				G4	SNR
Nyssa aquatica - nyssa biflora forest	Water Tupelo - Swamp Blackgum Swamp Forest			G4G5	SNR
Nyssa biflora - (*acer rubrum*) / *ilex opaca* / *leucothoe axillaris* / *carex atlantica* ssp. *capillacea* forest	Swamp Blackgum Floodplain Seepage Forest			G2G3	SNR
Nyssa biflora - acer rubrum var. *rubrum* / *lyonia lucida* forest	Sandhills Swamp Blackgum Floodplain Forest			G3G4	SNR
Oak - hickory forest				G5	S5
Open water lake				GNR	SNR
Piedmont seepage forest				G2	S1
Pine - oak heath				G5	S3
Pine - saw palmetto flatwoods				G4	S2
Pine - scrub oak sandhill				G4	S4
Pine flatwoods				G5	S3S4
Pine savanna				G3	S2
Pinus palustris - pinus (*echinata, taeda*) - *quercus* (*incana, margarettiae, falcata, laevis*) woodland	Longleaf Pine - (Shortleaf Pine, Loblolly Pine) - (Bluejack Oak, Sand Post Oak, Southern Red Oak, Turkey Oak) Forest			G3?	SNR
Pinus palustris - pinus serotina / ctenium aromaticum - muhlenbergia expansa - carphephorus odoratissimus woodland	Longleaf Pine / Pond Pine Savanna, Wet Spodosol Variant			G3	SNR
Pinus palustris / quercus laevis - quercus incana / aristida beyrichiana - baptisia perfoliata woodland	South Atlantic Xeric Longleaf Pine Sandhill			G2G3	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Pinus palustris / *Quercus laevis* / *Leiophyllum buxifolium* - *Cyrilla racemiflora* - *Clethra alnifolia* Woodland	Sandstone/Gravel Longleaf Pine Woodland			G1	SNR
Pinus serotina - (*liriodendron tulipifera*) / *lyonia lucida* - *clethra alnifolia* - *ilex glabra* woodland	Pond Pine - (Tuliptree) / Shining Fetterbush - Coastal Sweet-pepperbush - Little Gallberry Woodland			GNR	SNR
Pinus serotina / *arundinaria gigantea* ssp. *tecta* woodland				G1	SNR
Pocosin				G3G4	S3S4
Pond cypress pond				G4	S4
Pond cypress savanna				G3	S2
Pond pine woodland				G4G5	S3
Quercus alba - *carya alba* / *euonymus americana* / *hexastylis arifolia* forest	Mesic Subacid Southern Piedmont Oak - Hickory Forest			G5?	SNR
Quercus alba - *carya alba* / *vaccinium elliottii* forest	Acidic Dry-mesic Coastal Plain White Oak Forest			G5?	SNR
Quercus alba - *carya glabra* - *carya alba* / *aesculus pavia* forest	Basic Mesic Coastal Plain Oak - Hickory Forest			G4?	SNR
Quercus alba - *carya glabra* / mixed herbs coastal plain forest	Acid Mesic Coastal Plain Oak - Hickory Forest			G4?	SNR
Quercus hemisphaerica - *carya glabra* - (*fagus grandifolia*) forest				G4?	SNR
Quercus hemisphaerica - *magnolia grandiflora* - *carya* (*glabra, pallida*) / *vaccinium arboreum* / *chasmanthium sessiliflorum* forest	Sand Laurel Oak - Mixed Hardwood Upland Forest			G3G4	SNR
Quercus lyrata - *quercus laurifolia* - *taxodium distichum* / *saururus cernuus* forest	Overcup Oak - Diamondleaf Oak - Bald-cypress Blackwater Bottomland Forest			G3G5	SNR
Rhododendron thicket				G5	S5
Salt flat				G5	S5
Salt flat (allard)	Salt Flat			G5	SNR
Salt marsh				G5	S5
Salt marsh (allard)	Salt Marsh			G5	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Salt shrub thicket				G5	S5
Salt shrub thicket (allard)	Salt Shrub Thicket			G5	SNR
Saxifraga michauxii Herbaceous Vegetation	Low-Elevation Rocky Summit (Acidic Type)			GNR	SNR
Seepage pocosin				G3	S1S2
Shoal and stream bar				GNR	SNR
Small stream forest				G5	S5
South atlantic barrier island forest	Maritime Forest			G2	SNR
South atlantic inland maritime forest	Maritime Forest			G2	SNR
Southeastern coastal plain subxeric pine-scrub oak sandhill	Pine-scrub Oak Sandhill			G4G5	SNR
Southern mixed hardwood forest				GNR	S1
Southern mixed hardwood forest, allard	Mesic Mixed Hardwood Forest			G5	SNR
Southern wild rice riverbed herbaceous vegetation				G2?	SNR
Spray cliff				G3	S3
Spruce pine - mixed hardwood forest				G3	S2
Spruce pine / mixed hardwood				GNR	SNR
Streamhead pocosin				G4	S4
Successional loblolly pine - hardwood forest				GNR	SNR
Sugarberry - american elm - green ash bottomland hardwoods forest	Bottomland Hardwoods			G5	SNR
Swale pocosin				G2?	S2?
Swamp tupelo pond				G3	S3
Swamp tupelo pond forest	Swamp Tupelo Pond			G5	SNR
Sweetgum - mixed bottomland oak forest	Bottomland Hardwoods			G4G5	SNR
Taxodium distichum - nyssa aquatica / fraxinus caroliniana forest				G5?	SNR
Temperate shell midden woodland	Middens			G3G4	SNR
Tidal bald cypress - tupelo gum swamp				G3	S3
Tidal freshwater marsh				G3	S3
Tidal freshwater marsh (allard)	Tidal Freshwater Marsh			G3	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Tsuga canadensis - liriodendron tulipifera - betula lenta / rhododendron maximum forest	Southern Appalachian Acid Cove Forest			G5	SNR
Tupelo swamp	Bald Cypress - Tupelo Gum Swamp			GNR	SNR
Upland bog				GNR	SNR
Upland depression swamp forest				G3	S1S2
Upland pine - wiregrass woodland				G3	S3
Willow oak forest	Bottomland Hardwoods			G4G5	SNR
Xeric sandhill scrub				G5	S3
Yaupon - live/sand live oak - wax-myrtle - saw palmetto shrubland				G3?	SNR
Yaupon - live/sand live oak - wax-myrtle - saw palmetto shrubland				G3?	SNR
Geological					
Calcareous cliff				G3?	S1S2
Carolina bay				GNR	SNR
Granitic dome				G3	S3
Granitic flatrock				G3	S2
Levee				G4G5	S3S4
Monadnock				GNR	SNR
Outcrop				GNR	SNR
Sandstone outcrop				GNR	SNR
Waterfall				GNR	SNR

APPENDIX H

TOTAL SUSPENDED SOLIDS (TSS) MONITORING PLAN

TOTAL SUSPENDED SOLIDS (TSS) MONITORING PLAN

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

October 2017

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TOTAL SUSPENDED SOLIDS (TSS)
MONITORING PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former manufactured gas plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will prevent direct contact with the TLM material in the near-shore areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment.

The capping project is designed to be mostly non-intrusive in nature and is not expected to regularly generate a significant amount of sediment. However, sediment will be disturbed during construction and monitoring and controlling TSS levels will be an important component of the project. The project will entail removal of a small sand bar, as described in the Sediment Capping Work Plan (SCWP), construction of access points for material and equipment and placement of the ACB mats. The planned location of the excavation (sand bar) and capping areas are shown on Figure 2. TSS monitoring will be conducted at various locations during these activities, as described below.

TSS MONITORING PLAN OBJECTIVE

The objective of this TSS Monitoring Plan is to ensure that the cap construction operations do not directly cause the addition of significant or uncontrolled amounts of suspended solids within the Congaree River that exceed bench marks established within this plan. SCE&G has experience successfully conducting river-based construction activities at another MGP site in South Carolina and does not anticipate that this project will generate significant levels of TSS, above permissible limits. Implementation of this Plan will provide a means to measure, collect and document real-time TSS information and compare the results to conservative action levels as described herein. This Plan also establishes the appropriate response/mitigation activities to be implemented in the event that elevated readings are observed during river-based construction activities.

TSS MONITORING PLAN CONTENTS

The TSS monitoring plan consists of the following:

- Establishment of a mixing zone;
- Determination of a background and action level for TSS exceedances;
- Description of real-time field measurements of TSS to be obtained during river-based construction activities that have the potential to generate or liberate sediment;
- Actual background monitoring of TSS; and
- Contingency and mitigation procedures to implement if it is determined that site-related activities are contributing to a significant increase in TSS concentrations.

TSS CONTROLS - SILT CURTAIN AND/OR SAND BAG BERM

TSS controls will likely involve deployment of a floating silt curtain and/or large sand bags to act as a barrier to downstream movement of dislodged sediment. For example, a silt curtain will be deployed around the active work area prior to any excavation or construction activities to help prevent downstream migration of sediment. A berm made of large sand bags may also be utilized instead of, or in addition to, the silt curtain depending on current river conditions. The sand bag berm would be placed directly downstream of the active work area, perpendicular to the flow direction and serve the same function as the silt curtain, which is to contain released sediment within the general work area.

TSS "BENCH MARK" LEVEL FOR THE PROJECT AREA

Table 1 provides historical analytical results for TSS measured by SCDHEC from February 1999 to December 2000 at water quality monitoring stations CSB-001L and CSB-001R (located just south of the Blossom Street Bridge). These water quality monitoring locations are shown on Figure 3. This is the most recent TSS data available at the time of work plan development.

The historical data was utilized to develop an average TSS concentration for that timeframe and will serve as an initial "bench mark" concentration level for the Congaree River Sediments Project. The Congaree River exhibits highly variable flow rates and corresponding TSS concentrations based on many factors including: the large drainage basin; upstream precipitation events; and runoff from upstream sources for both the Broad River and the Saluda River. During the timeframe noted above, the bench mark TSS measurements ranged from 1.2 mg/L to 42 mg/L with an average concentration of 6.2 mg/L.

Due to this large variability of TSS levels, exceedance of the bench mark level (TSS > 6.2 mg/L) likely occurs on a regular basis. Therefore, SCE&G proposes to utilize this average concentration as the bench mark level that will trigger more frequent TSS monitoring activities at pre-defined locations within the project area, as discussed below.

MEASUREMENT OF TSS

SCE&G plans to conduct real-time monitoring of TSS concentrations in various locations within the project area during various construction activities (e.g. sand bar excavation and cap installation). In general, the following areas will be monitored:

- A downstream location;
- An upstream (background) zone;
- The active construction work area; and
- The mixing zone.

The area located directly downriver of the active work zone, and below the mixing zone, will be the most representative location to collect the real-time TSS data. Figure 4 provides a monitoring scenario with an active work zone located at the tip of the alluvial fan as an example of potential monitoring locations. This area will change as the ongoing construction activities progress and as a result, the mixing zone and monitoring locations will need to be transient.

The downstream location will be evaluated first. If the TSS readings are less than 6.2 mg/L, then no additional monitoring is required for that period. If the readings are greater than 6.2mg/L, the following areas will be evaluated. The frequency of collecting measurements is also discussed below.

MIXING ZONE

Directly downstream of the silt curtain and/or sandbag berm will be a mixing zone where a limited amount of disturbed sediment will likely pass through the control measures and will move away from the project area. The silt curtain and sand bag berm will be maintained to prevent any significant releases, but due to the nature of the project area and the river flow, some minor sediment movement from the work area is expected. Therefore, a mixing zone of approximately 700 feet in length will be established downstream of the active work zone. The mixing zone length is based on the average river width along the project area. TSS levels in the mixing zone will be monitored but periodic elevated levels and spikes will be acceptable as long as the downstream monitoring location does not exceed the action level. It is anticipated that as disturbed sediment moves down river with the current, the sediment will settle out. The remainder of this TSS Plan addresses sediment impacts outside of the mixing zone.

ACTION LEVEL TRIGGERS

Generally, as the river elevation increases so does TSS due to these upstream effects. Therefore, the objective of this Plan is to determine when the increase in TSS levels are a result of construction activities related to the sediment capping project and result in “action level” triggers. Subsequently, a “background” reading will be collected directly upstream of the project area when the initial bench mark level of 6.2mg/L is exceeded. Background level measurements may not be collected if readings downstream of the work area are below 6.2 mg/L. This data will be critical in determining if an elevated TSS reading is due to project-related activities. As a side note, when river levels are elevated, and sediment loads are heavy, there will likely be no in-the-river construction activities due to adverse working conditions.

For the purposes of this project, SCE&G proposes that an “action level” or significant increase in TSS concentration is defined as a reading of 25% higher than the “background” monitoring results. Measuring equipment and procedures are defined later in this Plan. In summary, upstream (background) data will be compared with downstream monitoring results, measured after the mixing zone allowance. If downstream TSS concentrations are less than 1.25 times the upstream results, then work can proceed. If

the downstream TSS levels are greater than 1.25 times the upstream background measurement, then work will cease (i.e. a Stop Work Order will be issued) and contingency measures will be employed.

If a significant increase is noted between comparison of the upstream (background) and downstream concentrations, then mitigation/control measures will be implemented as described below. Exceedance of the action level below the mixing zone must be a sustained reading for at least 15 minutes. Transient readings, or one time "spikes" will not constitute a Stop Work Order. Also, if an action level exceedance can be attributed to a non-project-related condition, or unusual, natural or man-made event, the exceedance will be recorded in the field notes and no contingency measures will be employed and work may continue.

The following scenarios are provided to illustrate the potential monitoring and mitigation activities.

Scenario 1 – Bench Mark Readings < 6.2 mg/L

If the downstream "bench mark" TSS monitoring activities produce results below 6.2 mg/L, work will continue as planned without mitigation measures. Continued real-time monitoring and visual observations of river conditions directly downstream of the active work zone and the mixing zone will continue to be conducted on a daily basis as the project progresses. Background monitoring will not be necessary.

Scenario 2 – Bench Mark Readings > 6.2 mg/L but <1.25 X Background

Exceedance of the "bench mark" level will trigger additional background monitoring (above the project area) for comparison to the downstream monitoring data. If the downstream TSS monitoring activities produce results above 6.2 mg/L, but below 1.25 times the background level, work will continue as planned without mitigation measures. Continued real-time monitoring and visual observations of river conditions directly downstream of the active work zone and the mixing zone will be conducted daily as the project progresses.

Scenario 3 – Bench Mark Readings > than 1.25 X Background

If the downstream TSS monitoring activities produce consistent (sustained for 15 minutes) results above 1.25 times the background (above the work area) level, a Stop Work Order will be implemented, and mitigation/control measures will be employed, as described below. Downstream and background monitoring will continue, and mitigation measures remain in place until TSS concentrations below the mixing zone are reduced to less than 1.25 times the background concentration or below 6.2 mg/L for a period of two hours.

TSS INSTRUMENTATION

To fulfill the monitoring requirements and objectives, SCE&G currently anticipates utilizing a combination of instruments and techniques. Measurements will be obtained by either a hand-held instrument and/or remote monitoring equipment positioned in the river. Since the river is readily accessible from the shoreline, site personnel will be able to wade into the shallow water and collect readings via a hand-held TSS meter. The data will be downloaded or manually recorded. If the water is too deep, site personnel may use a small boat or kayak to collect the data. As a third option, a wireless buoy system may be employed. Examples of the proposed monitoring instruments are described below, and additional information is provided in Attachment A.

Hand-Held Instrumentation

As currently planned, the Royce Model 711 portable Suspended Solids / Interface Level analyzer or similar hand-held instrument will be used to collect real-time measurements in the river. The instrument is a rugged and waterproof device that provides reliable operation in rivers, lakes and other aqueous environments. SCE&G has utilized this instrument to conduct TSS monitoring at previous MGP-related sediment remediation projects. Readings will be periodically obtained by project oversight personnel by lowering the instrument's probe into the water column and recording the results in a field logbook or daily monitoring form.

Remote Buoy Mounted Instrumentation

Project personnel may utilize the buoy system when the hand-held instrument will not provide representative TSS information and/or the appropriate monitoring location is not readily accessible. The remote buoy will contain a portable monitoring instrument capable of conducting continuous TSS monitoring and transmitting the real-time data to shore where it can be viewed and compared to the applicable action level.

Currently SCE&G envisions utilizing the YSI EXO1 Sonde multiparameter portable instrument and the EXO Turbidity Sensor with TSS functionality. The EXO1 can continuously collect data and store it onboard the instrument, transfer it to a data collection platform (DCP), or relay it directly to a PC or EXO handheld device. Communication to the instrument is accomplished by using a field cable, Bluetooth® wireless connection, or a USB connection. Since the instrumentation will likely be staged or moored within the Congaree River and access may be limited or difficult, the Bluetooth® wireless connection will be the likely method for data transmission.

If the remote system is utilized, the data will be downloaded or collected on a periodic basis throughout the day by oversight personnel and compared to the action level. For both handheld and the remote system, an effort will be made to place the sensor at approximately the midpoint of the water column to obtain a representative sample.

The same instrumentation and techniques will be employed to conduct the background monitoring, if required. Handheld devices will likely be utilized, if possible, and the remote system will be installed if adequate and representative background TSS concentrations cannot be obtained using the handheld device.

Measurement Frequency

Pre-construction readings will be taken to document river TSS levels prior to commencement of activities. After construction activities begin for the day, the TSS readings will be obtained at approximate two-hour intervals. Either handheld readings will be conducted by field personnel or the remote buoy will be deployed, and the data downloaded or checked on the two-hour intervals. Monitoring will continue at this frequency while work is being conducted and one final reading will be obtained after activities are completed for the day to document post-construction conditions. If the action level is exceeded at any point during the day, background monitoring will be initiated, and the results compared to determine if mitigation measures are required.

If the downstream readings are less than the 1.25 times background threshold, work will continue, and downstream monitoring frequencies will remain at the approximate two-hour frequency. If the 1.25 times background threshold is exceeded, the appropriate mitigation measures will be employed, and monitoring will be conducted on an hourly basis until work is completed for the day or the action levels are no longer exceeded.

CONTINGENCY MEASURES

After an exceedance of the action level has been observed and it can be readily attributed to project activities, the following contingency measures will be implemented:

- A Stop Work Order will be issued to the construction contractor;
- An immediate inspection of the silt curtain and/or sand bag berm will be performed, and repairs or replacement will be made as appropriate;
- If the exceedance can be attributed to a damaged or dislocated silt curtain and repairs or redeployment are completed to the satisfaction of on-site personnel (QA/QC, regulatory agency representatives, or others) – work can then continue;
- If required, a second silt curtain will be deployed (outside of the first) and work will continue; and
- If the action level exceedance persists after the above measures have been implemented, another Stop Work Order will be issued, the situation will be re-evaluated by field personnel to determine additional contingency measures.

REPORTING

Daily reports of TSS monitoring results will be maintained on-site. Sustained action level exceedances, should they occur, and any subsequently implemented contingency measures will be communicated to the appropriate SCDHEC representative.

ATTACHMENTS

A Tables and Figures

B Proposed Monitoring Instruments Information

Attachment A

Table and Figures

TABLE 1

TSS CONCENTRATIONS IN MG/L AT
SCDHEC WATER QUALITY MONITORING STATIONS
LOCATED DOWNSTREAM OF THE BLOSSOM STREET BRIDGE
FEBRUARY 1999 THROUGH DECEMBER 2000

Congaree River Sediments
Columbia, South Carolina

Date Sampled	Monitoring Station	
	CSB-001L	CSB-001R
02/10/99	5.4	8
03/10/99	3	4.6
04/07/99	NA(1)	7.2
05/12/99	3.9	5.6
06/24/99	3.6	3.9
07/07/99	3.9	3.2
08/31/99	5.9	6.6
09/30/99	4.2	7.1
10/21/99	1.7	4.2
11/08/99	4.2	8.2
12/16/99	2	NA
01/05/00	NA	5.2
02/09/00	3	5.1
03/29/00	6.6	NA
04/12/00	2.7	4.3
05/16/00	3.1	4
06/15/00	42	5.8
07/19/00	2.8	2.8
08/10/00	2.1	1.5
09/20/00	4.2	4
10/25/00	1.2	1.8
11/15/00	3.2	14
12/13/00	39	NA

Average of both stations (mg/L): 6.2

Note:
(1) NA - not analyzed

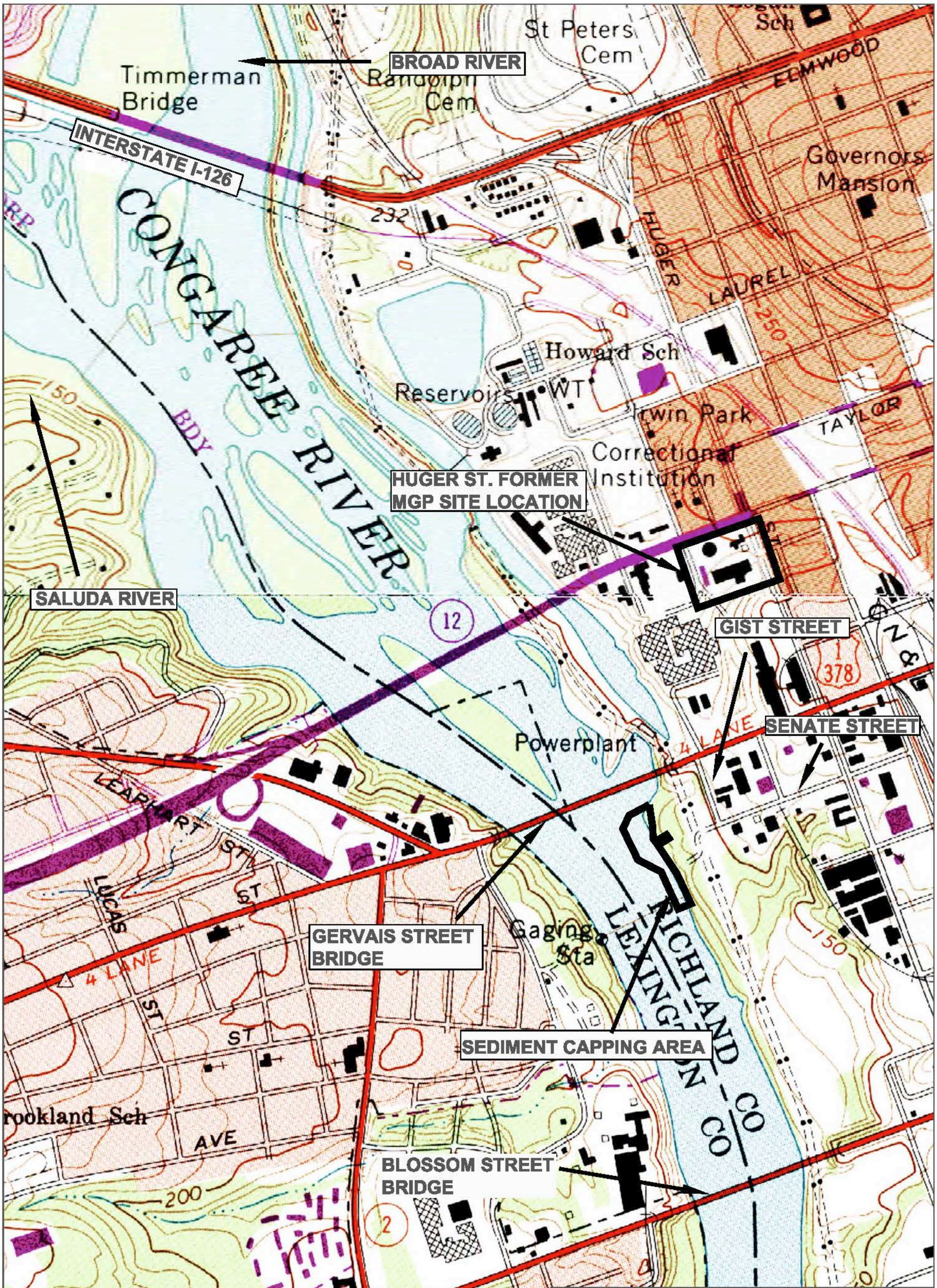


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

N

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

18"DIP

PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)

SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)

ACBs INSTALLED FOR EROSION CONTROL (APPROX. 6,000 sq ft)

CONGAREE RIVER

LEGEND

– APPROXIMATE EDGE OF RIVER

– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.

– BATHYMETRIC LINE (FEET NAVD '88) – 2010

– ARTICULATED CONCRETE BLOCK MATS (ACBs)

0' 40' 80' 120' 160'

(Feet Scale)

FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION AND COMPONENTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 1/4/2017 FILE NAME: CONG404

APEX COMPANIES, LLC

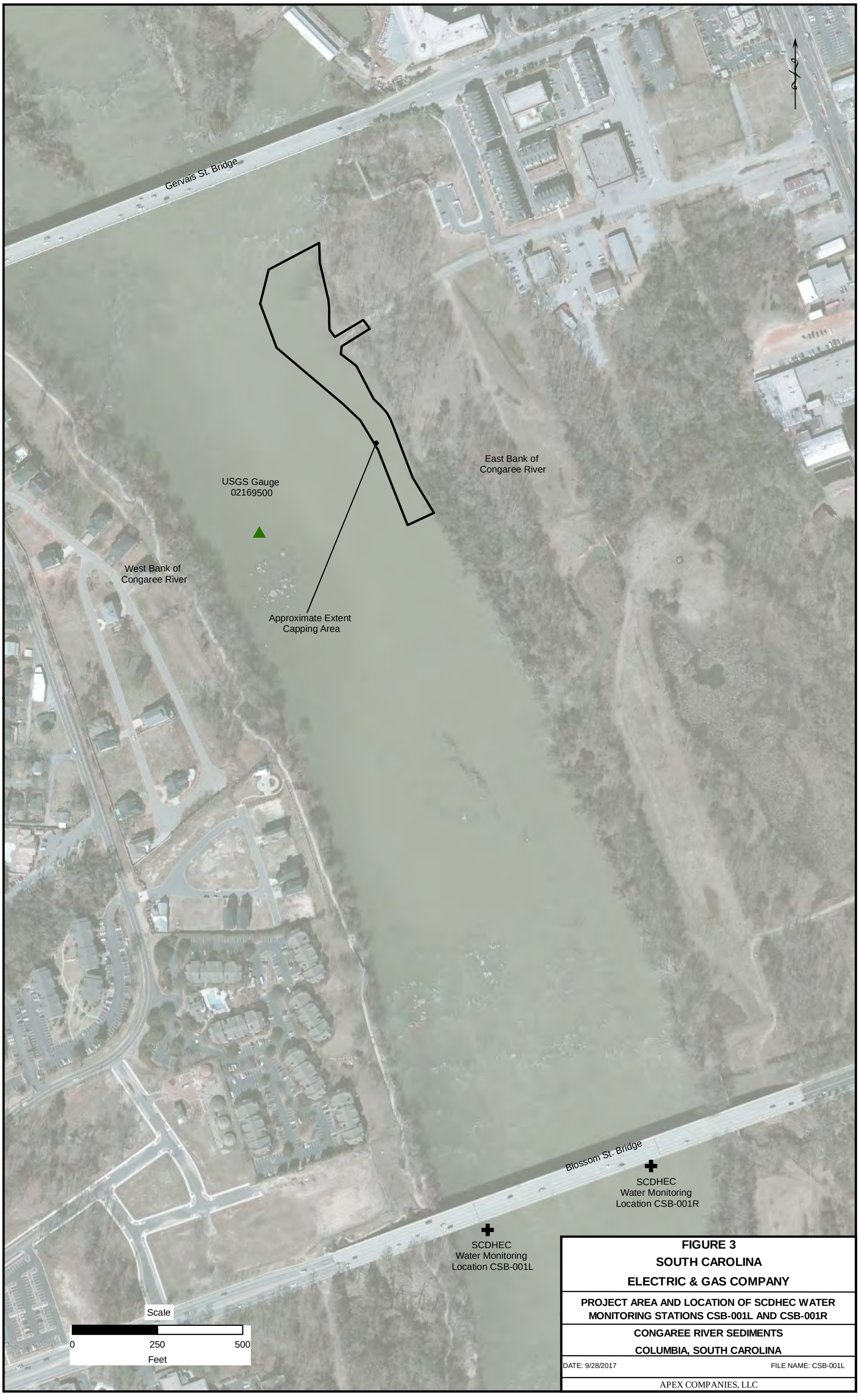


FIGURE 3

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

PROJECT AREA AND LOCATION OF SCDHEC WATER MONITORING STATIONS CSB-001L AND CSB-001R

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 9/28/2017 FILE NAME: CSB-001L

APEX COMPANIES, LLC

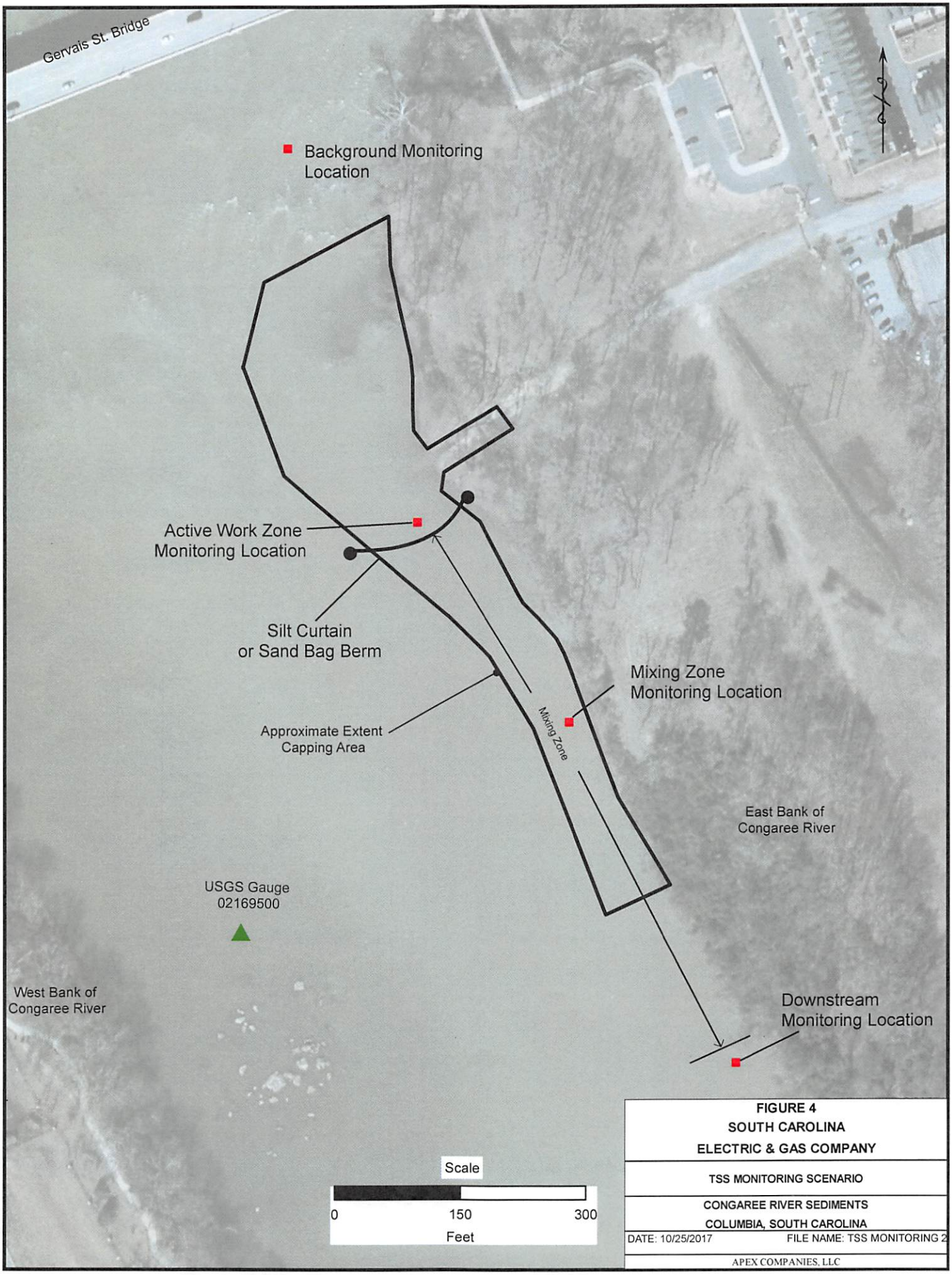


FIGURE 4
SOUTH CAROLINA ELECTRIC & GAS COMPANY

TSS MONITORING SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/25/2017 FILE NAME: TSS MONITORING 2

APEX COMPANIES, LLC

Attachment B

Proposed Monitoring Instruments Information

Enhance Data Collection with these EXO Components

EXO Handheld

The EXO handheld provides an extremely durable, portable, weather-proof interface to the EXO sondes. The handheld uses a mobile version of the KOR interface software.

Additional standard features:

- GPS
- Temperature-compensated barometer
- Backlit alphanumeric keypad
- Microphone/speaker
- Wet-mate wireless connector
- Bluetooth communication
- Color LED screen
- 2 GB of storage
- Rechargeable battery capable

Interface with the EXO Sonde using the EXO Handheld Display

KOR Interface Software

The KOR Software offers users the capability to easily manage, visualize, and organize large amounts of field data. KOR also provides an interface to the EXO products for fast calibration, configuration, QA/QC or data collection.

- New calibration processes for long-term monitoring
- Graphical user interface for quick data analysis
- Multiple languages

Multiple Data Output Options

Sonde output is readable by YSI handheld instruments, interface software, and data telemetry modules. In addition to the cable (standard), these communication interfaces are also available:

DCP Signal Output Adapter

Wires into the end of the YSI field cable via flying leads and converts signal to RS-232 or SDI-12 for datalogger applications.

DCP Signal Output Adapter

USB Adapter

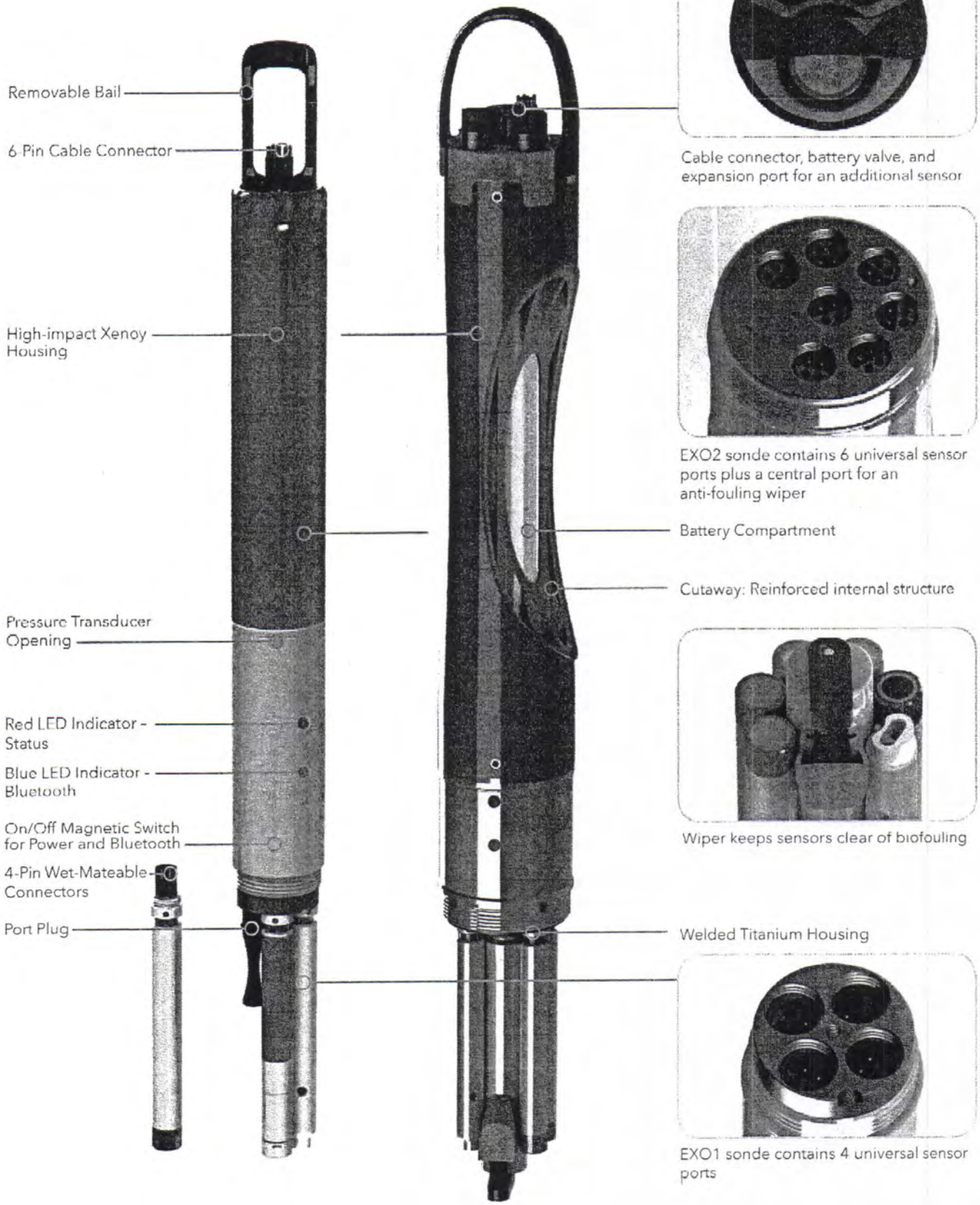
Allows connections between an EXO sonde and a PC.

USB Adapter

Bluetooth Wireless Technology

Enables communication between a sonde and a user in the lab and pre-deployment in the field.

Sondes: EXO1 EXO2



Instrument Specifications*

EXO1 Sonde		
Ports	4 sensor ports Peripheral port: 1 power communication port	
Size	Diameter: 4.70 cm (1.85 in) Length: 64.77 cm (25.50 in)	
Weight	1.42 kg (3.15 lbs) with 4 probes, guard and batteries installed	
EXO2 Sonde		
Ports	7 sensor ports (6 ports available when central wiper used) Peripheral ports: 1 power communication port; 1 auxiliary expansion port	
Size	Diameter: 7.62 cm (3.00 in) Length: 71.10 cm (28.00 in)	
Weight	3.60 kg (7.90 lbs) with 5 probes, guard and batteries installed	
Sondes		
Operating Temperature	-5 to 50°C	
Storage Temperature	-20 to 80°C (except 0 to 60°C for pH and pH/ORP sensors)	
Depth Rating	0 to 250 m (0 to 820 ft)	
Communications	Computer Interface: Bluetooth wireless technology, RS-485, USB Output Options: USB with signal output adapter (SOA); RS-232 & SDI-12 with DCP-SOA	
Sample Rate	Up to 4 Hz	
Battery Life	90 days**	
Data Memory	512 MB total memory; >1,000,000 logged readings	
Sensors		**Calculated Parameters**
Ammonium**	ORP	Salinity
Chloride**	pH	Specific Conductance
Conductivity	Temperature	Total Dissolved Solids
Depth	Total Algae (Chlorophyll + BGA-PC or PE**)	Total Suspended Solids
Dissolved Oxygen	Turbidity	
Fluorescent Dissolved Organic Matter (fDOM)	Vented Level**	
Nitrate**		
EXO Handheld		
Size	Width: 12.00 cm (4.72 in) Height: 25.00 cm (9.84 in)	
Weight	0.71 kg (1.56 lbs) without batteries	
Operating System	Windows CE 5.0	
Operating Temperature	-10 to 50°C	
Storage Temperature	-20 to 80°C	
IP Rating	IP-67	
Data Memory	2 GB total memory; >2,000,000 data sets	
Accessories		
Cables (non-vented)	Flow cells	Sonde/sensor guard
Carrying case	KOR software	Calibration cup
DCP Signal Output Adapter	USB Signal Output Adapter	Anti-fouling components
Warranty		
1 Year	pH, ORP, and optical DO membranes	
2 Years	Cables, sondes (bulkheads), handheld, and the following sensors: conductivity, temperature, depth, and optical sensors	

* Specifications indicate typical performance and are subject to change. Please check EXOwater.com for up-to-date information.

** Typically 90 days at 20°C at 15-minute logging interval; temperature/conductivity, pH/ORP, DO, and turbidity sensors installed on EXO1; or temperature/conductivity, pH/ORP, DO, total algae, and turbidity sensors installed with central wiper that rotates once per logging interval on EXO2. Battery life is heavily dependent on sensor configuration.

EXO Bluetooth modules comply with Part 15C of FCC Rules and have FCC, CE Mark and C-tick approval. Bluetooth-type approvals and regulations can be country specific. Check local laws and regulations to insure that the use of wireless products purchased from Xylem are in full compliance.

** Release in 2013. BGA-PE specs TBD.

Sensor Specifications*

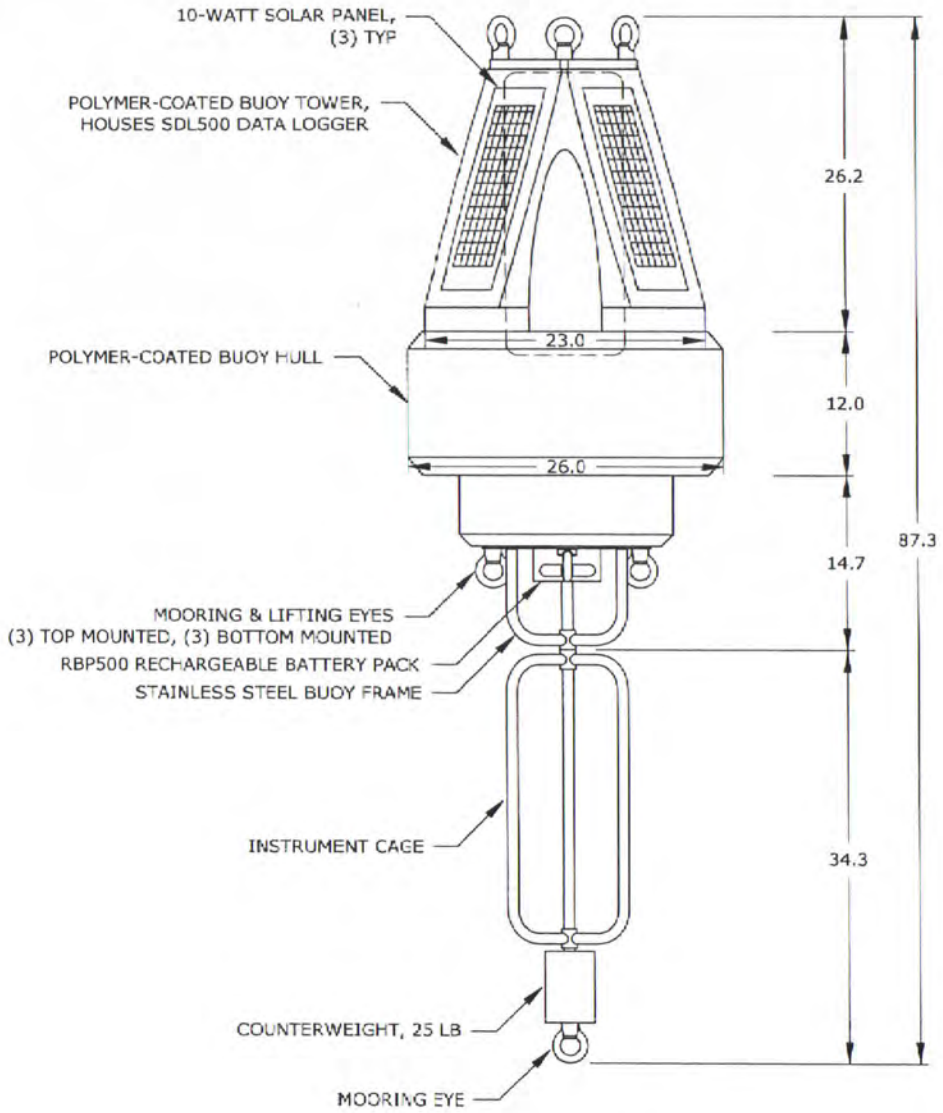
Sensor	Range	Accuracy*	Response	Resolution
Ammonium** [11] (ammonia with pH sensor)	0 to 200 mg/L [1]	±10% of reading or 2 mg/L-N, w.i.g.	-	0.01 mg/L
Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	-	0.1 mmHg
Blue-green Algae Phycocyanin (PC) or Phycoerythrin (PE)** (part of Total Algae sensor)	0 to 100 µg/L PC; 0 to 100 RFU	Linearity: R^2 > 0.999 for serial dilution of Rhodamine WT solution from 0 to 100 µg/mL PC equivalents Detection Limit: 0.04 µg/L PC	T63<2 sec	0.01 µg/L PC; 0.01 RFU
Chloride** [11]	0 to 1000 mg/L [2]	±15% of reading or 5 mg/L, w.i.g.		0.01 mg/L
Chlorophyll (part of Total Algae sensor)	0 to 400 µg/L Chl; 0 to 100 RFU	Linearity: R^2 > 0.999 for serial dilution of Rhodamine WT solution from 0 to 400 µg/L Chl equivalents Detection Limit: 0.09 µg/L Chl	T63<2 sec	0.01 µg/L Chl; 0.01 RFU
Conductivity [3]	0 to 200 mS/cm	0 to 100: ±0.5% of reading or 0.001 mS/cm, w.i.g.; 100 to 200: ±1% of reading	T63<2 sec	0.0001 to 0.01 mS/cm (range dependent)
Depth [4] (non-vented)	0 to 10 m (0 to 33 ft)	±0.04% FS (±0.004 m or ±0.013 ft)	T63<2 sec	0.001 m (0.001 ft) (auto-ranging)
	0 to 100 m (0 to 328 ft)	±0.04% FS (±0.04 m or ±0.13 ft)		
	0 to 250 m (0 to 820 ft)	±0.04% FS (±0.10 m or ±0.33 ft)		
Vented Level**	0 to 10 m (0 to 33 ft)	±0.03% FS (±0.003 m or ±0.010 ft)		
Dissolved Oxygen Optical	0 to 500% air saturation	0 to 200%: ±1% of reading or 1% saturation, w.i.g.; 200 to 500%: ±5% of reading [5]	T63<5 sec [6]	0.1% air saturation
	0 to 50 mg/L	0 to 20 mg/L: ±0.1 mg/L or 1% of reading, w.i.g.; 20 to 50 mg/L: ±5% of reading [5]		0.01 mg/L
fDOM	0 to 300 ppb Quinine Sulfate equivalents (QSE)	Linearity: R^2 > 0.999 for serial dilution of 300 ppb QS solution Detection Limit: 0.07 ppb QSE	T63<2 sec	0.01 ppb QSE
Nitrate** [11]	0 to 200 mg/L-N [1]	±10% of reading or 2 mg/L-N, w.i.g.	-	0.01 mg/L
ORP	-999 to 999 mV	±20 mV in Redox standard solutions	T63<5 sec [7]	0.1 mV
pH	0 to 14 units	±0.1 pH units within ±10°C of calibration temp; ±0.2 pH units for entire temp range [8]	T63<3 sec [9]	0.01 units
Salinity (Calculated from Conductivity and Temperature)	0 to 70 ppt	±1.0% of reading or 0.1 ppt, w.i.g.	T63<2 sec	0.01 ppt
Specific Conductance (Calculated from Conductivity and Temperature)	0 to 200 mS/cm	±0.5% of reading or .001 mS/cm, w.i.g.	-	0.001, 0.01, 0.1 mS/cm (auto-scaling)
Temperature	-5 to 50°C	-5 to 35°C: ±0.01°C [10] 35 to 50°C: ±0.05°C [10]	T63<1 sec	0.001 °C
Total Dissolved Solids (TDS) (Calculated from Conductivity and Temperature)	0 to 100,000 g/L Cal constant range 0.30 to 1.00 (0.64 default)	Not Specified	-	variable
Total Suspended Solids (TSS) (Calculated from Turbidity and TDS)	0 to 1500 mg/L	Not Specified	T63<2 sec	variable
Turbidity [11]	0 to 4000 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, w.i.g.; 1000 to 4000 FNU: ±5% of reading [12]	T63<2 sec	0 to 999 FNU: 0.01 FNU; 1000 to 4000 FNU: 0.1 FNU

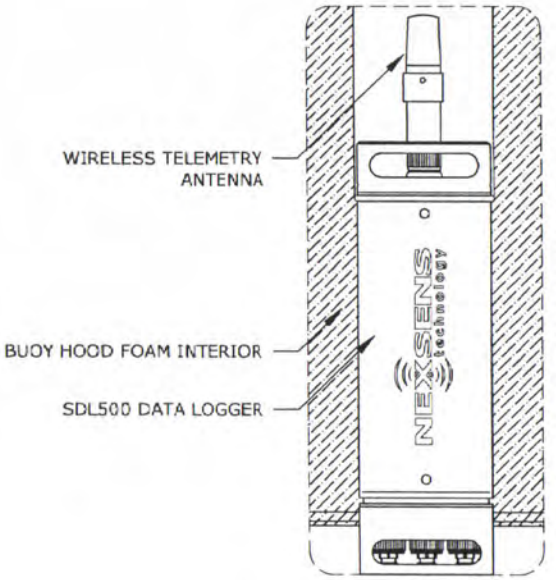
All sensors have a depth rating to 250 m (820 ft), except shallow and medium depth sensors and ISEs. EXO sensors are not backward compatible with 6-Series sondes.

* Specifications indicate typical performance and are subject to change. Please check EXOwater.com for up-to-date information.
Accuracy specification is attained immediately following calibration under controlled and stable environmental conditions. Performance in the natural environment may vary from quoted specification.

[1] 0-30°C [2] 0-40°C w.i.g. = whichever is greater
[3] Outputs of specific conductance (conductivity corrected to 25°C) and total dissolved solids are also provided. The values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (Ed. 1989).
[4] Accuracy specifications apply to conductivity levels of 0 to 100,000 µS/cm.
[5] Relative to calibration gases
[6] When transferred from air-saturated water to stirred deaerated water
[7] When transferred from water-saturated air to Zobell solution
[8] Within the environmental pH range of pH 4 to pH 10
[9] On transfer from water-saturated air to rapidly stirred air-saturated water at a specific conductance of 800 µS/cm at 20°C; T63<5 seconds on transfer from water-saturated air to slowly-stirred air-saturated water
[10] Temperature accuracy traceable to NIST standards
[11] Calibration: 1-, 2-, or 3-point, user-selectable
[12] Specification is defined in AMCO-AEPA Standards

** Release in 2013. BGA-PE specs TBD.





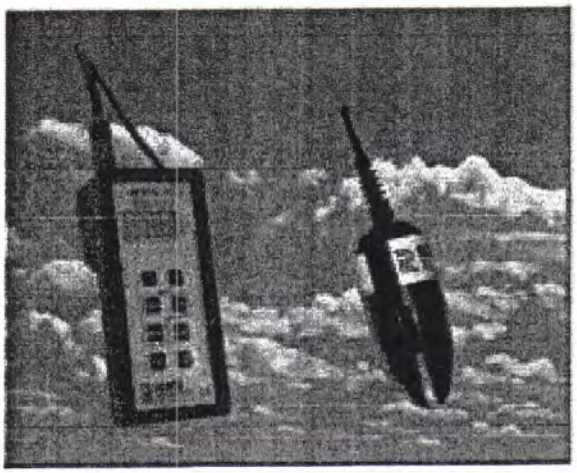
CB-200 DATA BUOY DIMENSIONAL VIEW

SCALE: 1:10

NEXSENS technology

ITEM:	NEXSENS CB-200 COASTAL DATA BUOY
SHEET TITLE:	DATA BUOY DIMENSIONAL VIEW
DRAWING NUMBER:	NEX177
REV:	01
DRAWN BY:	MHD
DATE:	8/6/13
SHEET:	1 of 1

Model 711 Portable
Suspended Solids and Interface Level Analyzer



Model 711 Specific Features

- **Two analyzers in one package:**
  Switch from Solids measurement to Interface level without losing calibration.
- **Automatic ranging:**
  Goes completely over the operating range of the analyzer with manual adjustment.
- **Simple, insitu calibration:**

The Royce **Model 711** Portable Suspended Solids/ Interface Level Analyzer is a rugged, waterproof instrument designed for the rigors of remote sampling. The meter provides reliable operation in waste treatment plants, rivers, lakes and other aqueous systems. the meter will read in either grams per liter when in the suspended solids mode or relative density percentage while in the interface level mode of operation.

The **Model 711** stores the calibration values for suspended solids and interface level in two separate non-volitale memory locations allowing the user to switch between operational modes without having to recalibrate. The net effect is two analyzers in one.

Due to the full utilization of the microprocessor, calibration values are stored so that recalibration is not required on a daily basis. If the sensoris cleaned after use, monthly calibration is usualyy more than sufficient for proper operation in eithermode of calibration.

The **Model 711** analyzer utilizes the **Model 71** medium range sensor. The **Model 71** is a rugged, reliable sensing element that has polymer optical grade lenses. It was designed specifically to meet the rigorous demands that are a requirement for a portable sensor.

Model 711 / 71 Specifications

Range:
0 - 10 grams per liter (o to 10,000 mg/l)
Readout Device:
Harsh environment, 1/2" LCD digital display
Input Power:
Standard 9V battery
Enclosure:
Waterproof
Size:
7 inches long
3.2 inches wide
1.5 inches deep
Weight:
1.5 pounds (.68 kgms)

Type:
Single Gap, Optical
Accuracy: ± 5% of reading or ± 100 mg/l, whichever is greater
Repeatability:
± 1% of reading or ± 20 mg/l, whichever is greater
Range:
0 - 10 g/l
Operating Limits:
Temperature, 0 - 65° C
Pressure, o - 50 PSIG
Size:
4 inches long
2 inches diameter
Weight:
1 pound (.45 kgms)
Construction:
Polyurethane body
Optical grade ploymer lenses

Supplied Standard with Model 711 System

- **Model 711** rugged Suspended Solids analyzer
- **Model 71** rugged SS sensor with 8 meters or 25 feet of cable and waterproof, military connector.
  Cable is scaled in one foot increments.
- Velcro "grip strap" which can convert to a handy belt holder.
- 9V battery.
- Detailed instruction manual.

APPENDIX I

WATER MANAGEMENT PLAN

WATER MANAGEMENT PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

WATER MANAGEMENT PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former manufactured gas plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach site operations scenario.

WATER MANAGEMENT SCENARIO

For project implementation purposes, two categories of site-related water will require effective management. These include:

1. Unimpacted stormwater from the landside support zone; and
2. Contact water (i.e., water that has come into contact with impacted sediment or TLM).

The planned methods for managing both types of site-related water are described below.

Unimpacted Landside Stormwater

The stormwater associated with the landside operations will include precipitation and runoff from non-impacted areas. This stormwater will be controlled to prevent erosion following the minimal clearing activities expected to be required to construct access roads and laydown areas, as shown on Figure 2. Some minimal grading in the form of drainage swales, berms or other measures may also be employed to direct stormwater runoff from the landside area away from the cap construction area. Newly disturbed areas will be quickly stabilized by the addition of geotextile material and gravel or re-seeded with a quick germinating seed mixture. Sediment and erosion control best management practices will be implemented and will include deployment of a silt fence, sediment socks, and an improved construction entrance. Specific details pertaining to the management of stormwater, such as the specific sediment and erosion control measures are not covered in this Water Management Plan since they are described in detail in the

Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) submitted as part of the National Pollutant Discharge Elimination System (NPDES) permit application and the City of Columbia Land Disturbance permit application. These documents will be reviewed and approved by SCDHEC and the City of Columbia and the resultant permits will be provided in the final report for the project. All landside stormwater management activities will be conducted in accordance with the approved C-SWPPP.

It is important to note that the project was designed so that the major site-related components will be placed and constructed in such a manner as to minimize clearing and grading activities. This will preserve the current vegetated cover and reduce the potential for erosion. The primary planned location for the majority of site operations is the power line right-of-way, which has already been cleared of trees and undergrowth. SCE&G has relocated the overhead wires located within the right-of-way to accommodate site operations. This scenario will reduce disturbance of currently forested land and further preserve the riparian corridor.

Contact Water

Since installation of the engineered cap will be a relatively non-intrusive activity, management of impacted "contact" water from site-related activities is not anticipated. However, as a contingency, SCE&G will construct a water management system on-site in order to be prepared should the need arise to containerize and properly dispose of water impacted by TLM. The water management system will consist of appropriately sized pumps and hoses and two 20,000-gallon frac tanks. These tanks will be located in the landside support zone, as shown on Figure 2. Other equipment and materials such as oil absorbent booms will be kept on-site to contain contact water where it is observed, until it can be collected in the tanks and properly disposed. SCE&G has obtained the appropriate approvals to dispose of water from site-related activities at the Vopak Logistic Services facility in Mauldin, SC. Once moved to the frac tanks, contact water will be transferred to tanker trucks for transportation to the disposal facility.

Contact water is expected to include:

- Entrained water that seeps from the sediment once it is excavated or disturbed (i.e. during the sand bar removal); and
- Precipitation or river water that contacts the exposed impacted sediment.

Contact water may appear visually impacted (i.e., contain large amounts of suspended solids, exhibit a sheen, have a tar-like odor, or have TLM particles suspended within the water column). The primary method for distinguishing between contact and non-contact water will be a visual evaluation by experienced site personnel. Also, the area of origin of the water will be utilized to aid in determining which mode of water management will be used.

The primary cap construction activities (i.e., placement of the geotextile and ACBs) is not expected to generate contact water, but intrusive project activities that may result in disturbance of TLM will have the potential to generate water requiring management. These will include removal of the sandbar and construction of access roadways along the edge of the river.

The sand bar, shown on Figure 2, is planned for removal in order for the sediment cap articulated concrete mats to be effectively placed in the project area. Previous sediment sampling conducted during

the investigation phase of the project characterized the sand bar material as being unimpacted by TLM. As a result, contact water is not expected to be generated during the removal activities. Similar sampling was completed along the shoreline and no impacts were identified. However, as a contingency during excavation and removal of the sand bar, the following measures will be in place prior to commencement of intrusive activities and the general sequence of activities will be followed:

- Removal of the sand bar will be completed during low river levels to limit the amount of river water that comes into contact with the sediment.
- A silt curtain and absorbent boom will be installed directly downstream of the work area to contain sediment within the work area. The silt curtain may be augmented by the placement of large 1-ton sandbags downstream of the work area to further contain the sediment.
- The Total Suspended Solids (TSS) Monitoring Plan will be implemented to measure TSS levels downstream of the work area in real-time to ensure the project does not contribute to elevated TSS concentrations.
- Remediation personnel will be present in the excavation area to observe the sediment as it is removed to determine if TLM is encountered and to check for the presence of sheens or odors emanating from the disturbed sandbar material.
- The wet sandbar material will be stacked on the alluvial fan and the entrained water allowed to drain out and collect in a contained low area where it will be observed for evidence of TLM contact. If sheens or other indications are observed, the contact water will be pumped to the water management system.
- A lined and bermed sand storage area will be constructed in the landside support zone. The sand bar material will be transported to the lined area and stacked in this area to allow for further release of entrained water. The liner will consist of poly sheeting placed on the ground surface and a berm will be constructed around the extent of the sand pile to contain the released water. Accumulated water will be examined for evidence of a sheen or odor. If evidence of impacts is noted, the water will be pumped to the water management system.
- Once the sand bar material is dry enough for off-site transport, it will be loaded into trucks and transported to the proper disposal facility. Material used to construct the lined area will also be disposed.

The water management system and other contingency measures will remain on-site for the duration of river based construction activities and if contact water is encountered during non-intrusive activities it will be managed accordingly. If the system is utilized to store water, it will be properly decontaminated prior to demobilization.

Water management activities will be documented by project personnel and the associated disposal manifests, etc. will be included in the final report.

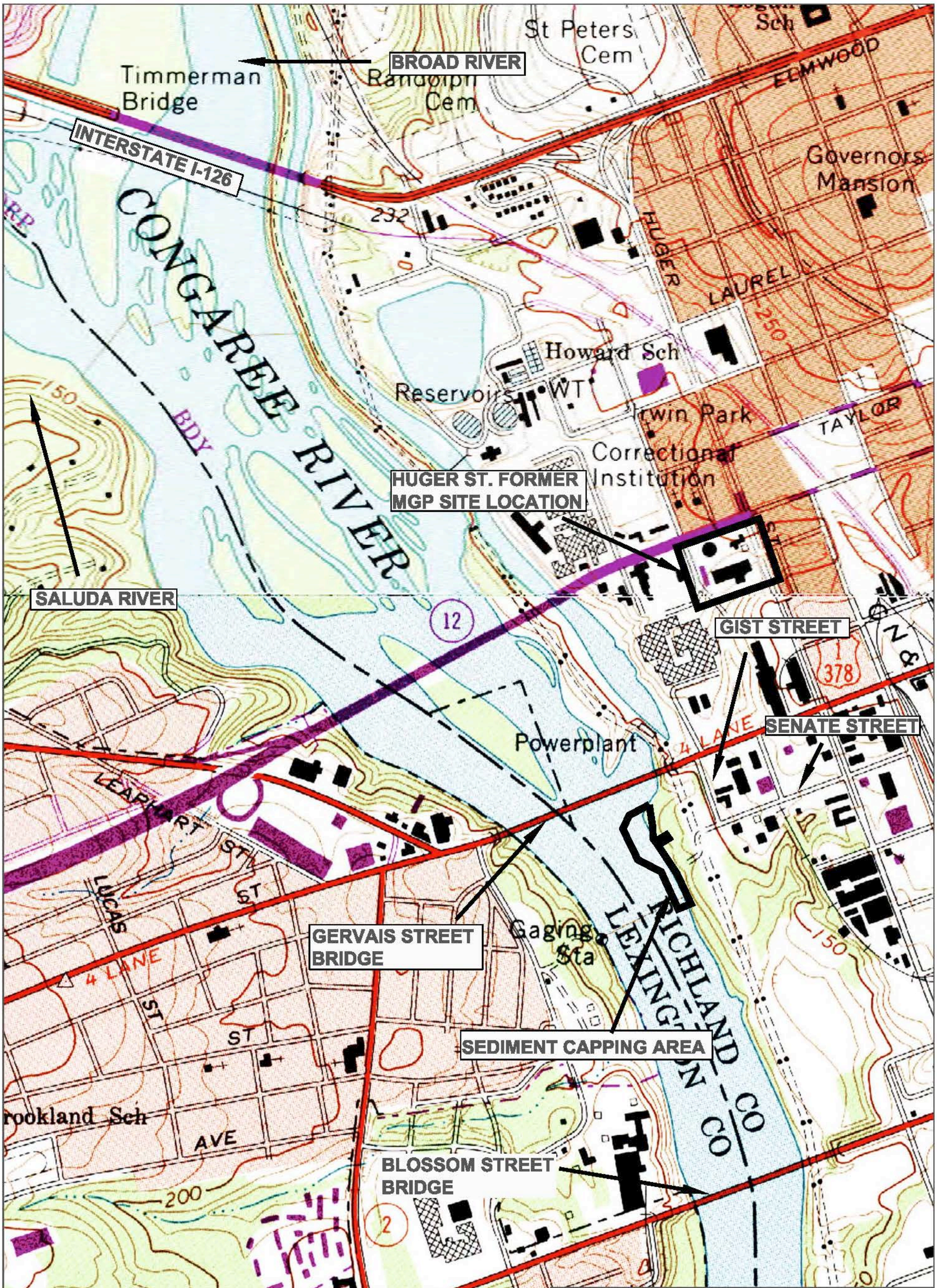


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

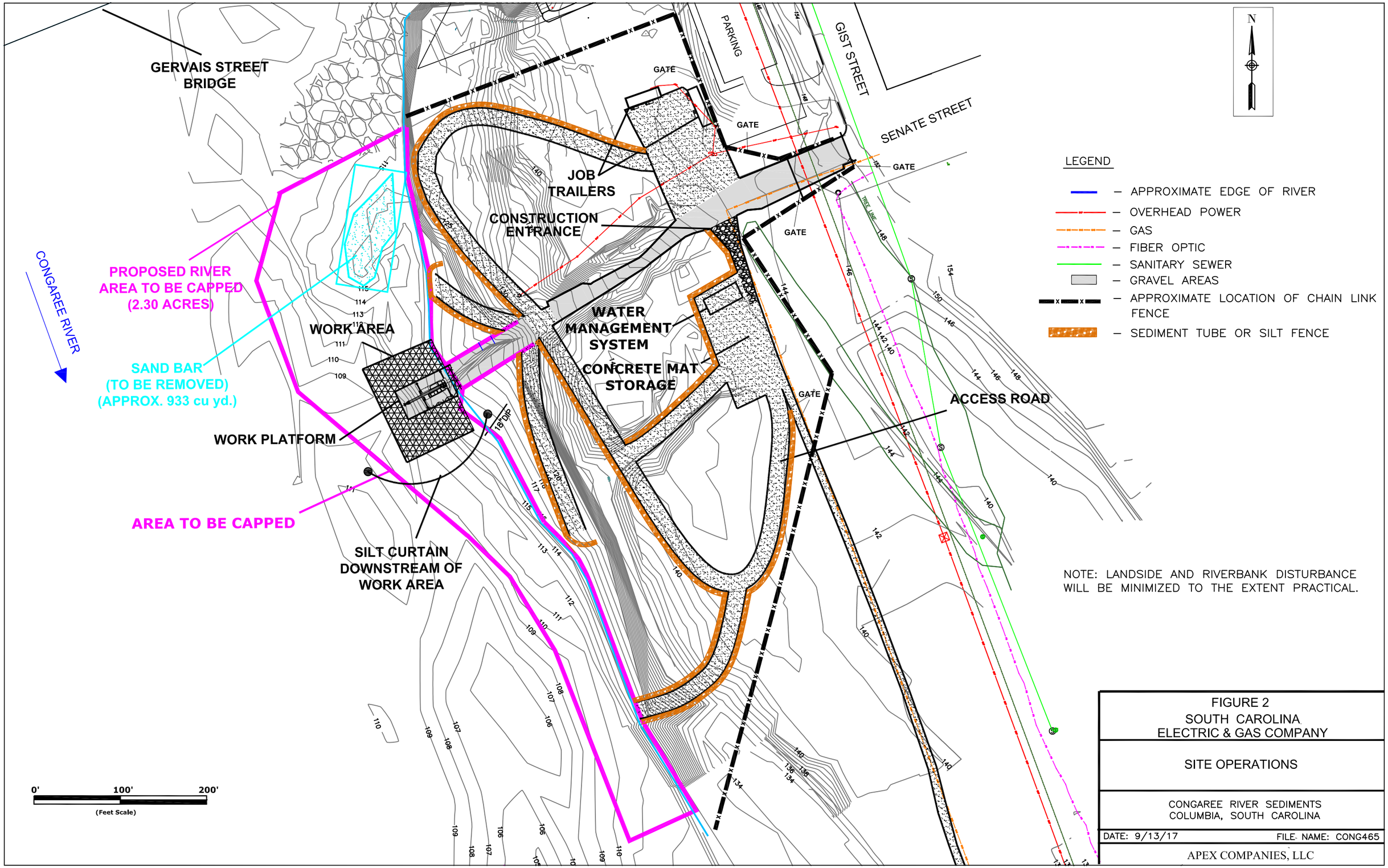


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/13/17 FILE NAME: CONG465

APEX COMPANIES, LLC

APPENDIX J

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

SOUTH CAROLINA ELECTRIC & GAS COMPANY
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014
Updated: July 2015
Updated: January 2017
Updated: October 2017

Prepared for:

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Cayce, SC 29033-3701

Prepared by:

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1600 Commerce Circle
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TABLES

FIGURE

APPENDICES

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared by Apex Companies, LLC (Apex) for SCANA Services, Inc. (SCANA). The HASP addresses activities associated with remedial investigations and remedial actions at the South Carolina Electric & Gas Company (SCE&G) Congaree River Sediments site (Site) in Columbia, South Carolina.

Work conducted at the Site by Apex will comply with the Apex corporate health and safety guidelines and all applicable Occupational Safety and Health Administration (OSHA) requirements. OSHA regulations applicable to the anticipated work include:

- 29 CFR 1910 (Occupational Safety and Health Standards), specifically 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response); and
- 29 CFR 1926 (Safety and Health Regulations for Construction), specifically 29 CFR 1926, Subpart P-Excavations (29 CFR 1926.650-652).

Apex and its subcontractors will conduct site activities consistent with the requirements of this HASP. This HASP is also available as a reference to SCE&G and other contractors that may perform work at the Site. However, any work performed by others must be conducted in accordance with the requirements of the written Health and Safety Program of each contractor, as well as a site-specific HASP that each contractor deems appropriate to cover their site activities, which may vary from those addressed in this HASP. The written Health and Safety Program of each contractor must address the personal protective equipment (PPE) requirements specified in 29 CFR 1910.120(g)(5). Apex assumes no liability or responsibility for any other parties based upon the accuracy or completeness of the information contained herein.

Development of this HASP indicates that the workplace has been evaluated for the hazards as described, and the adequacy of the PPE selected is based on available information. The health and safety-related procedures and PPE specified in this HASP are based on specific work activities currently planned or anticipated in the future for the site. Any changes in the project work scope or site conditions as described herein must be addressed in an amendment to this HASP.

Site emergency information is summarized in the form provided as Appendix A. A sign-in sheet (see Example in Appendix B) will be used to maintain control of project personnel and visitors on-site. A HASP Agreement and Acknowledgement Form is provided in Appendix C. All project personnel prior to conducting field activities should sign the form. A list of acronyms used within this document or other health and safety-related reference information is provided for reference as Appendix D.

1.1 Site Location

The Site is located within Columbia, South Carolina, and is generally defined by the stretch of the Congaree River and adjacent eastern shoreline from the Gervais Street Bridge to a distance of approximately 3,200 feet down river to the Blossom Street Bridge. The river project area extends from the eastern shore to the approximate mid-point of the river. Figure 1 provides the location of the site.

1.2 Scope of Work

This HASP addresses the safety issues associated with meeting the following tasks anticipated at the Site, which include:

- Sediment investigation;
- Construction of a landside support zone;
- Unexploded ordnance (UXO) management;
- Water management;
- Excavation and off-site disposal of impacted and unimpacted material; and
- Construction of a sediment cap.

Details of the work scope (e.g., soil boring/coring investigations, removal activities, cap construction, etc.) will be provided in written plans specific to each project task. As noted previously, the health and safety-related procedures specified in this HASP are based on the work activities currently planned or potentially anticipated for the Site. Any changes in the project work scope as identified above must be addressed in an amendment to this HASP.

Due to documented historical activities conducted in the vicinity of the project area, this project will include screening all or a portion of the planned river based construction area for potential Civil War era unexploded ordnance (UXO). Only properly trained personnel will conduct site activities relating to the location, identification and subsequent management of historical artifacts and/or unexploded ordnance (UXO). These activities will be completed in accordance with the appropriate plans. This HASP does not provide guidance with respect to UXO related work.

1.3 Level of Protection for Site Activities

For each task, the potential for employee exposure to site contaminants and/or air monitoring results will determine the level of required training and personal protection. Initial investigation and excavation activities will be conducted in Level D. It is not anticipated that an upgrade to Level C or Level B will be required at the site. Action levels for upgrade to Modified Level D, Level C or Level B are discussed in the air monitoring section (Section 5.0).

Personnel conducting clean construction activities such as construction of the landside support zone, access roads and placement of the capping materials within the river are not expected to come into contact with TLM or other constituents of concern. As a result, these workers are not required to complete training in accordance with 29 CFR 1910.120. Site workers without the required training will be limited to areas of the site (i.e. landside support zone) where no impacted material is expected or to activities (i.e. placement of the sediment cap material) that is not anticipated to disturb impacted material. Properly trained personnel will be onsite to manage material or complete tasks where the potential for contacting impacted material is present. All site personnel will be made aware of the activities that can and cannot be conducted in accordance with the applicable training level.

This HASP must be amended when circumstances or conditions develop that are beyond the scope of this plan. Any changes in project work scope or site conditions as described must be addressed.

1.4 Project Personnel and Responsibilities

The following management structure must be followed by each contractor performing work at the Site pursuant to the requirements of this HASP, for the purpose of successfully and safely completing this project.

A technical advisor, site health and safety officer (SHSO), project supervisor and work team must be designated for each project task. Table 1 outlines the project personnel and responsibilities. Specific duties of the technical advisor include:

- Providing technical input into the design and implementation of the site HASP; and
- Advising on potential for worker exposure to project hazards along with appropriate methods or controls to eliminate site hazards.

A SHSO will be assigned to the site during field activities. The SHSO:

- Has the responsibility and authority to implement and enforce the HASP;
- Determine what level of training is required to complete a certain task;
- May modify work, halt work, or remove personnel from the site if work conditions change and adversely affect health and safety matters; and
- Serves as the main contact for any on-site emergency situation.

A project supervisor will be designated for all field activities. The project supervisor has the authority to direct and control site activities. During implementation of larger projects, the project supervisor will coordinate with the SHSO regarding health and safety-related matters. During smaller project tasks, the project supervisor may also serve as the SHSO.

The project team reports to the project supervisor for on-site activities. Project teams must be comprised of at least two people for high hazard operations. Personnel on the project team work to safely fulfill the requirements of the work plan in accordance with this HASP, and notify the SHSO or project supervisor of any suspected unsafe conditions.

Apex currently has the responsibility to provide investigation and remediation management and oversight for all phases of the project. Apex personnel assignments on this project, pursuant to the above requirements, include:

Technical Advisor:	Mr. William Zeli 412-829-9650
Site Health and Safety Officer:	Varies with work activities (may be same as project supervisor) 412-829-9650, or on-site cell phone when available.
Project Supervisor:	Varies with work activities (may be same as SHSO) 412-829-9650, or on-site cell phone when available.

Project Team: Various personnel reporting to project supervisor.

The SHSO, or another qualified individual, will conduct inspections as necessary on behalf of the employer to determine the effectiveness of this HASP. The employer will correct any deficiencies in the effectiveness of this HASP.

2.0 CONSTITUENTS OF CONCERN PROFILE

The constituents of concern at the Site include VOCs primarily benzene, toluene, ethylbenzene and xylenes (BTEX) and SVOCs, primarily polynuclear aromatic hydrocarbons (PAHs). Chemical and physical properties of the constituents of concern are summarized in Table 2. Published exposure levels for the constituents of concern are provided in Table 3.

Based upon the background information, including site history and site characterization, a summary profile of the hazards and control measures to follow for the constituents of concern has been developed. Summarized in Table 4, the profile provides an overview of the hazards associated with potential exposure to the constituents of concern and the preventative measures.

For more detailed and specific information, refer to the Safety Data Sheet (SDS) or equivalent information for the contaminant located in Appendix E.

3.0 TRAINING

All Apex employees and other site workers with the potential to come into contact with impacted material or constituents of concern will have completed health and safety training, in compliance with OSHA's Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). This requirement includes an initial 40 hours of training and a minimum of three days of actual field experience under the direct supervision of an experienced supervisor, as well as eight hours of annual refresher training. Site personnel without the above-referenced training will be restricted to duties that do not have the potential for contacting impacted material or constituents of concern. Or work in areas where this material is present and disturbed. The designated SHSO will ensure that only workers with the appropriate training come into contact with potentially impacted material.

The SHSO will conduct an initial information session prior to initiation of any site activity. These pre-entry briefings are intended to ensure that field personnel are aware of the hazards at the site associated with the scheduled activities, and that the project team will perform in a manner to minimize risks to health and safety. The health and safety instructions during these briefings will generally include the following:

- A general overview of the project and site;
- An explanation of potential exposure routes and constituents identified at the site;
- Requirements for personal protective equipment and clothing, skin protection, etc.;

- Decontamination and disposal procedures;
- Personal hygiene requirements;
- Emergency response procedures (personal injury, accidents and other emergencies);
- Route to hospital and local emergency contacts;
- General site safety rules and standard operating procedures;
- Responsibility of on-site supervision and management related to health and safety issues;
- Names of personnel responsible for site safety and health;
- Work practices to minimize on-site health and safety risks;
- Use of site engineering controls;
- Contingency plans; and
- Cold and Heat stress.

The instructions will address site-specific issues, and job-specific health and safety instructions will be reviewed before beginning each new phase of work. Also, general health and safety issues will be routinely discussed in daily health and safety "tailgate" meetings. The daily meetings will be documented (see example form in Appendix F).

4.0 HAZARD IDENTIFICATION AND CONTROL

Site-specific job tasks and the associated hazards are identified in Table 5. For each anticipated task, the types of hazards that may be encountered are listed. The hazard analysis matrix (Table 5) is used as a guide for implementing specific health and safety procedures.

Based upon the hazard analysis of tasks that are anticipated at the Site, Table 6 lists the general control procedures and practices to follow to prevent injury or illness. Field personnel must complete appropriate training for specific hazards prior to initiating work activities. Precautions must be taken to prevent injuries and exposures to the potential hazards identified in Table 6.

Specific procedures that address excavation and trenching activities, drilling, and sampling are provided for reference in Appendices G, H and I, respectively.

5.0 ENVIRONMENTAL SITE AIR MONITORING

To ensure the safety of on-site workers and nearby residents, a comprehensive environmental site air-monitoring program will be implemented during all site excavation activities. Of particular interest is the monitoring of fugitive organic vapors and airborne particulate (dust) emissions during excavation activities.

5.1 Air Monitoring

To ensure a safe working environment, the capping contractor will monitor organic vapor using a photoionization detector (PID) in the active work area during intrusive excavation activities. Periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation worker likely to have the highest exposure. Continuous air monitoring will be conducted at the perimeter of the site during activities with the potential to disturb impacted material. Perimeter air monitoring is discussed further in Section 5.3. Monitoring may be conducted at lower or higher frequencies depending on site conditions or by direction of the Project Site Supervisor or SHSO. If high organic vapor levels (greater than 1 ppm) are observed in the active work area, work will be temporarily stopped.

Air monitoring measurements will be taken in the breathing zone of the worker most likely to have the highest exposure. Temporary peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a five-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

If organic vapors above 1 ppm are sustained for 5 minutes or longer, Colormetric Detector Tubes (e.g., Draeger) will be used to determine if the constituent being measured is benzene. The action limit for benzene is 0.5 ppm. Should this limit be reached, activities will cease until engineering controls can be utilized to reduce the vapors to within acceptable levels. Any organic vapor measurements of greater than 250 ppm on the PID sustained for five minutes will require immediate evacuation of the work area.

Particulate monitoring will be conducted as needed during capping and excavation operations. If particulate levels exceed 0.10 mg/m^3 in the work area, engineering controls, such as suppressant sprays, may be used to control and minimize particulate emissions.

All organic vapor monitoring will be conducted with the use of a MiniRAE 2000 PID with a 10.6 eV lamp or equivalent. Particulate levels will be monitored with the use of a MiniRam, DataRam particulate meter, or similar. Guidelines for frequency of air monitoring are presented in Table 7. Personal protective equipment (PPE) and the type of air monitoring required are summarized in Table 8 for the various job tasks. Air monitoring action levels (Table 9) have been developed to indicate the chemical concentrations in the breathing zone that require an upgrade in level of PPE. Action levels are typically set at one-half the OSHA Permissible Exposure Limit (PEL), National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV). Rationale for establishing action levels based on the contaminants of concern are then set based on the compound(s) with the lowest OSHA PEL, NIOSH REL or ACGIH TLV. By adhering to the air monitoring protocols set forth, the potential for overexposure is minimized.

All workers on-site that may be required to work in areas where particulates or organic vapors may be present above background levels must have been properly fitted with the proper PPE (i.e., respirators) and have been trained in their use (i.e., cleaning, inspecting for defects, donning and doffing).

Exclusion zones will be installed around the work areas to prevent unauthorized personnel from entering into the area, thus minimizing exposure. Workers will be instructed to stand up-wind whenever activities occur that generate visible signs of airborne particulates and/or organic vapors and odors.

When excavating soil highly impacted with volatile organic compounds, engineering controls for vapor/odor mitigation as a means to downgrade PPE requirements (e.g., Level B to C or Level C to D) may include:

- Use of circulating fans to exhaust or dissipate vapors emanating from the excavation;
- Closing the excavator cab door;
- Minimizing the open excavation area;
- Covering the open excavation with plastic sheeting; and/or
- Applying vapor suppressant foams or spray to the active excavation area.

Some of these controls may also be used for any soil stockpiles present on the site.

5.1.1 Drilling

Air monitoring will be performed in the breathing zone of either the driller or helper on approximate 1 to 2-hour intervals as conditions warrant. Air monitoring will be performed to assess concentration of organic vapors in the breathing zone following criteria previously established.

5.2 Air Monitoring Equipment Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. The operator must understand the limitations and possible sources of errors for each instrument. All monitoring equipment will be calibrated and maintained periodically by the operator. It is important that the operator ensures that the instrument responds properly to the constituent it was designed to monitor. A written record of all air monitoring equipment calibration and adjustment information must be maintained. An Air Monitoring Report form is presented in Appendix J.

Initially, the PIDs and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the fieldwork. Calibration and/or zeroing will also be conducted during work hours if a potential malfunction in the instrument is detected.

5.3 Work Area Perimeter Monitoring

As a contingency measure and for documentation purposes, SCE&G plans to implement a perimeter air monitoring program during completion of impacted material removal and handling operations. SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at most other SCE&G MGP remediation sites and it successfully documented the absence of elevated concentrations at these locations. A site-specific Community Air Monitoring and Odor/Dust Control Plan was developed for the

remediation portion of the project and provides the specific details pertaining to the perimeter air monitoring activities. It is included in the Sediment Capping Work Plan (SCWP) for the project and in Appendix L. The associated dust/particulate action level calculation is provided in Appendix M. The conservative action level was calculated utilizing the highest concentration of total semi-volatile organic compounds (SVOCs) identified during the sediment sampling program. This calculation is provided in Appendix M. The action level is 5,300 µg/$m^{3.}$ Since the action levels provided in Table 9 and the Community Air Monitoring and Odor/Dust Control Plan are well below this action level, they will be utilized as the conservative action levels for this phase of the project.

The air monitoring data stored in the perimeter instruments will be periodically downloaded to the site computer and provided in the final report.

5.4 Noise Monitoring

Noise levels can be monitored in the field with either a Type I or Type II Sound Level Meter (SLM). Noise dosimeter readings can also be obtained to determine the percent of noise dose. Noise levels and percentage dose measured are then compared to limits listed in OSHA standard 29 CFR 1910.95, Hearing Conservation.

Action levels listed in Table 10 will trigger upgrade in PPE to include appropriate hearing protection (muffs or plugs) or initiate possible noise control engineering. All personnel that are operating or working near heavy equipment (e.g., front-end loaders) will wear earplugs or muffs. Apex will initiate noise monitoring activities at the site perimeter if required based on the site conditions.

Selection of hearing protection must match the employees' needs and the ability to attenuate noise below 90dB(A). Each hearing protection device (muffs or plugs) has a Noise Reduction Rating (NRR) assigned by the U.S. Environmental Protection Agency (EPA). To calculate the hearing protector's effectiveness, use the following formula: Noise Reading dB (A) – (NRR – 7dB) < 90dB(A).

Most drilling methods (e.g., DPT, sonic, etc.) are inherently noisy and likely require the use of hearing protection. Given the inherent noise levels associated with drilling, all employees will use hearing protection devices and noise monitoring will not be performed.

5.5 Combustible Gas and Oxygen Monitoring

A combustible gas indicator (CGI)/oxygen (O_2) meter (MSA Model 261 or equivalent) may be used if the potential for explosive conditions exist, or as directed by the Project Site Supervisor or SHSO.

Guidelines have been established by NIOSH concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

- <10% Lower Explosive Limit (LEL) – Conduct work activities freely
- >10% LEL – Cease all activities in order to allow time for combustible gasses to vent

6.0 CONFINED SPACE ENTRY (CSE) PROCEDURES

Any site work that may require personnel to enter confined spaces must be conducted in accordance with their corporate health and safety program procedures and the site-specific requirements of this HASP. Any on-site field personnel shall not enter an area identified as a confined space without proper training on the use of CSE procedures.

The purpose of the CSE procedures is to protect employees from potentially hazardous environments and to facilitate immediate rescue in an emergency situation. During work, a CSE Permit must be posted at the entrance to each confined space.

7.0 PHYSICAL AND OUTDOOR HAZARDS

7.1 Physical Hazards

Physical hazards at sites may include conditions such as uneven terrain, holes, ditches, unstable slopes, slippery surfaces, unguarded openings, unmarked projections and ground debris that can cause employees to trip and fall. Examine site conditions upon arrival at the site and take precautions to avoid potentially hazardous situations. Appropriate precautions include:

- Identify traffic flow, and high and low traffic periods.
- Visually examine slopes for stability.
- Test one's footing.
- Mark or remove large projections.
- Make sure the walking/work area is adequately lit.
- Be aware of ground debris; remove broken glass, nails, wire, and other debris if possible, or mark off and avoid areas of heavy debris.
- During the initial on-site survey, any existing site buildings should be inspected for evidence of water damage and deteriorated walls, floors, and roofs. Stairs should be inspected for missing, loose, or warped steps. These items may need to be repaired before site operations begin.
- All personnel in the vicinity of overhead power lines must utilize extreme caution.
- Identify location of underwater utility line and ensure remedial activities are located a sufficient distance from the utility line.
- Potential for Civil War era unexploded ordnance (UXO) as discussed below

Historical research shows that the potential for Civil War era UXO may be present at the Site and buried within the sediment. A magnetic survey was performed in August 2010 to map the location of magnetic anomalies at the Site. Since the nature of the magnetic anomalies are not known, a conservative approach is used and assumed to be representative of UXOs. Prior to the initiation of drilling activities, a magnetic field detecting device will be used to clear each drilling location.

A qualified UXO contractor will be utilized to clear the planned river based work areas prior to initiation of intrusive activities during completion of the removal action. The UXO contractor's plans for screening, identification and subsequent management of the potential UXO will be followed at all times.

7.2 Outdoor Hazards

Heat stress and cold exposure are important factors to consider during any project. Both hyperthermia (heat stress) and hypothermia (cold exposure) can lead to death or serious injury. Procedures to manage heat or cold-related stress hazards are included as Appendix K. Other outdoor hazards may include insect or animal bites and poisonous plants.

Heat Stress

In hot environments, the human body cools itself by the evaporation of perspiration. However, PPE, which provides protection from chemical exposure, also prevents perspiration from evaporating. Heat stress can occur within minutes and severe heat stress requires immediate medical attention.

- Be familiar with the signs and symptoms of heat stress and treatment:

  Heat Rash or muscle cramps (heat cramps) - The least serious condition. Provide cool non-caffeine and non-alcohol fluids. Rest in a cool place.

  Heat Exhaustion - Weakness or fatigue, nausea, headache, clammy or moist skin with a pale or flushed complexion. Rest in a cool place; provide cool, non-caffeine and non-alcohol fluids.

  Heat Stroke - The most serious condition, may be fatal, get medical help immediately. Symptoms are hot, dry skin, mental confusion or delirium, convulsions or unconsciousness, and body temperature of 105^{o}F. Call for medical help or transport to a hospital immediately. Apply cool towels over the person; apply cool towel or ice pack to back of person's neck.

- Plan the most strenuous work for the coolest times of the day, or work in the evening if possible.
- Drink plenty of cool liquids to replace body fluids lost to sweating. Drink even when not thirsty; heat stress and dehydration can happen before you feel thirsty.
- Drink only water, or occasionally, electrolyte-balanced drinks such as Gatorade. Avoid caffeine-containing beverages such as colas, tea, coffee; these can dehydrate body tissues.
- Do not use salt tablets unless recommended by a physician.
- Use the buddy system and self-monitoring to check for signs of heat stress.
- Use rest periods in the shade as necessary; at least 15 minutes in the morning and afternoon, and at least 30 minutes for lunch.
- Acclimatize (get used to) working in hot conditions gradually by working for increasing periods of time over a few days rather than jumping into daylong strenuous activities.

Cold Stress

Cold injury to the body may be influenced by temperature, wind speed, and degree of body covering. Injury may range from mild frostbite to severe hypothermia. To prevent or minimize the effects of cold stress, use the following work practices:

- Use dry, insulated and/or layered work clothing; warm gloves; hardhat liners and boots. Combine winter gear with PPE and waterproof gear to provide appropriate protection for the task.

- Take frequent rest breaks in warm areas as necessary. For operations conducted below 19 °F, follow the work/warm-up schedule recommended by American Conference of Governmental Industrial Hygienists (ACGIH).
- Drink warm fluids occasionally, but not stimulants such as coffee, tea or alcohol.
- Be aware of the signs and symptoms of various degrees of cold stress and know how to treat each accordingly:

  Frostnip - Usually involves the ears, nose, chin, cheeks, fingertips, and tips of toes. It may occur during high winds and/or low temperatures. The skin suddenly turns white. Frostnip may occur without a person knowing it because it does not cause immediate pain. It can be treated by warming the affected area using warm water. Do not rub.

  Superficial Frostbite - A more severe localized injury involving the skin and tissue just beneath the skin. The skin becomes white, waxy, and firm while the tissue below remains soft. Get out of the cold and warm the affected area slowly and carefully. Do not rub the area. Stinging and burning sensations will occur and occasionally small blisters may appear. Drink warm fluids but no stimulants such as coffee, tea, or alcohol, and no tobacco products.

  Deep Frostbite - Involves freezing of skin, underlying tissue, and even muscle and bone. Remove wet clothes and put on dry clothes, warm up with blankets, heater or warm water. Protect frostbitten parts with a bandage. Transport patient immediately to an emergency room. The injured area will turn blue or purple and is very painful when thawing. Drink warm fluids but no stimulants such as coffee, tea, or alcohol, and no tobacco products.

  Hypothermia - Occurs when the core body temperature decreases. Symptoms begin with severe shivering, apathy, loss of coordination, lethargy and coma, and possibly death. Hypothermia is life threatening, get medical help immediately. Remove wet clothes and put on dry ones, warm up the body slowly. Give warm fluids only if the victim is conscious; but no coffee, tea, alcohol, or tobacco products.

Insect or Animal Bites and Poisonous Plants

Working outdoors can result in exposure to hazards including animals, insects, snakes, ticks, poison ivy, poison oak and poison sumac.

- Avoid contact with wild animals. Do not try to capture, pet, or otherwise touch animals, even domestic animals. They may react unpredictably or they may transmit diseases.
- Be familiar with the hazards of certain insects in the area you are working. Bees, ants, spiders, wasps, and ticks may be present and cause mild to severe injury or illnesses. Check areas where these insects may live or hide before conducting work, especially if work is to be done in a precarious position of height.
- Ticks may be present on many sites in brush, grass, and weeds. Some ticks carry diseases like Lyme Disease or Rocky Mountain Spotted Fever. Wear protective clothing, boots, secure pant leg to leg/boot, and apply bug repellent to the lower legs. Check for ticks after every outing through the brush. If a tick is found, do not try to pick it off or scrape it with a credit card or other object. Use fine tip tweezers to remove the tick at the base of the skin where it is attached. Save the tick for later identification. Wash the bitten area with soap and water. See a doctor if a rash appears at the tick bite or if flu-like symptoms appear in a few days or few weeks.
- Be familiar with the appearance of poison ivy and other poisonous plants. Contact with vines, roots, leaves, or sap can cause a skin rash. Wear protective clothing and gloves as necessary to prevent contact. Consult a doctor if a severe reaction occurs.
- Avoid contact with snakes. If bitten get to a doctor quickly. Attempt to save or identify the snake for identification to assist in treatment. Use a snakebite kit only if you are an hour or more away

from a doctor; always follow up with a doctor even if a kit is used. Never use a tourniquet or attempt to suck the venom out of the snakebite site.

- Some individuals may have severe allergic, and possibly fatal, reactions to animal and insect bites. Observe victims of bites carefully for shortness of breath, chest pain or tightness, or other unusual behaviors and get the victim medical attention immediately if any symptoms appear.

7.3 Water Hazards

The outdoor hazards reviewed in Section 7.2 are applicable and in some cases potentially exacerbated while working in or near water. Heat stress occurs more easily while working on or in water due to additional personal protective equipment worn (raising body temperature more quickly), and the additional exertion required to perform actions in the denser, aqueous medium. Cold stress is also a concern while working in watery conditions, because immersion in water speeds the loss of body heat, amplifying hypothermic reactions. Insect and animal bites can be more prevalent in or near water due to the common occurrence suitable habitats such as warm shallow pools of stagnant water where mosquitoes and other insects breed. Additionally, these environments are ideal habitats for snakes, amphibians, and possibly crocodiles. Extra attention to the above stated outdoor hazards should be practiced while site personnel are performing tasks in close proximity to water.

Working in and around water presents hazards different from those on dry ground. These water hazards vary based on whether work is being performed on or near shore in water that can be waded, or in deeper water requiring a boat or barge. These hazards include, but are not limited to: wet, slippery conditions (worsening slip and trip hazards), swift currents, and drowning.

Site personnel working on-shore, or in shallow water, that is water which is no greater than waist deep, will observe the following safety precautions:

- Employ the use of the buddy system. All sampling, drilling, digging, or site related activities are performed with a minimum of two site personnel working in tandem for mutual safety and assistance.
- The donning of water specific PPE including hip or chest waders, wading belts (if chest waders are worn), type II personal floatation devices (PFD), and standard Level D PPE (hard hat, safety glasses, and rigid toed boots).
- Seek immediate first aid for cuts or abrasions that are exposed to surface water, as the likelihood of infection is greater in water.
- Be mindful of the potential for rapidly changing water conditions, submerged objects, unexpected changes in water depth, current velocity, floating debris, and entrapment hazards such as submerged logs and boulders.
- Use of a walking stick or rod is recommended for stability on uneven portions of the river bed or unknown water depths to minimize slipping and tripping hazards, and to probe the water for changing conditions.

Work performed in water greater than approximately waist deep will be performed from a boat and/or barge. Workers on a boat or barge will be required to wear PFDs and the boat or barge will be equipped with a life ring. Any site work that may require personnel to operate and or work on a boat or barge must be conducted in accordance with the laws of the state of South Carolina, the United States Coast Guard,

their corporate health and safety program procedures, and the site-specific requirements of this HASP. Any on-site field personnel shall not operate or board a boat or barge without proper training. Table 11 provides a list of boating hazards and safeguards for each phase of water work.

In addition, SCE&G personnel working at Lake Murray and the Broad River Hydroelectric plant (located north of the site) will be contacted prior to the investigative and remedial activities to discuss lake and canal levels and discharge plans. Contacts for both facilities will be incorporated into the HASP or contact list for future reference.

8.0 CHEMICAL HAZARD CONTROL

8.1 Chemical Handling Procedures

Personnel must practice the chemical-specific handling procedures outlined in Table 12.

8.2 Personal Protective Equipment (PPE)

Based upon the hazards that may be encountered during site activities, PPE as follows was selected. Only PPE that meets the following American National Standards Institute (ANSI) standards are to be worn.

- Eye protection - ANSI Z87.1-1989
- Head protection - ANSI Z89.1-1986
- Foot protection - ANSI Z41-1991

Field personnel must maintain the proper use and care of PPE. Initial work in the exclusion zone and during drilling will commence in Level D PPE.

Level D is the minimum acceptable level of protection for the project site. Upgrade to Modified Level D occurs when the possibility of contact to the skin or work uniform can occur from contaminated media. Upgrade to Level C will occur when results of air monitoring reveal that action levels have been exceeded. Upgrade to Level B will occur by site personnel that meet the applicable training requirements when results of air monitoring reveal that action levels have been exceeded. Hearing protection must be worn when working in areas where high noise levels are generated. Table 13 summarizes the various levels of PPE.

Should the use of a respirator be required, cartridge life will be calculated based upon information provided by the manufacturer and conservative assumptions.

8.3 Decontamination Procedures

Operations conducted at this site have the potential to contaminate field equipment and PPE. To prevent the transfer of contamination to vehicles, administrative offices and personnel, the procedures presented

in Table 14 must be followed. Utilizing the equipment for that purpose will follow specific decontamination requirements. PPE must be left either on-site or in the company vehicle.

8.4 Example Decontamination Diagram

If Level C or Level B PPE is required, a contamination reduction zone (CRZ) will be constructed at an appropriate location with a travel path identified from the exclusion zone (EZ). When necessary, the decontamination procedure for this project site is a two-stage process.

Stage 1

- Gross contamination removal with a brush
- Remove outer boots and dispose in a drum
- Remove Tyvek® suit and dispose in a drum
- Remove outer gloves and dispose in a drum
- Walk to Stage 2 area

Stage 2

- Remove respirator
- Remove cartridge and dispose in a drum
- Clean respirator and insert into a bag
- Remove inner gloves and dispose in a drum
- Wipe hands with a towelette and dispose in a drum
- Walk out of decontamination area

9.0 SITE CONTROL PROGRAM

A map depicting the Congaree River Sediments site is provided as Figure 1. The site is located west of the intersection of Gist and Senate Streets in Columbia, South Carolina.

During investigative and corrective action activities, work zones will be established in order to:

- Delineate high-traffic locations;
- Identify hazardous locations; and
- Contain contamination within the smallest area possible.

Employees entering the work zone must wear the proper PPE for that area. Work and support zones will be established based on ambient air monitoring data, necessary security measures, and site-specific conditions. Work zones will be identified as either hot zone (HZ)/EZ, decontamination zone (DZ)/ CRZ; or clean zone (CZ)/support zone (SZ).

The following PPE requirements apply for the various work zones:

- HZs/EZs require Level D PPE
- DZs/CRZs require Level D PPE
- SZs/CZs require Level D PPE

Listed are general guidelines for delineation of work zones. CRZs will be developed for decontamination procedures.

1. The HZ/EZ is identified by a minimum 10-foot distance surrounding this area (on-land), and will be designated if unattended with cones, barricades or caution tape, depending on the location in relation to employees, the general public and high traffic areas.
2. The DZ/CRZ will be designated at its boundaries, as appropriate, depending on the location in relation to employees, the general public and high traffic areas. In some cases, the DZ/CRZ may include the back-end of a pick-up truck.
3. Support zones are located in clean areas.

Site security procedures that address various working areas of the site are summarized in Table 15.

10.0 CONTINGENCY PLANS

Table 16 presents contingency plans for potential emergency situations. The information in the contingency plans must be clearly communicated to all project personnel that may be affected at the site. Additional site emergency information is provided in Appendix A.

Communications at the work site can be accomplished by verbal or non-verbal means. Verbal communication can be impacted by the on-site background noise or while wearing respiratory protection. Table 17 lists the type of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation, and all project personnel must be initially briefed on the communication methods prior to starting work and reminded as necessary during the daily safety meetings.

Absorbent booms and turbidity curtains will be incorporated as contingency elements during the investigation, and potentially remediation. During the investigation, absorbent booms may be deployed around a portion of the boat to capture material that may be spilled during accidental or inadvertent spills. Drilling will be assessed to determine if turbidity is generated. If turbidity is significant, then deployment of a turbidity curtain on a section of the boat may be considered.

11.0 MEDICAL MONITORING PROGRAM

All field personnel who may work at hazardous waste sites must undergo medical surveillance in accordance with their corporate health and safety program and the requirements of 29 CFR 1910.120(f).

This requirement applies to employees who may be exposed to hazardous substances or health hazards at or above the permissible exposure limits, without regard to the use of respirators, for 30 days or more a year; to all employees who may wear a respirator; and to all employees who are injured or develop signs or symptoms of overexposure to hazardous substances or health hazards from hazardous waste operations or an emergency response. The medical surveillance program consists of baseline pre-employment screening and periodic exams/consultations.

TABLES

TABLE 1

RESPONSIBILITIES OF PERSONNEL

Title	General Description	Responsibilities
Technical Advisor APEX - William Zeli	Has authority to direct all health and safety aspects of response operations.	• Coordinates with the PM (if different from PM). • Prepares and organizes background review of the project for the HASP. • Advises on potential for worker exposure to project hazards along with appropriate control methods. • Together with the SHSO, assures that health and safety requirements are met.
Site Health and Safety Officer (SHSO)	Advises all aspects of health and safety on site. Stops work if site operations threaten worker health and safety. Informs of any changes in site conditions or project status.	• Ensure personnel have the appropriate level of training • Periodically inspects protective clothing and equipment. • Sees that protective clothing and equipment are properly stored and maintained. • Controls entry and exit at the access control points. • Monitors the workers for signs of stress, including heat stress, cold exposure, and fatigue. • Implements the HASP. • Conducts periodic inspections to assess whether the HASP is being followed. • Enforces the "buddy" system. • Informed of emergency procedures, evacuation routes, and telephone number of local hospital, poison control center, fire department, and police department. • Notifies, when necessary, local public emergency officials. • Coordinates emergency medical care. • Sets up decontamination lines and decontamination solutions appropriate for the chemical contaminants encountered. • Controls the decontamination of equipment, personnel, and samples from contaminated areas. • Facilitates the proper disposal of contaminated clothing and materials. • Maintains the availability of required equipment. • Advises health services and medical personnel of potential exposures. • Notifies emergency response personnel in the event of an emergency. • Maintains and oversees operation of monitoring equipment and interpretation of data from the monitoring equipment.
Project Supervisor	Has authority to direct response operations. Assumes total control over site activities.	• Conducts Daily Safety Tailgate Meeting and documents attendance. • Conducts periodic field health and safety inspections. • Manages field operations. • Executes the work plan and schedule. • Enforces safety procedures. • Enforces site control. • Documents field activities and sample collection. • Notifies when necessary, local public emergency officials.
Work Team	Reports to project supervisor for on-site activities. Work parties must comprise of at least two people for high hazard operations.	• Safely completes on-site tasks required to fulfill the work plan. • Complies with the HASP. • Attends and participates in Daily Safety Tailgate Meetings. • Notifies SHSO or supervisor of suspected unsafe conditions.

TABLE 2

CHEMICAL AND PHYSICAL PROPERTIES OF SELECT ORGANIC CONSTITUENTS

Constituents	Molecular Weight (g/mol)	Solubility in Water (mg/L)	Soil-Water Partition Coefficient	Water-Carbon Partition Coefficient (mL/g)	Vapor Pressure (torr)	Specific Gravity	Relative Mobility Index[1]	Henry's Law Constant (atm-m^3/mol)
Volatile Organic Compounds (Mono-Aromatic Hydrocarbons)								
Benzene	78.1	1,780	97	83	9.52E+01	0.879	3.3	5.59E-03
Toluene	92.1	515	242	300	2.81E+01	0.871	1.7	6.37E-03
ortho-Xylene	106	170	363	240	1.00E+01	0.870	0.9	8.043-03
Ethylbenzene	106	150	622	1,100	9.35E+00	0.872	0.1	8.44E-03
Polynuclear Aromatic Hydrocarbons								
Naphthalene	128	31.7	1,300	9,400	8.70E-02	1.175	-3.5	4.26E-04
1-Methylnaphthalene	142	28				1.020		
2-Methylnaphthalene	142	25	12,882	8,511	5.10E-02	1.020	-3.8	
Acenaphthene	154	7.4	2,580	4,600	1.55E-03	1.069	-5.6	9.20E-05
Acenaphthylene	152	3.93	3,814	2,500	2.90E-02	0.899	-4.3	1.48E-03
Fluorene	166	1.98	5,835	7,300	7.10E-04		-6.7	6.42E-05
Carbazole	167	1.2 *	2,455	3,390	2.66E-04	1.10	-7.0	
Fluoranthene	202	0.275	19,000	38,000	5.00E-06		-10.4	6.46E-06
Phenanthrene	178	1.29	23,000	14,000	6.80E-04	1.025	-7.2	1.59E-04
Anthracene	178	0.073	26,000	14,000	1.95E-04	1.250	-9.0	1.02E-03
Pyrene	202	0.135	63,000	38,000	2.50E-06		-11.1	5.04E-06
Benzo(a)anthracene	228	0.014	125,179	1,380,000	2.20E-08		-15.7	1.16E-06
Benzo(a)pyrene	252	0.0038	282,285	5,500,000	5.60E-09		-17.4	1.55E-06
Chrysene	228	0.006	420,108	200,000	6.30E-09	1.274	-15.7	1.05E-06
Benzo(b)fluoranthene	252	0.0012	1,148,497	550,000	5.00E-07		-15.0	1.19E-05
Benzo(g,h,i)perylene	276	0.0003	1,488,389	1,600,000	1.03E-10		-19.8	5.34E-08
Dibenz(a,h)anthracene	278	0.0025	1,668,800	3,300,000	1.0E-10		-19.1	7.33E-08
Benzo(k)fluoranthene	252	0.0006	2,020,971	550,000	5.1E-07		-15.3	3.94E-04
Indeno(1,2,3-cd)pyrene	276	0.0002		1,600,000	1.0E-10		-19.9	6.86E-08
Arsenic	74.9	0				5.73		

[1] - Relative Mobility Index

Relative Mobility Index	Mobility Descriptor
> 5	Extremely Mobile
0 to 5	Very Mobile
-5 to 0	Slightly Mobile
-10 to -5	Immobile
< -10	Very Immobile

REFERENCES:

U.S. EPA, 1979. Water-Related Environmental Fate of 129 Priority Pollutants.
U.S. EPA, 1982. Aquatic Fate Process Data for Organic Priority Pollutants.
Vershueren, 1983. Handbook on Environmental Data on Organic Chemicals, 2nd Edition.
Lyman and others, 1982. Handbook of Chemical Property Estimation Methods.
Ford and Gurba, 1984. Methods of Determining Relative Contaminant Mobilities and Migration Pathways Using Physical-Chemical Data.
* - Pennsylvania Act 2 Technical Guidance Manual, Table 5A.
U.S. ACE , 1997. Riverine Emergency Management Model Chemical Properties Table.

TABLE 3

CONSTITUENTS OF CONCERN EXPOSURE LEVELS

Constituents of Concern	PEL-TWA [1]	PEL-STEL [1]	TLV-TWA[2]	TLV-STEL[2]
Benzene	1 ppm	5 ppm	0.5 ppm	2.5 ppm
Ethylbenzene	100 ppm	125 ppm	20 ppm	N/A
Toluene	200 ppm/300 ppm C[3]	150 ppm	20 ppm	N/A
Xylene	100 ppm	150 ppm	100 ppm	150 ppm
Arsenic	0.010 mg/m^3	N/A	0.01 mg/m^3	N/A
Creosote (Coal Tars)	0.2 mg/m^3	N/A	0.2 mg/m^3	N/A
Cyanide	5 mg/m^3	N/A	5 mg/m^3 C	N/A
Hydrogen Sulfide [4]	20 ppm C	15 ppm	1 ppm	5 ppm
Naphthalene	10 ppm	15 ppm	10 ppm	15 ppm
PAHs as Naphthalene	10 ppm	15 ppm	10 ppm	15 ppm
Phenol	5 ppm	N/A	5 ppm	N/A

(1) Source: 29 CFR 1910.1000 and NIOSH Pocket Guide to Chemical Hazards Online (last updated 2010).

(2) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) from OSHA Chemical Sampling Information Online. Data represented is from various years ranging from 2001-2011.

(3) C - ceiling recommended exposure limit, should not be exceeded at any time

(4) Hydrogen sulfide may be present due to a reduced geochemical environment in the subsurface.

(5) Some constituents (e.g. arsenic) are included as a conservative measure

(6) Highlighted values - refer to Appendix G: 1989 Air Contaminants Update Project - Exposure Limits NOT in Effect of the NIOSH Pocket Guide to Chemical Hazards for additional information.

TABLE 4

CONSTITUENTS OF CONCERN PROFILE

Contaminant of Concern	Profile of Hazards and Control Measures
Petroleum Hydrocarbons	1. Main concerns with petroleum hydrocarbons are preventing skin contact and inhalation of petroleum hydrocarbons. Utilize air monitoring equipment for screening of vapor concentrations and confirm specific substances, such as benzene with detector tubes. Benzene is a known carcinogen. Toluene can be absorbed through the skin. Aromatic hydrocarbons, when inhaled, cause central nervous system depression with symptoms such as headache, dizziness, tiredness, and nausea. If exposure is suspected, leave area to fresh air and seek medical attention. 2. Excessive and repeated exposure to petroleum hydrocarbons can cause reddening, drying, and cracking of the skin. If direct contact occurs, rinse for 15 minutes with water and seek medical attention. 3. Chemical protective clothing and gloves must be specified by a health and safety professional. Respiratory protection, as well as action levels for upgrade, need to be specified by a health and safety professional.
Coal Tar	1. Coal Tar can contain up to 160 aromatic compounds such as phenol, pyrol, and pyridine plus additional poly aromatic hydrocarbons (PAHs). It is listed as a carcinogenic substance by IARC, NTP, and OSHA. 2. Coal Tar is toxic by inhalation, ingestion and skin contact. The range of toxicity depends on the exposure, concentration and duration. Effects may include irritation to skin, mucous membranes and respiratory system upon exposure from direct contact short term contact to respiratory and skin diseases from repeated long term exposure. Symptoms include redness and itching to skin leading to a dermatitis from skin contact, severe eye irritation when contacted in the eye, and trouble breathing from inhalation. 3. Precautions to take to avoid exposure to Coal Tar are wearing appropriate PPE to avoid skin and eye contact when working with contaminated soil and water. Minimize breathing in contaminated soil by using wet methods to control dust or wear a cartridge respirator with HEPA filter. In the event of contact or suspected exposure, rinse the affected area with water, and seek medical attention.

TABLE 5

HAZARD ANALYSIS MATRIX

	Tasks										
Hazards	Mobilization	Decon Pad Construction	Air Monitoring	Excavation/ Trenching/ Dewatering	Material Handling Transportation	Soil/Water Sampling	Cap Install/ Construction	Wading	Work from Boat	Decontamination	Restoration
Unexploded Ordnance (UXO)				X	X	X	X	X	X		X
Constituents of Concern Exposure			X	X	X	X	X	X	X	X	
OSHA Chemicals Exposure			X	X		X	X	X	X	X	
Mechanical Equipment/ Construction	X	X	X	X	X	X	X	X	X	X	X
Lifting and Material Handling	X	X	X	X	X	X	X	X	X	X	X
Slip/Trip/Fall	X	X	X	X	X	X	X	X	X	X	X
Electrical	X	X	X	X			X				
Fire and Explosion			X	X			X	X	X		
Heat/Cold Stress	X	X	X	X	X	X	X	X	X	X	X
Vehicular Traffic	X	X	X	X	X	X	X			X	X
Pedestrian Traffic	X	X	X	X	X	X	X	X	X	X	X
Overhead Utilities	X			X	X		X				X
Underground Utilities		X		X			X	X	X		
Noise	X		X	X	X	X	X	X	X	X	X
Confined Space Entry (CSE)				X							
Poisonous Plants	X	X	X	X	X	X	X	X		X	X
Reptiles/Spiders/ Insects	X	X	X	X	X	X	X	X	X	X	X

TABLE 6

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Unexploded Ordnance (UXO)	1. All river work areas must be cleared by trained UXO personel prior to intrusive activities. 2. Follow all UXO Management Plan requirements
Exposure to Chemical Products (Refer to Appendix B: MSDS Definitions and MSDSs)	1. Stand up-wind of chemical products whenever possible. 2. Minimize direct contact and contact time with contaminated media to prevent exposure. 3. Avoid walking through discolored areas, puddles, leaning on drums, or contacting anything that is likely to be contaminated, unless wearing the appropriate PPE. 4. Do not eat, drink, smoke and/or apply cosmetics in the hot or warm zones. 5. Wear appropriate PPE when it is required to come in contact with contaminated media or surfaces. 6. Level D PPE must be worn as a minimum when on project site. 7. >50 parts per million (ppm) organic vapors, sustained for 5 minutes, in breathing zone requires upgrade to Level C. 8. If unknown materials are encountered, call the PM.
Exposure to OSHA Defined Hazardous Materials (Refer to Appendix B: MSDS Definitions and MSDSs)	1. All chemicals brought on-site by APEX personnel or their subcontractors, such as pipe glues, solvents, reagents, decontamination solutions, or any other OSHA defined hazardous material must be adequately labeled and the MSDSs available on-site. 2. MSDSs brought on-site can be attached in Appendix B or in the MSDS binder that is kept in the company vehicle. 3. Training on OSHA defined hazardous materials must be completed and documented. Use the Daily Safety Tailgate Meeting Form in Appendix C to record training attendance.
Exposure to Surface/Subsurface Airborne Dust	1. Stand up-wind whenever intrusive activities occur and generate visible signs of airborne dust. 2. Monitor air for airborne soil dust (surface or subsurface soil) with portable aerosol dust direct-reading instrument. 3. >0.1 mg/M^3 in breathing zone requires upgrade to Level C. 4. Utilize wet methods (spraying ground, wet drilling, etc.) when visible signs of airborne dust are generated.
Mobilization	1. Wear leather gloves in addition to Level D PPE. 2. Follow the back injury prevention techniques included in this table under “Back Injury”. 3. Be aware of traffic hazards. Follow the traffic control procedures specified in the HASP. In addition, a spotter must be used for moving and positioning equipment.
Decon Pad Construction Hand and Power Tools	1. Wear leather gloves in addition to Level D PPE 2. HAND TOOLS • Wear leather gloves. • Use tools to do the job they were intended for…don’t cut corners! • No “homemade” handles or extensions (cheaters) are permitted! • Never operate without proper training or instructions. • Tools and equipment must be maintained in good condition. Keep hand tools sharp, clean, oiled, dressed, and not abused. • Worn tools are dangerous (e.g., the “teeth” in a pipe wrench) can slip if worn smooth; and adjustable wrench will slip if the jaws are sprung; hammerheads can fly off loose handles. • Tools subject to impact (chisels, star drills and caulking irons) tend to “mushroom”. Keep them dressed to avoid flying spalls. Use tool holders. • Don’t force tools beyond their capacity. • Don’t use tools for pry bars. • Use non-sparking tools where required per client policy or when working around flammable or explosive materials.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Decon Pad Construction Hand and Power Tools (Continued)	3. POWER TOOLS • Loose clothing, long hair, rings, and other jewelry shall not be worn around rotating equipment. • Warn those around you and use proper eye protection. • Examine for damaged parts, cracked housing in insulated tools, loose fittings, and frayed or cut cords. Tag and return defective tools for repairs. • Use only 3-prong plug power tools and extension tools. • Inspect also for adequate lighting, proper lubrication, and abandoned tools or material that could "vibrate into trouble." • Portable electrical equipment and tools shall be grounded. Ground fault circuit interrupters (GFCIs) shall be used on all extension chords and portable electrical tools. • Air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection. • Air compressors must have a relief valve and must be shut down during extended breaks, such as lunch. • Proper guards or shields must be installed on all power tools before issued. Do not sue improper tools or tools without guards in place. • Replace all guards before start-up. Remove cranks, keys, or wrenches used in service work. 4. MATERIAL HANDLING AND EQUIPMENT • Severe back and other bodily injuries can be safely prevented by using proper procedures and equipment. APEX personnel must wear a back belt when lifting more than 40 pounds, and seek assistance or use a mechanical lifting device when lifting more than 70 pounds. Subcontractors must maintain their own back prevention program.
Heavy Equipment	1. Wear leather gloves while attaching support member to protect against pinching injuries. 2. While working from elevated levels greater than 6 feet, ensure that all employees have 100% fall protection with full body harnesses and guardrails. 3. Do not stand under loads that are being raised or lowered with cranes or aerial lifts. 4. Conduct pre-operational inspection of all equipment. In addition, daily inspections will be conducted on the equipment prior to site activities. 5. Maintain a safe distance of 20 feet from unguarded overhead power lines. 6. Always stay out of the swing radius of all heavy equipment. Always use a spotter during movement of equipment. The spotter, and others as appropriate, shall maintain constant communication with the operator. 7. All operators must have adequate training and be qualified to operate the particular heavy equipment unit. 8. Conduct site evaluation to determine proper positioning for the unit. Make sure surface l level. Cordon off holes, drip-offs, bumps or weak ground surfaces. 9. When using a crane, do not use hands when the load is being lifted or lowered. Use no-conductive tag line to help direct and position the load. 10. Never climb a raised platform or stand on the min-rail or top-rail. 11. Tools should always be hung or put into a belt whenever possible. 12. Wear face shield and hearing protection in conjunction with other required PPE when hoe ram in operating. Also ensure adequate clearance around overhead power lines, other equipment and personnel.
Excavation/Trenching	1. It is APEX policy that no personnel will enter an excavation hole or trench. 2. Excavation/trenching requirements per 29 CFR 1926 shall be followed. 3. Procedures for excavation and trenching are included in Appendix D. 4. Follow all UXO Management Plan requirements .

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Inclement Weather	1. Stop outdoor work during electrical storms and other extreme weather conditions such as extreme heat or cold temperatures. 2. Take cover indoors or in vehicle. 3. Listen to local forecasts for warnings about specific weather hazards such as tornados, hurricanes, and flash floods.
Utility Lines Contact	1. Contact PUPS to have utility lines marked prior to excavation/trenching. 2. Refer to site drawings or customer interviews if on private property for utility locations. 3. Hand dig 3 to 5 feet down and 5 feet each side of utility marker to avoid breaking utility lines.
Noise	1. Wear hearing protection when equipment such as a drill rig, jackhammer, cut saw, air compressor, blower or other heavy equipment is operating on the site. 2. Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection. 3. Hearing protection is required when measured sound pressure levels (SPL) exceed 85 dB(A) where employees stand or conduct work. 4. Conduct noise monitoring of suspected high noise operations at the beginning of the workday or start up of new operations to verify noise control/hearing protection requirements. 5. Refer to Section 3.2, Noise Monitoring for guidance.
Electric Shock	1. Maintain appropriate distance from overhead utilities; **20-foot minimum clearance from power lines required;** **10-foot minimum clearance from shielded power lines.** 2. Use ground-fault circuit interrupters as required. 3. Perform LO/TO procedures. 4. Use three-pronged plugs and extension cords. 5. Contact your local underground utility-locating service. 6. Follow code requirements for electrical installations in hazardous locations.
Physical Injury (All Tasks)	1. Wear hard hats and safety glasses when on-site. 2. Maintain visual contact with the equipment operator and wear orange safety vest when heavy equipment is used on-site. 3. Avoid loose-fitting clothing (driller and driller's helper). 4. Prevent slips, trips, and falls; keep work area uncluttered. 5. Keep your hands away from moving parts (i.e., augers). 6. Test the emergency shut-off switch on the drill rig daily.
Back Injury (All Tasks)	1. Use a mechanical lifting device or a lifting aid where appropriate. 2. If you must lift, plan the lift before doing it. 3. Check your route for clearance. 4. Bend at the knees and use leg muscles when lifting. 5. Use the buddy system when lifting heavy or awkward objects. 6. Do not twist or jerk your body while lifting.
Heat Stress	1. Increase water intake while working. 2. Minimize and/or avoid alcohol intake the night before working in heat stress situations. 3. Increase number of rest breaks and/or rotate workers in shorter work shifts; take breaks in shaded areas. 4. Watch for signs and symptoms of heat exhaustion and fatigue. 5. Plan work for early morning or evening during hot months.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Heat Stress (Continued)	6. Use ice vests when necessary. 7. Rest in cool, dry areas. 8. In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. Refer to Appendix K.
Insects (All Tasks)	1. Tuck pants into socks. 2. Wear long sleeves. 3. Use insect repellent. 4. Avoid contact by always looking ahead to where walking, standing, sitting, leaning, grabbing, lifting or reaching into. 5. Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms. 6. Use buddy system to check each other for signs of insect/spider bites. 7. Remove ticks immediately with fine tipped tweezers by grasping the tick as close to your skin as possible and gently pulling straight out. Do not squeeze the tick's body as this may inject fluids into you. Wash the bite area of skin and apply antiseptic.
Poisonous Plants (i.e., Poison Ivy, Oak or Sumac) (All Tasks)	1. Don't enter areas infested with poisonous plants. 2. Immediately wash any areas that come into contact with poisonous plants. 3. Protect exposed skin area with gloves and Tyvak® suits. 4. Be aware that the oil from the plant can be carried on boots, clothes and equipment. Always protect skin from contact. 5. If you have known or suspected allergies, carry an Epi-Pen at all times and notify co-workers that you are allergic.
Poisonous Snakes (All Tasks)	1. Avoid walking in areas where snake may nest or hide. Always look ahead to where walking for signs of snakes. 2. Use extreme caution when moving or lifting objects which could be used by snakes as cover. 3. Never reach under or behind objects or into other areas where snakes may hide. 4. Wear study leather boots.
Slip/Trip/Fall (All Tasks)	1. Inspect each work area for slip/trip/fall potential prior to each work task. 2. Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided. 3. All personnel must be aware of their surroundings and maintain constant communication with each other at all times.
Restoration	1. Follow the heavy equipment procedures specified in this table. 2. Use leather gloves in addition to Level D PPE when handling grading tools. 3. Beware of slip/trip/fall hazards. Follow the slip/trip/fall procedures outlined in this table **Follow the traffic control procedures when necessary.**
Material Handling Drums/Transportation	1. Drums will be safely transported on-site using conventional drum handling techniques including a bobcat, dump truck, front-end loader. Heavy equipment used for transporting will follow the heavy equipment procedures specified in this table. 2. Extreme care will be taken during drum handling operations to prevent release and to ensure safe working conditions. All drums will be staged and labeled in accordance with regulatory requirements. 3. Ensure that your body, material, tools and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, blowing, or any other uncontrolled motion.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Material Handling Drums/Transportation (Continued)	4. Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released. 5. Chock all material and equipment (such as pipes, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
Drilling/Boring Operations (Refer to Appendix H)	1. Driller and helper must be present during all active operations. 2. Driller helper and other site personnel must know location of emergency shut off switch. 3. Unauthorized personnel must be kept clear of drilling rig. 4. Area of drilling operation must be cordoned off/barricade. 5. When hazardous conditions are deemed present, operation must be shut down.
Cap Install/ Construction (refer to Heavy Equipment section)	1. Ensure properly trained personnel conduct crane and heavy equipment operations. 2. Stay away from moving equipment or suspended loads. Make eye contact with operators before approaching equipment. 3. Watch for pinch points with concrete cap materials. 4. Ensure contractor personnel responsible for rigging loads are properly trained and rigging material is in good condition and free of defects.
Fire Control	1. Smoke only in designated areas. 2. Keep flammable liquids in closed containers. 3. Keep site clean; avoid accumulating combustible debris such as paper. 4. Follow Hot Work Safety Procedures when welding or performing other activities requiring an open flame. 5. Isolate flammable and combustible materials from ignition sources. Ensure fire safety integrity of equipment installations.
Cleaning Equipment	1. Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, or other cleaning materials. 2. Stand upwind to minimize any potential inhalation exposure. 3. Dispose of spent cleaning solutions and rinses accordingly.
Wading	1. Buddy system must be employed 2. Preferably wade in water where bottom can be seen 3. When bottom cannot be seen, use a probing device to check bottom 4. Inspect area for crevices, washouts, etc. 5. Visually assess current and depth. Stay clear of rapidly moving water and do not proceed above wader height 6. Do not wade during periods of storm flush, or with floating debris in water
Boat	1. Life jackets must be worn at all times on boat 2. Be aware of surroundings since the boat will contain limited space and have a fair amount of equipment 3. Respect railing and boat edge 4. Move deliberately 5. River conditions will be inspected daily to ensure safe boating conditions exist
First aid kit, blood borne pathogen kit, emergency eye wash/shower station, fire extinguisher and absorbent pads will be located on-site either in the decontamination zone, or in the company vehicle.	

TABLE 7

AIR MONITORING FREQUENCY GUIDELINES

Conduct periodic monitoring when:

1. It is possible that an immediately dangerous to life or health (IDLH) condition or a flammable atmosphere has developed; or

2. There is an indication that exposures may have risen over established action levels, permissible exposure limits or published exposure levels since the last monitoring. Look for a possible rise in exposures associated with these situations:

   - Change in site area - work begins on a different section of the site.
   - Change in contaminants - handling contaminants other than those first identified.
   - Visible signs of particulate exposure from intrusive activities such as drilling/boring and excavation.
   - Perceptible chemical odors or symptoms of exposure.
   - Change in on-site activity - one operation ends and another begins.
   - Handling leaking drums or containers.
   - Working with obvious liquid contamination (e.g., a spill or lagoon).

Conduct air monitoring when the possibility of volatilization exists (such as with a new monitoring well).

TABLE 8

PERSONAL PROTECTIVE EQUIPMENT AND AIR MONITORING SUMMARY

Job Task	Level PPE	Instrument	Frequency
Mobilization	Level D	None	None.
Decon Pad Construction	Level D	None	None.
Drilling/Well Installation	Level D	PID[1] or FID[2], O_2/LEL[3], HS/B[4], DM[5]	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Excavation/ Trenching/ Dewatering	Level D	PID or FID, O_2/LEL, HS/B, DM	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Material Handling/ Transport	Level D	PID or FID, O_2/LEL, HS/B, DM	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Soil Sampling	Level D	PID or FID, O_2/LEL, HS/B	Surface - None, unless visible evidence of contamination is observed. Subsurface - Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Water Sampling	Level D	PID or FID, O_2/LEL, HS/B	Monitor initially at each location, and continue if necessary (potential for action level exceedance). Subsequent monitoring after initial event to be conducted if potential for action level exceedance is suspected (e.g., based on analytical results or product accumulation in well). O2/LEL, HS/B used based on site conditions.
Decontamination	Modified Level D	PID or FID, O_2/LEL, HS/B	Initial decontamination: Every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. Based on monitoring results and site conditions, a decrease in frequency or cessation of monitoring may be warranted. O2/LEL, HS/B used based on site conditions.
Restoration	Level D	None	None.

[1] PID, Photoionization Detector
[2] FID, Flame Ionization Detector
[3] O_2LEL, Oxygen Level and Combustible Gas Meter
[4] HS/B, Hydrogen Sulfide Real-time Monitors and Benzene Detector Tubes
[5] DM, Dust, Particulate Monitor

Note: "Start up of work at each new task location" means to monitor the air quality at each new operation on the site. The breathing zone is the area inside a 1-foot radius around the head.

TABLE 9

AIR MONITORING ACTION LEVELS

Instrument*	Function	Measurement	Action
FID or PID (10.6 eV lamp) - Measures Total Organic Vapors			
Conduct air monitoring for volatile organic compounds during activities where exposure to contaminated media may occur.		>1ppm	Sustained for five minutes. Level D required. Check for benzene with detector tubes.
		> 10 ppm	Sustained in breathing zone for five minutes. Upgrade to Level C with a minimum of a half face APR with combination organic vapor/P100 cartridges
		>25 ppm	Sustained in breathing zone for five minutes. Upgrade to Level C with a minimum of a full face APR with combination organic vapor/P100 cartridges.
		>250 ppm	Sustained for five minutes. Stop work. Evacuate site. Contact PM and HSR.
Conduct perimeter air monitoring for volatile organic compounds during activities where exposure to contaminated media may occur.		>1ppm	Sustained at perimeter. Stop work. Identify source and abate emissions.
Benzene Detector Tube			
Conduct grab sampling for benzene when sustained PID/FID readings are detected in the breathing zone.		0 – 0.5 ppm	Modified Level D required.
		>0.5 – 10 ppm	Upgrade to Level C with a minimum of a half face APR with combination organic vapor/P100 cartridges required.
		>10 – 50 ppm	Upgrade to Level C with a minimum of a full face APR with combination organic vapor/P100 cartridges required.
		>50 ppm	Stop work. Evacuate site. Contact PM and HSR for guidance.
Hydrogen Sulfide Monitor			
Conduct air monitoring when intrusive activites such as drilling or excavation could release hydrogen sulfide gas. Levels of hydrogen sulfide greater than 5 ppm will require work to be temporarily suspended. Stop work, leave the area, and contact PM and HSR.			
Dust/Particulate Monitor			
Conduct dust monitoring during activities where exposures to contaminated media may occur. Engineering controls (e.g., ground spraying) will be employed as appropriate to control dust. If action levels (>0.10 mg/M^3) are exceeded, engineering controls will be utilized.		Background – 0.10 mg/M^3	Level D required
		>0.10 – 5.0 mg/M^3	Upgrade to Level C.
		>5.0 mg/M^3	Stop work. Contact PM or HSR for guidance.
Conduct perimeter dust monitoring during activities where exposures to contaminated media may occur. Engineering controls (e.g., ground spraying) will be employed as appropriate to control dust. If action levels (>0.10 mg/M^3) are exceeded or visible airbone dust observed, engineering controls will be utilized.		>0.15 mg/M^3	Sustained at perimeter. Stop work. Contact PM or HSR for guidance.
Oxygen/Combustible Gas (O_2/LEL) Monitor – Measures oxygen level (O_2) and lower explosive limit (LEL).			
Conduct air montioring for O_2/LEL when conditions exist where flamable vapors/gasses and/or oxygn deficiency or inrichment can occur.		O_2 >19.5 – 20.8%	Verify reasons for O_2 depletion with appropriate air monitoring instrumentation before work continues. Utilize appropriate engineering controls/PPE once atmospheric contaminants have been verified.
A decreased O2 reading of 0.1% (e.g., 20.9% to 20.8%) actually represents a change in the total air envelope of approximately 0.5% or 5,000 ppm. This represents little hazard if the displacing gas is inert; if the displacing gas is toxic/flamable/reactive, such a concentration represents a real hazard.		O_2 >20.8 % – 22%	Verify reasons for O_2 enrichment before entering area. Utilize appropriate engineering controls/PPE to control O_2 enriched atmosphere.
		O_2 >22%	Leave area immediately; this atmosphere is extremely flamable. Notify PM or HSR for guidance.
		O_2 <19.5%	Leave area immediately; this atmosphere is oxygen deficient. Verify reason for O_2 depletion with appropriate air monitoring instrumentation before work continues. Utilize appropriate engineering controls/PPE once atmospheric contaminants have been verified.
Verify reasons for O2 depletion by conducting air monitoring with instruments that can measure suspected contaminants (PID/FID) or that can confirm presence of contaminats (detector tubes or chemical specific real-time air monitors).		LEL <10%	Acceptable conditions. Continue normal activity.
		LEL >10%	Leave area immediately. Contact PM or HSR for guidance on venting and other safety measures.
***Note: Instruments must be calibrated according to manufacturer's recommendations.**			

TABLE 10

NOISE MONITORING

Instrument	Measurement	Action
Type I or Type II SLM Calibrate Before Use	>80 dB(A) - 85 dB(A)	Hearing protection recommended. Limit work duration to 8-hour shifts.
	>85 dB(A) - 90 dB(A)	Hearing protection required. Limit work duration to 8-hour shifts.
	>90 dB(A) - 115 dB(A)	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	>115 dB(A)	Stop work. Contact PM.

TABLE 11

BOATING HAZARDS AND SAFEGUARDS

Job Steps	Job Hazards	Safeguards and Precautions
Pre-boarding	a) Damaged Equipment b) Improper Equipment c) River conditions	1) Inspect boat; holes, dents, cracks, etc. 2) Inspect motor; leaks, damaged propeller, etc. 3) Inspect personal floatation devices (PFDs). There should be one PFD for each person on board the boat, and throwable PFDs (life rings, buoys) for emergency use 4) Do not wear hip/chest waders while on boat 5) Assess river conditions at the beginning of the day and during the day to ensure safe boating conditions
Boarding/deboarding the boat	a) Slip, trip and/or fall	1) Don appropriate safety equipment including shoes with non-slip soles and PFD
Performing tasks on boat	a) Slip, trip and/or fall b) Fall overboard c) River traffic d) Severe weather	1) Restrict non essential movement. 2) Wear PFD at all times. 3) Enforce buddy system 4) Do not lean awkwardly over boat to perform tasks 5) Implement rescue procedures should someone fall overboard 6) Remain watchful of other boats on water and other equipment, floating debris 7) Return to shore immediately at the onset of severe weather

TABLE 12

CHEMICAL HANDLING PROCEDURES

Chemical	Description	Procedures
Acids and Bases Acids: Including hydrochloric, nitric, and sulfuric acids Bases: Including sodium hydroxide	Extremely corrosive materials with a variety of uses.	• Wear gloves and eye-splash protection while using acid dispensed from a small dropper bottle during water sampling. • Wear a full-face, air-purifying respirator equipped with combination cartridges (organic vapor/ acid gas) as well as Tyvek® coveralls and nitrile and/or nitrile butyl rubber (NBR) gloves for large volume applications. • Have an eye wash bottle or portable eye wash station on-site. • Cap all drums after dispensing chemicals. • Do not add anything into a virgin chemical drum, including unused product. • Avoid mixing strong acids and bases. Consult SHSO for task-specific evaluation. If mixing is absolutely necessary, do it slowly. Avoid vapors or fumes that are generated. • When diluting acids, add the acid to water in small quantities and mix cautiously. • When diluting bases, add water to the base in small quantities and mix cautiously.
Activated Carbon	Granular adsorbent medium used to remove residual hydrocarbons from water and/or air.	• Use respiratory protection when activated carbon creates a dusty environment. • Avoid using Activated Carbon Filter Beds for Ketone Solvents - an exothermic reaction can develop over time and result in possible explosion. • Contact SHSO for task-specific evaluation.
Oxygen-Supplying Chemicals	Dry chemical used to increase subsurface oxygen levels and enhance aerobic biodegradation of organic constituents.	• Refer to product information provided in Appendix M of the HASP.

TABLE 13

PERSONAL PROTECTIVE EQUIPMENT

Level	Requirements
Level D	• Work Uniform • Steel-toed boots • Approved safety glasses or goggles • Hard hat • Fluorescent vest, when vehicular traffic is on or adjacent to the site Nitrile gloves for water sampling handling.
Modified Level D	**One or more of the following:** • Chemical resistance (acid or solvent) boot covers • Kleen Guard LP (Reduced Heat Stress) or PE-coated Tyvek® suit, Neoprene outer and PVC inner gloves. • Hearing protection (muffs and/or plugs).
Level C	• Level D and Modified Level D • NIOSH/MSHA-approved full-face respirator with organic vapor/acid gas high efficiency particulate air-purifying (HEPA) cartridges.
Level B	• Level B cannot be worn without the prior approval of the SHSO.
Level A	• Level A cannot be worn without the prior approval of the SHSO.
Prior to use, all equipment must be inspected to ensure proper working condition.	

TABLE 14

DECONTAMINATION PROCEDURES

Item	Examples	Procedure
Field equipment	Bailers, interface probes, hand tools, drill augers, and miscellaneous sampling equipment.	• Decontaminate with a solution of detergent and water; rinse with water prior to leaving the site. • Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.
Disposable PPE	Tyvek® suits, inner latex gloves, respirator cartridges	• Dispose of according to the requirements of the client, state and federal agencies. • Change-out respirator cartridges on a daily basis and dispose accordingly.
Non-disposable PPE	Respirators	• Wipe out respirator with disinfecting pad prior to donning. • Decontaminate respirator on-site at the close of each day based upon extent of contamination. This procedure could include disassembling the respirator and cleaning, rinsing, sanitizing, and drying all parts with approved powders and solutions.
	Boots and gloves	• Decontaminate outside with a solution of detergent and water; rinse with water prior to leaving the site. • Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

TABLE 15

SITE SECURITY PROCEDURES

Working in Street or Roadway

- Wear traffic vest and hardhat when vehicle hazard exists.
- Use cones, flag-mounted cones, caution tape and/or barricades.
- Develop traffic patternization plan for high traffic situations:
  - use flag person;
  - use flashing arrow sign;
  - use "MEN WORKING" signs liberally;
  - obtain lane closing permits; and
  - engage police details.

Working at Excavation/Trenching Sites or Investigation Area

- "Competent person" is required per OSHA 29 CFR 1926 Subpart P.
- Safetyguard open excavations by restricting unauthorized access.
- Highlight work area and maintain zone definition along perimeter with appropriate controls (caution tape, signs, cones, barricades, etc.).
- Restrict access to work areas with fencing and gates or caution tape
- Use security on a 24-hour basis

Equipment and Excavations Left Unattended or Overnight

Use one of the following methods to address these situations:

- Restrict access to the site with fencing and locked gates.
- Surround entire perimeter of open excavation with appropriate controls (caution tape, signs, cones, barricades, etc.).
- Place barricades affixed with flashing lights end to end with construction net fence attached to barricades.
- Utilize temporary curbing or concrete "jersey" barriers affixed with flashing signal lights or other effective warning signs.
- Restrict access to work areas with fencing and gates or caution tape
- Use security on a 24-hour basis

TABLE 16

CONTINGENCY PLANS FOR SITE EMERGENCIES

Situation	Action
Evacuation	1. Immediately notify all on-site personnel of an emergency requiring evacuation. 2. Leave the dangerous area and report to a designated rally point. 3. Notify emergency medical service (EMS), as appropriate. 4. Account for all personnel. 5. Contact the PM as soon as possible. 6. Maintain site security and control measures for community safety until emergency responders arrive.
Medical Emergency	1. Survey the situation: • **Do not enter an area that may jeopardize your safety.** • Establish the patient's level of consciousness. • Call for help. • Contact EMS and inform them of patient's condition. 2. Primary assessment (patient unconscious). • Arousal • Airway • Breathing • Circulation • **Only trained personnel should perform CPR or First Aid - State that you are medically trained.** 3. Secondary assessment (patient conscious). • Check for bleeding: Control with direct pressure. • Do not move patient (unless location is not secure). • Monitor vital signs. • Provide first aid to the level of your training. • Contact the PM as soon as possible.
Fire Emergency	1. **Evacuate the area.** 2. Notify the EMS. 3. Extinguish small fires with an all-purpose extinguisher. 4. Contact the PM.
Spill/Release	Prevent problems by documenting the location of underground lines (e.g., product, sewer, telephone) before starting site work. If you drill through a line or tank or another leak occurs, document the spill/release in writing. Include dates, times, actions taken, agreements reached and names of people involved. In the event of a spill/release, follow this plan. 1. Wear appropriate PPE; stay upwind of the spill/release. 2. Turn off equipment and other sources of ignition. 3. Turn off pumps and shut valves to stop the flow/leak. 4. Plug the leak or collect drippings in a bucket, when possible. 5. Place sorbent pads to collect product, if possible. 6. Call Fire Department immediately if fire emergency develops. 7. Inform PM about the situation. 8. Determine if the client wants to repair the damage of if the client will use an emergency repair contractor. 9. Based on agreements, contact emergency spill contractor for containment of free product. 10. Advise the client of spill discharge notification requirements and determine who will complete and submit forms. Do not submit or report to agencies without the client's consent. Document each interaction with the client and regulators and note, in writing; name, title authorizations, refusals, decisions, and commitments to actions. 11. Do not transport or approve transportation of contaminated soils or product until proper manifests have been completed and approve. Be aware that soils/product may meet criteria for hazardous waste. 12. Do not sign manifests as generator of wastes; contact the regional compliance manager to discuss waste transportation.
The PM must contact the client or generator. The generator is under obligation to report to the proper government agencies. If the spill extends into waterways, the Coast Guard and the National Response Center (800-424-8802) must be notified immediately by the client or with their permission.	

TABLE 17

FIELD COMMUNICATION METHODS

Communication Device	Type of Communications	Signal
Telephone On-Site or Cellular Telephone	Emergency Notification	Initiate phone call using applicable emergency phone numbers.
Two-Way Radio	Emergency notification among site personnel.	Initiate radio communication with Code Red message.
Compressed Air Horn	Hailing site personnel for non-emergency.	One long blast, one short blast.
Compressed Air Horn	Hailing site personnel for emergency evacuation.	Three long continuous blasts.
Visual	Hailing site personnel for distress, need help.	Arms waved in circle over head.
Visual	Hailing site personnel for emergency evacuation.	Arms waved in criss-cross over head.
Visual	Contaminated air/strong odor.	Hands clutching throat.
Visual	Break, lunch, end of day.	Two hands together, break apart.

FIGURE

BROAD RIVER

Timmerman Bridge

Randolph Cem

St Peters Cem

Sch

ELMWOOD

INTERSTATE I-126

Governors Mansion

232

HUGER

LAUREL

250

CONGAREE RIVER

BDY

Howard Sch

Reservoirs

WT

Irwin Park

TAYLOR

150

Correctional Institution

HUGER ST. FORMER MGP SITE LOCATION

SALUDA RIVER

12

GIST STREET

1
378

N & S

SENATE STREET

Powerplant

4 LANE

LEAPHART

ST

LUCAS

GERVAIS STREET BRIDGE

Gaging Sta

RICHLAND-LEXINGTON CO

SEDIMENT CAPPING AREA

Brookland Sch

AVE

200

BLOSSOM STREET BRIDGE

2

PO

6TH

DRIVE

Brookland-Cayce

0 537 1,074 1,611 2,148

SCALE (APPROXIMATE)

FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 09/13/16 FILE NAME: CONG402

APEX COMPANIES, LLC

APPENDIX A

SITE EMERGENCY INFORMATION

SITE EMERGENCY FORM

Contaminants of Concern: PAHs, Coal Tars, BTEX, SVOCs, Arsenic
Minimum Level of Protection: Level D
Hazard Determination: Serious_____ Moderate__X___ Low_____

Do not endanger your own life. Survey the situation before taking any action.

Apex Companies, LLC Office Telephone	412-829-9650 - Trafford, Pennsylvania
Site Location Address:	West of Gist and Senate Streets, Columbia, South Carolina
Telephone Located at:	Trailer Phone: 412-818-6151

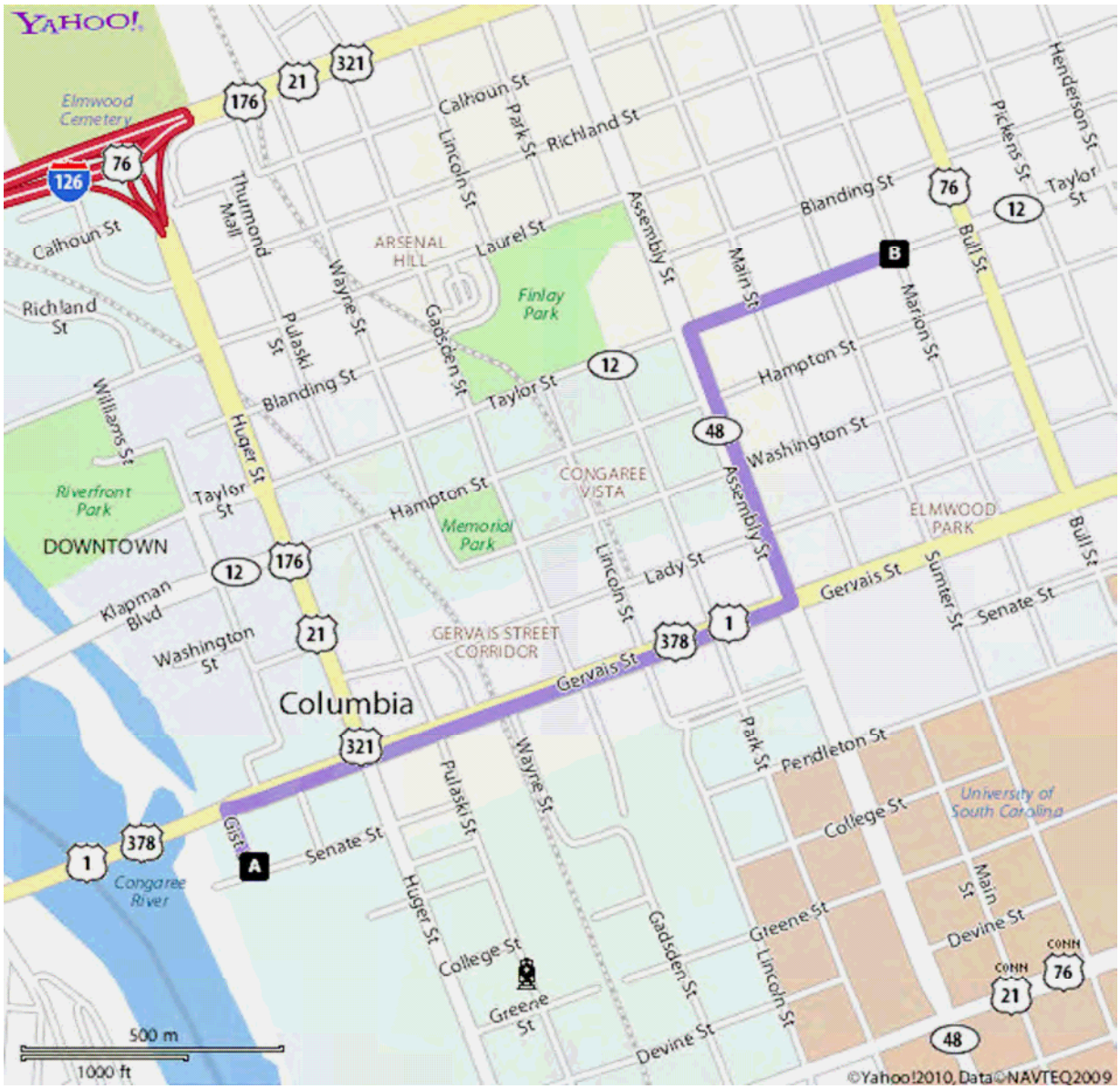
EMERGENCY PHONE NUMBERS **IN THE EVENT OF ANY EMERGENCY CONTACT PROJECT MANAGER (PM) OR HEALTH AND SAFETY REPRESENTATIVE (HSR).**

Ambulance	911
Fire	911
Police	911
Poison Control	1-800-222-1222
Hospital Name	Palmetto Health Baptist
Hospital Phone Number	911 or 803-296-5010
National Response Center (all spills)	800-424-8802
Project Manager	Andrew Contrael: 412-829-9650
Site Safety Officer	To be determined: 412-818-6151
Health and Safety Manager	Andrew Contrael: 412-829-9650
Client Contact	Bob Apple, SCANA Services, Inc.: 919-819-2748
State Agency	SCDHEC: 803-898-4258

UTILITY MARKER EMERGENCY TELEPHONE NUMBERS

Utility	Color Code	
Water Gas Electric Telephone/Cable Sewer	Blue Yellow Red Orange Green	Palmetto Utility Protection Service: 888-721-7877

HOSPITAL LOCATION MAP



HOSPITAL DIRECTIONS:

A	1. Start at 1102 GIST ST, COLUMBIA going toward GERVAIS ST	go 453 ft
	2. Turn R on GERVAIS ST (US-1 N)	go 0.8 mi
	3. Turn L on ASSEMBLY ST (SC-48 N)	go 0.4 mi
	4. Turn R on TAYLOR ST (SC-12)	go 0.29 mi
B	5. Arrive at TAYLOR ST & MARION ST, COLUMBIA	

HOSPITAL INFORMATION:

Name: Palmetto Health Baptist Center

Address: Taylor and Marion Streets
City, State: Columbia, SC

Phone: Emergency: 911
General: 803-296-5010

EMERGENCY FIRST AID

FIRST AID

Ingestion:	DO NOT INDUCE VOMITING. Call Poison Control - follow instructions. Administer cardiopulmonary resuscitation (CPR), if necessary. Seek medical attention.
Inhalation:	Remove person from contaminated environment. Administer CPR if necessary. Seek medical attention. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT.
Skin Contact:	Brush off dry material, remove wet or contaminated clothing. Flush skin thoroughly with water. Seek medical attention if irritation persists.
Eye Contact:	Flush eyes with water for 15 minutes. Seek medical attention.
Exposure Symptoms:	Headache, dizziness, nausea, drowsiness, irritation of eyes, nose, throat, breathing difficulties.
Contingency Plan:	Report incident to PM after emergency procedures have been implemented.

RESPONDER MUST BE QUALIFIED TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND TRAINED. ENSURE ALL PROTOCOLS ARE FOLLOWED INCLUDING THAT A STANDBY PERSON IS PRESENT.

2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.

3. Decontaminate the victim without delaying life-saving procedures.

4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by trained Emergency Medical Services (EMS) personnel: let the doctor assume the responsibility for determining the severity of the injury. If the condition is obviously serious, EMS must transport the victim.

5. Notify the PM.

EMERGENCY FIRST AID PROCEDURES	
To Stop Bleeding	**CPR**
1. Give medical statement. 2. Assure airway, breathing, circulation. 3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use nonpermeable gloves). Direct pressure will control most bleeding. 4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT**. Use pressure points for 30 - 60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement. 2. Arousal: Check for consciousness. 3. Open airway with chin-lift. 4. Look, listen, and feel for breathing. 5. If breathing is absent, give 2 slow, full rescue breaths. 6. Check the pulse for 5 to 10 seconds. 7. If pulse is present, continue rescue breathing: **1 breath every 5 seconds**. 8. If pulse is absent, initiate CPR; 15 compressions for each two breaths.

APPENDIX B

SIGN-IN SHEET

SIGN IN SHEET

South Carolina Electric & Gas Company
Congaree River Sediments Site
Columbia, South Carolina

Date	Name	Signature	Company	Time In	Time Out

APPENDIX C

AGREEMENT AND AKNOWLEDGEMENT SHEET

AGREEMENT AND ACKNOWLEDGEMENT SHEET
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

Apex Companies, LLC (APEX) personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the HASP. APEX project personnel, subcontractor personnel, and visitors are required to sign the Agreement and Acknowledgement Sheet prior to conducting field activities at this site.

APEX COMPANIES, LLC
AGREEMENT AND ACKNOWLEDGEMENT STATEMENT

1. I have read and fully understand the HASP and my responsibilities.
2. I agree to abide by the provisions of the HASP.

Name:		Signature:	
Company:		Date:	
Name:		Signature:	
Company:		Date:	
Name:		Signature:	
Company:		Date:	
Name:		Signature:	
Company:		Date:	
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Name:		Signature:	
Company:		Date:	

APPENDIX D

LIST OF ACRONYMS

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
BP	Breath pipe
BT	Body temperature
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BWL	Body water loss
BWT	Body water temperature
CET	Certified Environmental Trainer
CFR	Code of Federal Regulations
CGI	Combustible gas indicator
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
COHN	Certified Occupational Health Nurse
CNS	Central nervous system
CPR	Cardio-pulmonary resuscitation
CRZ	Contaminant reduction zone
CSE	Confined space entry
CSP	Certified Safety Professional
CZ	Clean zone
DM	Dust-particulate monitor
DOT	Department of Transportation
DT	Detector tube
DZ	Decontamination zone
EKG	Electrocardiogram
EMR	Environmental Medical Resources
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EZ	Exclusion zone
FID	Flame ionization detector
FP	Flashpoint
GFCI	Ground fault circuit interrupter
GM	Geiger-Mueller
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B-virus

LIST OF ACRONYMS (Continued)

HEPA	High efficiency particulate air-purifying
HR	Heart rate
HSM	Health and Safety Manager
HSR	Health and Safety Representative
HSS	Health and Safety Specialist
HVDPE	High vacuum dual-phase extraction
HZ	Hot zone
IDLH	Immediately dangerous to life or health
ILO	International Labor Organization
IP	Ionization potential
JSA	Job safety analysis
LEL	Lower explosive limit
LO/TO	Lockout/tagout
mg/M_3	Milligrams per cubic meter
mg/L	Milligrams per liter
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
N	NIDA drug screen
NA	Not available
NBR	Nitrile butyl rubber
NEC	National Electrical Code
NIDA	National Institution on Drug Abuse
NIOSH	National Institute for Occupational Safety and Health
NFPA	National Fire Prevention Association
NL	NIDA-like drug screen
NRR	Noise reduction rating
O_2	Oxygen
O_3	Ozone
OM	Operations Manager
OJT	On the job training
OT	Oral temperature
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
PID	Photoionization detector
PIR	Preliminary incident report

LIST OF ACRONYMS (Continued)

PM	Project Manager
ppb	Parts per billion
PPE	Personal protective equipment
ppm	Parts per million
RB	Random breathalyser
RBP	Random breath pipe
RCRA	Resource Conservation and Recovery Act of 1976
REL	Recommended exposure limit
RN	Registered Nurse
RR	Relative responses
RT	Random ten panel drug screen
SHSO	Site Health and Safety Officer
SLM	Sound level meter
SOW	Scope of work
SPL	Sound pressure level
STEL	Short-term exposure limit
SZ	Support zone
TLV	Threshold limit value
TSF	Tons per square foot
TWA	8-hour time-weighted average
UEL	Upper explosive limit
ug/L	Micrograms per liter
UST	Underground storage tank
VP	Vapor pressure
WBGT	Wet bulb globe temperature

APPENDIX E

SAFETY DATA SHEETS (SDS)

SAFETY DATA SHEET

Version 5.5
Revision Date 02/28/2015
Print Date 04/14/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Acenaphthylene

Product Number : 416703
Brand : Aldrich

CAS-No. : 208-96-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear eye protection/ face protection.
P280 Wear protective gloves.

P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{12}H_8$
Molecular weight	:	152.19 g/mol
CAS-No.	:	208-96-8
EC-No.	:	205-917-1

Hazardous components

Component	Classification	Concentration
Acenaphthylene		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H302, H315, H319, H335	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 78 - 82 °C (172 - 180 °F) - lit.
f)	Initial boiling point and boiling range	280 °C (536 °F) - lit.
g)	Flash point	122.0 °C (251.6 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	0.899 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Mouse - 1,760 mg/kg
Remarks: Autonomic Nervous System:Other (direct) parasympathomimetic. Respiratory disorder Blood: Hemorrhage.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: AB1254000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Acenaphthylene)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Acenaphthylene	CAS-No. 208-96-8	Revision Date 2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 02/28/2015 Print Date: 04/14/2015

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System.
THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: CROWN ACETONE
NEW MSDS DATE: 03/23/2011
COMPANY IDENTITY: Packaging Service Company, Inc.
COMPANY ADDRESS: 1904 Mykawa Road
COMPANY CITY: Pearland, TX 77581-0490
COMPANY PHONE: 1-281-485-5377
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

DANGER!!

RISK STATEMENTS:
- R36/37/38 Irritating to eyes, respiratory system and skin.
- R12 Extremely Flammable.
- R66 Repeated exposure may cause skin dryness or cracking.
- R67 Vapors may cause drowsiness and dizziness.

SAFETY STATEMENTS:
- S9 Keep container in a well-ventilated place.
- S16 Keep away from sources of ignition. No smoking.

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Crown Acetone	67-64-1	200-662-2	100

SECTION 4. FIRST AID MEASURES

EYE CONTACT:
For eyes, flush with plenty of water for 15 minutes & get medical attention.

SKIN CONTACT:
In case of contact with skin immediately remove contaminated clothing.
Wash thoroughly with soap & water. Wash contaminated clothing before reuse.

INHALATION:
After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR).

SWALLOWING:
Rinse mouth. GET MEDICAL ATTENTION IMMEDIATELY. Do NOT give liquids to an unconscious or convulsing person.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES
NO open flames, NO sparks, & NO smoking. Use a closed system, ventilation, explosion-proof electrical equipment, lighting.
Do NOT use compressed air for filling, discharging, or handling.

EXTINGUISHING MEDIA
Use dry powder, carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES
Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used.
Do not enter confined fire-space without full bunker gear.
(Helmet with face shield, bunker coats, gloves & rubber boots).
Use NIOSH approved positive-pressure self-contained breathing apparatus.

SECTION 5. FIRE FIGHTING MEASURES (CONTINUED)

UNUSUAL EXPLOSION AND FIRE PROCEDURES
EXTREMELY FLAMMABLE!! VAPORS CAN CAUSE FLASH FIRE
Isolate from oxidizers, heat, sparks, electric equipment & open flame.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.
Empty container very hazardous! Continue all label precautions!

SECTION 6. ACCIDENTAL RELEASE MEASURES

PERSONAL PROTECTIVE MEASURES:
Vapors may ignite explosively & spread long distances. Prevent vapor buildup.
Keep unprotected personnel away. Ventilate spill area. Remove all ignition sources.
Use self-contained breathing apparatus.

ENVIRONMENTAL PRECAUTIONS:
Keep from entering storm sewers and ditches which lead to waterways.

CONTAINMENT AND CLEAN-UP MEASURES:
Stop spill at source. Dike and contain. Collect leaking liquid in sealable containers.
Absorb remaining liquid in sand or inert absorbent. Remove to safe place.

SECTION 7. HANDLING AND STORAGE

HANDLING
Isolate from oxidizers, heat, sparks, electric equipment & open flame.
Use only with adequate ventilation. Avoid breathing of vapor or spray mist.
Avoid contact with skin & eyes.
Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse.
Avoid free fall of liquid. Ground containers when transferring. Do not flame cut, saw, drill, braze, or weld. Empty container very hazardous! Continue all label precautions!
To minimize static discharge when transferring, ensure electrical continuity by bonding and grounding all equipment. Use an inlet line diameter of at least 3.5 inches (8.9 centimeters) with a maximum flow rate of 1 meter/second.

STORAGE
Vapors may ignite explosively & spread long distances. Prevent vapor buildup. Put out pilot lights & turn off heaters, electric equipment & other ignition sources during use & until all vapors are gone. Isolate from strong oxidants.
Do not store above 49 C/120 F. Keep container tightly closed & upright when not in use to prevent leakage.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Crown Acetone	67-64-1	200-662-2	1000 ppm	500 ppm A4

MATERIAL	CAS#	EINECS#	CEILING	STEL(OSHA/ACGIH)	HAP
Crown Acetone	67-64-1	200-662-2	None Known	750 ppm	No

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

RESPIRATORY EXPOSURE CONTROLS
A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z86.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

VENTILATION
LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Acceptable
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

PERSONAL PROTECTIONS:
Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse.

WORK & HYGIENIC PRACTICES:
Provide readily accessible eye wash stations & safety showers.
Wash at end of each workshift & before eating, smoking or using the toilet.
Promptly remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	Ketone
ODOR THRESHOLD:	Not Available
pH (Neutrality):	Not Applicable
MELTING POINT/FREEZING POINT:	Not Available
BOILING RANGE (IBP,50%,Dry Point):	56 56 57 C / 133 134 135 F
FLASH POINT (TEST METHOD):	-16 C / 2 F (TCC)
EVAPORATION RATE (n-BUTYL ACETATE=1):	5.1
FLAMMABILITY CLASSIFICATION:	Class I B
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	2.6
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	12.8
VAPOR PRESSURE (mm of Hg)@20 C	186.0
VAPOR DENSITY (air=1):	2.0
GRAVITY @ 68/68 F / 20/20 C:	
SPECIFIC GRAVITY (Water=1):	0.792
POUNDS/GALLON:	6.597
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	537 C / 1000 F
DECOMPOSITION TEMPERATURE:	Not Available
REFRACTIVE INDEX:	1.358
TOTAL VOC'S (TVOC)*:	100.0 Wt% / 792.0 g/L / 6.5 Lbs/Gal
NONEXEMPT VOC'S (MVOC)*:	0.0 Wt% /0.0 g/L / 0.000 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS):	0.0 Wt% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C)	0.0

* Using California South Coast Air Quality Management District (SCAQMD) Rule 443.1.

SECTION 10. STABILITY & REACTIVITY

STABILITY
Stable under normal conditions.

CONDITIONS TO AVOID
Isolate from oxidizers, heat, sparks, electric equipment & open flame.

MATERIALS TO AVOID
Reacts with strong oxidants, causing fire & explosion hazard.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon Monoxide, Carbon Dioxide from burning.

HAZARDOUS POLYMERIZATION
Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:
Primary irritation to skin, defatting, dermatitis.
Primary irritation to eyes, redness, tearing, blurred vision.
Liquid can cause eye irritation. Wash thoroughly after handling.

INHALATION:
Anesthetic. Irritates respiratory tract. Acute overexposure can cause serious nervous system depression. Vapor harmful.

SWALLOWING:
Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED
Persons with severe skin, liver or kidney problems should avoid use.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:
This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.

MAMMALIAN TOXICITY INFORMATION

MATERIAL	CAS#	EINECS#	LOWEST KNOWN LETHAL DOSE DATA
			LOWEST KNOWN LD50 (ORAL)
Crown Acetone	67-64-1	200-662-2	5340.0 mg/kg(Rabbits)
			LOWEST KNOWN LC50 (VAPORS)
Crown Acetone	67-64-1	200-662-2	2100 ppm (Cats)
			LOWEST KNOWN LD50 (SKIN)
Crown Acetone	67-64-1	200-662-2	20000.0 mg/kg (Rabbits)

SECTION 12. ECOLOGICAL INFORMATION

AQUATIC ANIMAL INFORMATION:
The most sensitive known aquatic group to any component of this product is:
Mosquito Fish 13000 ppm or mg/L (48 hour exposure).

MOBILITY IN SOIL
This material is a mobile liquid.

DEGRADABILITY
This product is completely biodegradable.

ACCUMULATION
This product does not accumulate or biomagnify in the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste management options.
Recycle / dispose of observing national, regional, state, provincial and local health, safety & pollution laws. If in doubt, contact appropriate agencies.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: UN1090, Crown Acetone, 3, PG-II
DRUM LABEL: (FLAMMABLE LIQUID)
IATA / ICAO: UN1090, Crown Acetone, 3, PG-II
IMO / IMDG: UN1090, Crown Acetone, 3, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 127

> 5000 LB / 2272 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF CROWN ACETONE.

SECTION 15. REGULATORY INFORMATION

EPA REGULATION:
SARA SECTION 311/312 HAZARDS: Acute Health, Fire

All components of this product are on the TSCA list.
This material contains no known products restricted under SARA Title III, Section 313 in amounts greater or equal to 1%.

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
Crown Acetone	67-64-1	200-662-2	95-100	(311,312)	5000

SECTION 15. REGULATORY INFORMATION (CONTINUED)

> 5000 LB / 2272 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF CROWN ACETONE.
Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively.
Failure to report may result in substantial civil and criminal penalties.
State & local regulations may be more restrictive than federal regulations.

STATE REGULATIONS:
THIS PRODUCT MEETS REQUIREMENTS OF SOUTHERN CALIFORNIA AQMD RULE 443.1 & SIMILAR REGULATIONS

CALIFORNIA PROPOSITION 65: This product contains no chemicals known to the State of California to cause cancer & reproductive toxicity.

INTERNATIONAL REGULATIONS
The components of this product are listed on the chemical inventories of the following countries:
Australia (AICS), Canada (DSL, NDSL), China (IECSC), Europe (EINECS, ELINCS), Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC), Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)
B2: Flammable Liquid.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:
HEALTH (NFPA): 1, HEALTH (HMIS): 2, FLAMMABILITY: 3, REACTIVITY: 0
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING
See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

NOTICE

The supplier disclaims all expressed or implied warranties of merchantability or fitness for a specific use, with respect to the product or the information provided herein, except for conformation to contracted specifications. All information appearing herein is based upon data obtained from manufacturers and/or recognized technical sources. While the information is believed to be accurate, we make no representations as to its accuracy or sufficiency.
Conditions of use are beyond our control, and therefore users are responsible for verifying the data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their handling, and disposal of the product. Users also assume all risks in regards to the publication or use of, or reliance upon information contained herein.
This information relates only to the product designated herein, and does not relate to its use in combination with any other material or process.

Unless updated, the Safety Data Sheet is valid until 03/23/2014.

SAFETY DATA SHEET

Air

Section 1. Identification

GHS product identifier : Air

Chemical name : air

Other means of identification : Compressed Air ; Breathing Quality Air ; synthetic air, reconstituted air, medical air, medical air USP.

Product use : Synthetic/Analytical chemistry.

Synonym : Compressed Air ; Breathing Quality Air ; synthetic air, reconstituted air, medical air, medical air USP.

SDS # : 001002

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : Contains gas under pressure; may explode if heated.
May support combustion.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.

Prevention : Use and store only outdoors or in a well ventilated place.

Response : Not applicable.

Storage : Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Chemical name : air

Other means of identification : Compressed Air ; Breathing Quality Air ; synthetic air, reconstituted air, medical air, medical air USP.

CAS number/other identifiers

CAS number : Not applicable.

Product code : 001002

Ingredient name	%	CAS number
Nitrogen oxygen	76.5 - 80.5 19.5 - 23.5	7727-37-9 7782-44-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : "None expected"

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : "None expected"

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Section 4. First aid measures

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Section 7. Handling and storage

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls/personal protection

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas.

Color : Colorless.

Boiling/condensation point : -194.3°C (-317.7°F)

Melting/freezing point : -216.2°C (-357.2°F)

Critical temperature : Lowest known value: -146.95°C (-232.5°F) (nitrogen).

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Flash point : Not available.

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : Not available.

Vapor density : Highest known value: 1.1 (Air = 1) (oxygen). Weighted average: 1 (Air = 1)

Gas Density (lb/ft ^{3}) : 0.0749

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not applicable.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Section 10. Stability and reactivity

Incompatibility with various substances : Not considered to be reactive according to our database.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : “None expected”

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Section 11. Toxicological information

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1002	UN1002	UN1002	UN1002	UN1002
UN proper shipping name	Air, compressed	Air, compressed	Air, compressed	Air, compressed (nitrogen, oxygen)	Air, compressed (nitrogen, oxygen)
Transport hazard class(es)	2.2 	2.2 	2.2 	2.2 	2.2 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	-	**Explosive Limit and Limited Quantity Index** 0.125 **Passenger Carrying Road or Rail Index** 75	-	-	-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: All components are listed or exempted.
United States inventory (TSCA 8b): All components are listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Section 15. Regulatory information

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Sudden release of pressure

Composition/information on ingredients

No products were found.

State regulations

Massachusetts : The following components are listed: NITROGEN; OXYGEN (LIQUID)

New York : None of the components are listed.

New Jersey : The following components are listed: NITROGEN; OXYGEN

Pennsylvania : The following components are listed: NITROGEN; OXYGEN

Canada inventory : All components are listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory: Not determined.
Korea inventory: All components are listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

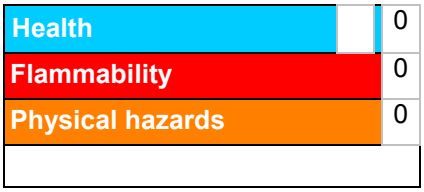
WHMIS (Canada) : Class A: Compressed gas.

CEPA Toxic substances: None of the components are listed.
Canadian ARET: None of the components are listed.
Canadian NPRI: None of the components are listed.
Alberta Designated Substances: None of the components are listed.
Ontario Designated Substances: None of the components are listed.
Quebec Designated Substances: None of the components are listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 10/14/2014.

Date of issue/Date of revision : 10/14/2014.

Date of previous issue : 9/22/2014.

Version : 0.03

Key to abbreviations :
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations

Section 16. Other information

DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

1 Identification of the substance/mixture and of the company/undertaking

· **1.1 Product identifier**

· **Trade name: ALCONOX**

· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.

· **Application of the substance / the mixture:** Cleaning material/ Detergent

· **1.3 Details of the supplier of the Safety Data Sheet**
· **Manufacturer/Supplier:**
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

· **Further information obtainable from:** Product Safety Department

· **1.4 Emergency telephone number:**
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards identification

· **2.1 Classification of the substance or mixture**
· **Classification according to Regulation (EC) No 1272/2008**


GHS05 corrosion

Eye Dam. 1; H318: Causes serious eye damage.


GHS07

Skin Irrit. 2; H315: Causes skin irritation.

· **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**


Xi; Irritant

R38-41: Irritating to skin. Risk of serious damage to eyes.
· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.
The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

· **2.2 Label elements**
· **Labelling according to Regulation (EC) No 1272/2008**
The product is classified and labelled according to the CLP regulation.

(Contd. on page 2)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

(Contd. of page 1)

· **Hazard pictograms**

GHS05

· **Signal word:** Danger

· **Hazard-determining components of labelling:**
sodium dodecylbenzene sulfonate
· **Hazard statements**
H315: Causes skin irritation.
H318: Causes serious eye damage.
· **Precautionary statements**
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264: Wash thoroughly after handling.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310: Immediately call a POISON CENTER or doctor/physician.
P321: Specific treatment (see on this label).
P362: Take off contaminated clothing and wash before reuse.
P332+P313: If skin irritation occurs: Get medical advice/attention.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
· **Hazard description:**
· **WHMIS-symbols:**
D2B - Toxic material causing other toxic effects

· **NFPA ratings (scale 0 - 4)**

Health = 1
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 1
Fire = 0
Reactivity = 0

· **HMIS Long Term Health Hazard Substances**
None of the ingredients is listed.

· **2.3 Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 3)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

(Contd. of page 2)

3 Composition/information on ingredients

· **3.2 Mixtures**
· **Description:** Mixture of substances listed below with nonhazardous additions.

· **Dangerous components:**		
CAS: 68081-81-2	sodium dodecylbenzene sulfonate Xn R22; Xi R36 Acute Tox. 4, H302; Eye Irrit. 2, H319	10-25%
CAS: 497-19-8 EINECS: 207-838-8 Index number: 011-005-00-2	Sodium Carbonate Xi R36 Eye Irrit. 2, H319	2,5-10%
CAS: 7722-88-5 EINECS: 231-767-1	tetrasodium pyrophosphate substance with a Community workplace exposure limit	2,5-10%
CAS: 151-21-3 EINECS: 205-788-1	sodium dodecyl sulphate Xn R21/22; Xi R36/38 Acute Tox. 4, H302; Acute Tox. 4, H312; Skin Irrit. 2, H315; Eye Irrit. 2, H319	2,5-10%

· **Additional information:** For the wording of the listed risk phrases refer to section 16.

4 First aid measures

· **4.1 Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

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· **5.2 Special hazards arising from the substance or mixture:** No further relevant information available.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information:** No further relevant information available.

6 Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Product forms slippery surface when combined with water.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Pick up mechanically.
Clean the affected area carefully; suitable cleaners are:
Warm water
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **7.1 Precautions for safe handling**
Prevent formation of dust.
Keep receptacles tightly sealed.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Protect from humidity and water.
· **7.3 Specific end use(s):** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**	
7722-88-5 tetrasodium pyrophosphate	
REL (USA)	5 mg/m³
TLV (USA)	TLV withdrawn
EV (Canada)	5 mg/m³

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· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
Not required under normal conditions of use.
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
· **Material of gloves**
Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber, NR
Neoprene gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**


Safety glasses

· **Body protection:** Protective work clothing

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9 Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Powder
Colour:	White
· **Odour:**	Odourless
· **Odour threshold:**	Not determined.
· **pH-value (10 g/l) at 20 °C:**	9,5 (- NA for Powder form)
· **Change in condition**	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not determined.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Self-igniting:**	Product is not self-igniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure:**	Not applicable.
· **Density at 20 °C:**	1,1 g/cm³
· **Relative density**	Not determined.
· **Vapour density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with water:**	Soluble.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	0,0 %
Solids content:	100 %
· **9.2 Other information**	No further relevant information available.

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10 Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions**
Reacts with acids.
Reacts with strong alkali.
Reacts with strong oxidizing agents.
· **10.4 Conditions to avoid:** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Phosphorus compounds
Sulphur oxides (SOx)

11 Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **On the skin:** Irritant to skin and mucous membranes.
· **On the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Irritant
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

12 Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **12.2 Persistence and degradability:** No further relevant information available.
· **12.3 Bioaccumulative potential:** Not worth-mentioning accumulating in organisms
· **12.4 Mobility in soil:** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water.
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

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· **vPvB:** Not applicable.
· **12.6 Other adverse effects:** No further relevant information available.

13 Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.
· **Recommended cleansing agents:** Water, if necessary together with cleansing agents.

14 Transport information

· **14.1 UN-Number**	
· **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.2 UN proper shipping name**	
· **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.3 Transport hazard class(es)**	
· **DOT, ADR, IMDG, IATA, ICAO**	
· **Class**	Not Regulated
· **14.4 Packing group**	
· **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	No
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	Not Regulated

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15 Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.
· **Section 313 (Specific toxic chemical listings):**
None of the ingredients is listed.
· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.
· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.
· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.
· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.
· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

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· **Canada**

· **Canadian Domestic Substances List (DSL)**	
All ingredients are listed.	
· **Canadian Ingredient Disclosure list (limit 0.1%)**	
None of the ingredients is listed.	
· **Canadian Ingredient Disclosure list (limit 1%)**	
497-19-8	Sodium Carbonate
7722-88-5	tetrasodium pyrophosphate
151-21-3	sodium dodecyl sulphate

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**
H302: Harmful if swallowed.
H312: Harmful in contact with skin.
H315: Causes skin irritation.
H319: Causes serious eye irritation.

R21/22: Harmful in contact with skin and if swallowed.
R22: Harmful if swallowed.
R36: Irritating to eyes.
R36/38: Irritating to eyes and skin.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road) IMDG: International Maritime Code for Dangerous Goods DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)

SAFETY DATA SHEET

Version 4.5
Revision Date 03/02/2015
Print Date 04/15/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Arsenic

Product Number : 267961
Brand : Aldrich
Index-No. : 033-001-00-X

CAS-No. : 7440-38-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H302 Harmful if swallowed.
H331 Toxic if inhaled.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you

	feel unwell. Rinse mouth.
P304 + P340 + P311	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	As
Molecular weight	:	74.92 g/mol
CAS-No.	:	7440-38-2
EC-No.	:	231-148-6
Index-No.	:	033-001-00-X

Hazardous components

Component	Classification	Concentration
Arsenic		
	Acute Tox. 4; Acute Tox. 3; Aquatic Acute 1; Aquatic Chronic 1; H302, H331, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Arsenic oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Arsenic	7440-38-2	TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Lung cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen		
		C	0.0020 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A 15 minute ceiling value		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Arsenic	7440-38-2	inorganic arsenic plus methylated metabolites	35µg As/l	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of the workweek (After four or five consecutive working days with exposure)			

		inorganic arsenic plus methylated metabolites	35µg As/l	Urine	ACGIH - Biological Exposure Indices (BEI)
		End of the workweek (After four or five consecutive working days with exposure)			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available

e)	Melting point/freezing point	Melting point/range: 817 °C (1,503 °F) - lit.
f)	Initial boiling point and boiling range	613 °C (1,135 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	5.727 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat Exposure to air may affect product quality.

10.5 Incompatible materials
Oxidizing agents, Halogens, Palladium undergoes a violent reaction with arsenic, Zinc, Platinum oxide, Nitrogen trichloride, Bromine azide

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 763 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

LD50 Oral - Mouse - 145 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

IARC:	1 - Group 1: Carcinogenic to humans (Arsenic)
NTP:	Known to be human carcinogen (Arsenic)
	Known to be human carcinogen (Arsenic)
OSHA:	OSHA specifically regulated carcinogen (Arsenic)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CG0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 9.9 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 3.8 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1558 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: ARSENIC
Marine pollutant:yes

IATA
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	7440-38-2	2008-10-10

Arsenic

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H331	Toxic if inhaled.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.5 Revision Date: 03/02/2015 Print Date: 04/15/2015

Buffer Solution pH 4.00

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/19/2013 Revision date: 08/06/2014 Supersedes: 02/19/2014 Version: 1.2

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : Buffer Solution pH 4.00

Product code : LC12270

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	98.94	Not classified
Potassium Hydrogen Phthalate	(CAS No) 877-24-7	1.02	Eye Irrit. 2B, H320
Formaldehyde, 37% w/w	(CAS No) 50-00-0	0.04	Flam. Liq. 3, H226 Acute Tox. 4 (Oral), H302 Acute Tox. 3 (Inhalation), H331 Skin Corr. 1B, H314 Eye Dam. 1, H318 Skin Sens. 1A, H317 Carc. 1B, H350 Aquatic Acute 2, H401

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Reactivity : None.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses.

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.

Hygiene measures : Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.

Incompatible products : Strong oxidizers.

Incompatible materials : None known.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Formaldehyde, 37% w/w (50-00-0)		
USA ACGIH	ACGIH Ceiling (mg/m³)	0.37 mg/m³
USA ACGIH	ACGIH Ceiling (ppm)	0.3 ppm

Formaldehyde, 37% w/w (50-00-0)		
USA OSHA	OSHA PEL (TWA) (ppm)	0.75 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	2 ppm

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Personal protective equipment : Avoid all unnecessary exposure.

Hand protection : Wear protective gloves.

Eye protection : Chemical goggles or safety glasses.

Respiratory protection : Wear appropriate mask.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Colour : Colourless

Odour : Odourless

Odour threshold : No data available

pH : 4

Relative evaporation rate (butylacetate=1) : No data available

Melting point : No data available

Freezing point : No data available

Boiling point : No data available

Flash point : No data available

Auto-ignition temperature : No data available

Decomposition temperature : No data available

Flammability (solid, gas) : No data available

Vapour pressure : No data available

Relative vapour density at 20 °C : No data available

Relative density : No data available

Density : 1

Solubility : Soluble in water.
Water:

Log Pow : No data available

Log Kow : No data available

Viscosity, kinematic : No data available

Viscosity, dynamic : No data available

Explosive properties : Not applicable.

Oxidising properties : None.

Explosive limits : No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

None.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

None.

10.4. Conditions to avoid

Extremely high or low temperatures.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Formaldehyde. Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Potassium Hydrogen Phthalate (877-24-7)	
LD50 oral rat	≥ 3200 mg/kg
ATE US (oral)	3200 mg/kg bodyweight

Formaldehyde, 37% w/w (50-00-0)	
LD50 oral rat	500 mg/kg
ATE US (oral)	500 mg/kg bodyweight
ATE US (vapours)	0.578 mg/l/4h

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg
ATE US (oral)	90000 mg/kg bodyweight

Skin corrosion/irritation : Not classified
pH: 4

Serious eye damage/irritation : Not classified
pH: 4

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Formaldehyde, 37% w/w (50-00-0)	
IARC group	1 - Carcinogenic to humans

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Formaldehyde, 37% w/w (50-00-0)	
LC50 fishes 1	41 mg/l (96 h; Brachydanio rerio; Pure substance)
EC50 Daphnia 1	14.7 mg/l (24 h; Daphnia magna; Pure substance)
LC50 fish 2	62 - 109 mg/l (96 h; Salmo gairdneri (Oncorhynchus mykiss); Pure substance)
EC50 Daphnia 2	2 mg/l
TLM fish 1	50 - 200,96 h; Poecilia reticulata; Pure substance
TLM fish 2	10 - 100,Pisces; Pure substance
TLM other aquatic organisms 1	10 - 100,96 h
Threshold limit algae 1	2.5 mg/l (192 h; Scenedesmus quadricauda; Pure substance)
Threshold limit algae 2	0.39 mg/l (192 h; Microcystis aeruginosa; Solution <50%)

12.2. Persistence and degradability

Buffer Solution pH 4.00	
Persistence and degradability	Not established.

Potassium Hydrogen Phthalate (877-24-7)	
Persistence and degradability	Not established.

Formaldehyde, 37% w/w (50-00-0)	
Persistence and degradability	Readily biodegradable in water. Biodegradability in soil: no data available. No (test)data on mobility of the components available. Photodegradation in the air.
Biochemical oxygen demand (BOD)	0.64 g O˜/ g substance
Chemical oxygen demand (COD)	1.06 g O˜/ g substance
ThOD	1.068 g O˜/g substance
BOD (% of ThOD)	(5 day(s)) 0.60

Water (7732-18-5)	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Buffer Solution pH 4.00	
Bioaccumulative potential	Not established.

Potassium Hydrogen Phthalate (877-24-7)	
Bioaccumulative potential	Not established.

Formaldehyde, 37% w/w (50-00-0)	
Log Pow	-0.78 - 0.0
Bioaccumulative potential	Bioaccumulation: not applicable.

Water (7732-18-5)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

Formaldehyde, 37% w/w (50-00-0)	
Ecology - soil	Toxic to flora.

12.5. Other adverse effects

Effect on ozone layer : No additional information available

Effect on the global warming : No known ecological damage caused by this product.

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

Not regulated for transport

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Formaldehyde, 37% w/w (50-00-0)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	100 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard
SARA Section 313 - Emission Reporting	0.1 %

15.2. International regulations

CANADA

Buffer Solution pH 4.00	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Potassium Hydrogen Phthalate (877-24-7)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Class D Division 2 Subdivision B - Toxic material causing other toxic effects

Formaldehyde, 37% w/w (50-00-0)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Class B Division 3 - Combustible Liquid Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision A - Very toxic material causing other toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects Class E - Corrosive Material

Water (7732-18-5)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

No additional information available

15.3. US State regulations

Formaldehyde, 37% w/w (50-00-0)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
Yes	Yes			

SECTION 16: Other information

Revision date : 08/06/2014

Other information : None.

Full text of H-phrases: see section 16:

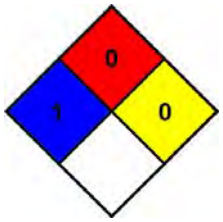
Acute Tox. 3 (Inhalation)	Acute toxicity (inhal.), Category 3
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 2	Hazardous to the aquatic environment — Acute Hazard, Category 2
Carc. 1B	Carcinogenicity, Category 1B
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Eye Irrit. 2B	Serious eye damage/eye irritation, Category 2B
Flam. Liq. 3	Flammable liquids, Category 3
Skin Corr. 1B	Skin corrosion/irritation, Category 1B

Skin Sens. 1A	Sensitisation — Skin, category 1A
H226	Flammable liquid and vapour
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H317	May cause an allergic skin reaction
H318	Causes serious eye damage
H320	Causes eye irritation
H331	Toxic if inhaled
H350	May cause cancer
H401	Toxic to aquatic life

NFPA health hazard : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : A

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **BENTONITE**

Revision Date: 16-Mar-2015 **Revision Number:** 33

1. Identification

1.1. Product Identifier

Product Trade Name: BENTONITE
Synonyms: None
Chemical Family: Mineral
Internal ID Code HM000126

1.2 Recommended use and restrictions on use

Application: Weight Additive
Uses Advised Against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Emergency Telephone: (281) 575-5000

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number

Emergency Telephone Number (281) 575-5000

2. Hazard(s) Identification

2.1 Classification in accordance with paragraph (d) of §1910.1200

Carcinogenicity	Category 1A - H350
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - H372

2.2. Label Elements

Hazard Pictograms

Signal Word Danger

Hazard Statements H350 - May cause cancer
H372 - Causes damage to organs through prolonged or repeated exposure

Precautionary Statements

Prevention	P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P260 - Do not breathe dust/fume/gas/mist/vapors/spray P264 - Wash face, hands and any exposed skin thoroughly after handling P270 - Do not eat, drink or smoke when using this product P280 - Wear protective gloves/protective clothing/eye protection/face protection
Response	P308 + P313 - IF exposed or concerned: Get medical advice/attention
Storage	P405 - Store locked up
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances	**CAS Number**
Crystalline silica, quartz	14808-60-7
Crystalline silica, cristobalite	14464-46-1
Crystalline silica, tridymite	15468-32-3

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1 (H350) STOT RE 1 (H372)
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)

The exact percentage (concentration) of the composition has been withheld as proprietary.

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Eyes	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Skin	Wash with soap and water. Get medical attention if irritation persists.
Ingestion	Under normal conditions, first aid procedures are not required.

4.2 Most important symptoms/effects, acute and delayed

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease. Carcinogen. May cause damage to internal organs.

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. Fire-fighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

5.2 Specific hazards arising from the substance or mixture

Special Exposure Hazards

None anticipated

5.3 Special protective equipment and precautions for fire-fighters

Special Protective Equipment for Fire-Fighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid creating and breathing dust.

See Section 8 for additional information

6.2. Environmental precautions

None known.

6.3. Methods and material for containment and cleaning up

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	$\frac{10\ mg/m^3}{\%SiO2 + 2}$	TWA: 0.025 mg/m^3
Crystalline silica, cristobalite	14464-46-1	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$	TWA: 0.025 mg/m^3
Crystalline silica, tridymite	15468-32-3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$	0.05 mg/m^3

8.2 Appropriate engineering controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

8.3 Individual protection measures, such as personal protective equipment

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid
Color: Various
Odor: Odorless
Odor Threshold: No information available

Property	Values	Remarks/ - Method
pH:	9.9	
Freezing Point/Range	No information available.	
Melting Point/Range	No data available	
Boiling Point/Range	No data available	
Flash Point	No data available	
Flammability (solid, gas)	No data available	
upper flammability limit	No data available	
lower flammability limit	No data available	
Evaporation rate	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	
Specific Gravity	2.65	
Water Solubility	Insoluble in water	
Solubility in other solvents	No data available	
Partition coefficient: n-octanol/water	No data available	
Autoignition Temperature	No data available	
Decomposition Temperature	No data available	
Viscosity	No data available	
Explosive Properties	No information available	
Oxidizing Properties	No information available	

9.2. Other information

VOC Content (%) No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical Stability
Stable

10.3. Possibility of Hazardous Reactions
Will Not Occur

10.4. Conditions to Avoid
None anticipated

10.5. Incompatible Materials
Hydrofluoric acid.

10.6. Hazardous Decomposition Products
Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information

11.1 Information on likely routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics
Acute Toxicity

Inhalation

Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.

Skin Contact May cause mechanical skin irritation.

Ingestion None known

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	>15,000 mg/kg (Human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Eye damage/irritation
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible.
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	Not regarded as a sensitizer.
Crystalline silica, cristobalite	14464-46-1	Not regarded as a sensitizer.
Crystalline silica, tridymite	15468-32-3	Not regarded as a sensitizer.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.

Crystalline silica, tridymite	15468-32-3	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity Effects

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L(Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil

Substances	Mobility
Crystalline silica, quartz	No information available
Crystalline silica, cristobalite	No information available
Crystalline silica, tridymite	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Contaminated Packaging Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

14. Transport Information

US DOT

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

US DOT Bulk

DOT (Bulk) Not applicable

Canadian TDG

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IMDG/IMO

UN Number:	Not restricted
UN Proper Shipping Name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number:	Not restricted
UN Proper Shipping Name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable
Special Precautions for User: None

15. Regulatory Information

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

Revision Date: 16-Mar-2015

Reason for Revision Update to Format SECTION: 2

Additional information
For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key or legend to abbreviations and acronyms
bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
UN – United Nations
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SAFETY DATA SHEET

Version 5.3
Revision Date 02/26/2015
Print Date 04/15/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzene

Product Number : 12540
Brand : Fluka
Index-No. : 601-020-00-8

CAS-No. : 71-43-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Germ cell mutagenicity (Category 1B), H340
Carcinogenicity (Category 1A), H350
Specific target organ toxicity - repeated exposure (Category 1), H372
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H340 May cause genetic defects.
H350 May cause cancer.
H372 Causes damage to organs through prolonged or repeated exposure.

H401	Toxic to aquatic life.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P281	Use personal protective equipment as required.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C_6H_6
Molecular weight	:	78.11 g/mol
CAS-No.	:	71-43-2
EC-No.	:	200-753-7
Index-No.	:	601-020-00-8
Registration number	:	01-2119447106-44-XXXX

Hazardous components

Component	Classification	Concentration
Benzene		
	Flam. Liq. 2; Skin Irrit. 2; Eye Irrit. 2A; Muta. 1B; Carc. 1A; STOT RE 1; Asp. Tox. 1; Aquatic Acute 2; H225, H304, H315, H319, H340, H350, H372, H401	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Flash back possible over considerable distance., Container explosion may occur under fire conditions.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Benzene	71-43-2	TWA	0.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		STEL	2.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		TWA	10 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.40-1969		
		CEIL	25 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.40-1969		
		Peak	50 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.40-1969		
		See 1910.1028. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028 The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.		
		TWA	0.1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		ST	1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzene	71-43-2	S-Phenylmercapturic acid	0.0300 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			
		t,t-Muconic acid	0.5000 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 5.5 °C (41.9 °F)
f)	Initial boiling point and boiling range	80 °C (176 °F)
g)	Flash point	-10.99 °C (12.22 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 8 %(V) Lower explosion limit: 1.3 %(V)
k)	Vapour pressure	221.3 hPa (166.0 mmHg) at 37.7 °C (99.9 °F) 99.5 hPa (74.6 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.874 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	562.0 °C (1,043.6 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

acids, Bases, Halogens, Strong oxidizing agents, Metallic salts

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,990 mg/kg

LC50 Inhalation - Rat - female - 4 h - 44,700 mg/m3

LD50 Dermal - Rabbit - 8,263 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Skin irritation

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
In vivo tests showed mutagenic effects

Human
lymphocyte
Sister chromatid exchange

Mouse
lymphocyte
Mutation in mammalian somatic cells.

Mouse
Sister chromatid exchange

Carcinogenicity

Carcinogenicity - Human - male - Inhalation
Tumorigenic:Carcinogenic by RTECS criteria. Leukaemia Blood:Thrombocytopenia.

Carcinogenicity - Rat - Oral
Tumorigenic:Carcinogenic by RTECS criteria. Endocrine:Tumors. Leukaemia

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC:	1 - Group 1: Carcinogenic to humans (Benzene)
NTP:	Known to be human carcinogen (Benzene)
OSHA:	OSHA specifically regulated carcinogen (Benzene)

Reproductive toxicity

Reproductive toxicity - Mouse - Intraperitoneal
Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - Rat - Inhalation
Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Developmental Toxicity - Mouse - Inhalation
Effects on Embryo or Fetus: Cytological changes (including somatic cell genetic material). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: CY1400000

Nausea, Dizziness, Headache, narcosis, Inhalation of high concentrations of benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation and/or giddiness, depression, drowsiness, or fatigue. The victim may experience tightness in the chest, breathlessness, and loss of consciousness. Tremors, convulsions, and death due to respiratory paralysis or circulatory collapse can occur in a few minutes to several hours following severe exposures. Aspiration of small amounts of liquid immediately causes pulmonary edema and hemorrhage of pulmonary tissue. Direct skin contact may cause erythema. Repeated or prolonged skin contact may result in drying, scaling dermatitis, or development of secondary skin infections. The chief target organ is the hematopoietic system. Bleeding from the nose, gums, or mucous membranes and the development of purpuric spots, pancytopenia, leukopenia, thrombocytopenia, aplastic anemia, and leukemia may occur as the condition progresses. The bone marrow may appear normal, aplastic or hyperplastic, and may not correlate with peripheral blood-forming tissues. The onset of effects of prolonged benzene exposure may be delayed for many months or years after the actual exposure has ceased., Blood disorders

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 5.90 mg/l - 96 h
	LC50 - Pimephales promelas (fathead minnow) - 15.00 - 32.00 mg/l - 96 h
	LC50 - Lepomis macrochirus (Bluegill) - 230.00 mg/l - 96 h
	NOEC - Pimephales promelas (fathead minnow) - 10.2 mg/l - 7 d
	LOEC - Pimephales promelas (fathead minnow) - 17.2 mg/l - 7 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 22.00 mg/l - 48 h
	EC50 - Daphnia magna (Water flea) - 9.20 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 29.00 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability	Result: - Readily biodegradable

12.3 Bioaccumulative potential

Bioaccumulation	Leuciscus idus (Golden orfe) - 3 d - 0.05 mg/l
	Bioconcentration factor (BCF): 10

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1114 Class: 3 Packing group: II
Proper shipping name: Benzene
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1114 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: BENZENE

IATA
UN number: 1114 Class: 3 Packing group: II
Proper shipping name: Benzene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Benzene	71-43-2	2009-02-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Benzene	71-43-2	2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Asp. Tox.	Aspiration hazard
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H340	May cause genetic defects.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
H401	Toxic to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3 Revision Date: 02/26/2015 Print Date: 04/15/2015

SAFETY DATA SHEET

Version 5.2
Revision Date 02/28/2015
Print Date 05/22/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzo[*a*]pyrene

Product Number : B1760
Brand : Sigma
Index-No. : 601-032-00-3

CAS-No. : 50-32-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin sensitisation (Category 1), H317
Germ cell mutagenicity (Category 1B), H340
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 1B), H360
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H317 May cause an allergic skin reaction.
H340 May cause genetic defects.
H350 May cause cancer.
H360 May damage fertility or the unborn child.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and

	understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	3,4-Benzpyrene 3,4-Benzopyrene Benzo[def]chrysene
Formula	:	$C_{20}H_{12}$
Molecular weight	:	252.31 g/mol
CAS-No.	:	50-32-8
EC-No.	:	200-028-5
Index-No.	:	601-032-00-3

Hazardous components

Component	Classification	Concentration
Benzo[a]pyrene		
	Skin Sens. 1; Muta. 1B; Carc. 1B; Repr. 1B; Aquatic Acute 1; Aquatic Chronic 1; H317, H340, H350, H360, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen		
		Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low		

		as possible. Suspected human carcinogen		
Benzo[a]pyrene	50-32-8	TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		1910.1002 As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen		
		TWA	0.100000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products. cyclohexane-extractable fraction See Appendix C See Appendix A		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzo[a]pyrene	50-32-8	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 177 - 180 °C (351 - 356 °F) - lit.
f)	Initial boiling point and boiling range	495 °C (923 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.35 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 5.97
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Subcutaneous - Rat - 50 mg/kg

Skin corrosion/irritation
Skin - Mouse
Result: Mild skin irritation

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
Chronic exposure may cause dermatitis.

Germ cell mutagenicity
May alter genetic material.
In vivo tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC:	1 - Group 1: Carcinogenic to humans (Benzo[a]pyrene)
NTP:	Reasonably anticipated to be a human carcinogen (Benzo[a]pyrene)
OSHA:	OSHA specifically regulated carcinogen (Benzo[a]pyrene)

Reproductive toxicity
May cause congenital malformation in the fetus.
Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: DJ3675000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.25 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 0.02 mg/l - 72 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Lepomis macrochirus (Bluegill) - 48 h - 0.0005 mg/l

Bioconcentration factor (BCF): 3,208

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Benzo[a]pyrene)
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[a]pyrene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[a]pyrene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Benzo[a]pyrene	CAS-No. 50-32-8	Revision Date 1990-01-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H317	May cause an allergic skin reaction.
H340	May cause genetic defects.
H350	May cause cancer.
H360	May damage fertility or the unborn child.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Muta.	Germ cell mutagenicity

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	3
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.2 Revision Date: 02/28/2015 Print Date: 05/22/2015

Safety Data Sheet

Section 1 – Chemical Products and Company Identification

Product Names: BioSolve® Pinkwater®
BioSolve® Clear

Product Uses: Remediation of hydrocarbon (oil, fuel, petrochemical) contamination, including: impacted soils, suppression of VOCs, surface cleaning of equipment and protective clothing.

Manufacturer: The BioSolve Company
329 Massachusetts Avenue
Lexington, MA 02420 USA

Contact Information:

+1 (800) 225-3909	US, Canada, Mexico and Puerto Rico
+1 (781) 482-7900	All other locations

Section 2 – Hazards Identification

Health Hazards:

Eye Contact:	Causes transient eye irritation
Skin Contact:	May cause mild, transient irritation
Ingestion:	May be harmful if swallowed; can cause gastrointestinal irritation, nausea, vomiting and/or diarrhea

Hazard Mitigation: Wear protective gloves and eye/face protection
Avoid prolonged breathing of spray

Environmental Hazards: Moderately toxic to aquatic life. Avoid discharge to storm drains and waterways

GHS Classification: Toxic to aquatic life, Acute Category 2

Section 3 – Composition/Information on Ingredients

Proprietary formulation with nonionic surfactants (32% active ingredients in water)

BioSolve products contain no caustic, d-limonene or hydrocarbon solvents.

BioSolve products do not contain any hazardous ingredients as defined by CERCLA, Massachusetts Right to Know Law and California Prop 65. All ingredients are TSCA compliant.

Section 4 – First Aid Measures

Eyes: Immediately flush eyes with water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Seek medical attention for lasting irritation.

Skin: Rinse exposed area and wash with mild soap and water for several minutes. Seek medical attention if irritation develops.

Ingestion: Seek medical attention in the event of serious or persistent abdominal discomfort, nausea or diarrhea.

Inhalation: Inhalation of concentrated vapors resulting from spraying or heating in confined or poorly ventilated areas may cause irritation of nose and throat. Remove person to fresh air and seek medical attention if irritation persists.

Section 5 – Fire Fighting Measures

Suitable Extinguishing Media: None required; BioSolve products are non-flammable

Special Protective Equipment for Firefighters: None necessary

Unusual Fire or Explosive Hazards: None

Section 6 – Accidental Release Measures

In case of accidental release, breakage or leakage: Eliminate or contain source with inert material, such as sand, earth, absorbent pads, etc. Transfer liquid to suitable containers for recovery, re-use or disposal. Wipe up or mop up using water. Hard surfaces (e.g., floors, driveways) may be slippery; use care to avoid falling.

Rinse area with water. Avoid flow of run-off to surface waters. Always check with local regulations before discharging effluent to storm drains or sewers.

Section 7 – Handling and Storage

Handling: Minimize periods of exposure to extreme temperatures. Keep from freezing. If frozen, separation may occur; thaw and stir thoroughly prior to use. Freezing will not affect product performance.

Precautions: Chemical resistant gloves and eye protection are recommended while mixing and using.

Incompatibilities: Avoid contact with strong acids or strong oxidants.

Storage: Recommended storage temperature: 35^{o} – 120^{o} F (1^{o} – 48^{o} C).

Shelf Life: If unopened, more than 10 years.

Section 8 – Exposure Controls / Personal Protection

Eyes Protection: Safety glasses; chemical goggles or face shield recommended when spraying to protect against backsplash and drift.

Skin Protection: Rubber or latex gloves recommended.

Respiratory Protection: None required, except if application results in significant misting of product. If so, use of an approved air purifying respirator is recommended.

Engineering Controls: For indoor use or for use in a confined space , normal ventilation is generally satisfactory.

Section 9 – Physical and Chemical Properties

Appearance: Pinkwater: Deep red; Clear: Light golden

Odor: Mild, pleasant sassafras fragrance

Concentration: ~32% active ingredients as sold

Boiling Point	265°F/129°C	**Vapor Pressure mm/Hg**	Not available
Melting/Freezing Point	28°F/-2°C	**Vapor Density (Air=1)**	Not available
Flash Point	Non-flammable	**Surface Tension***	29 Dyne/cm @25°C
Flammability Limits	Not applicable	**Viscosity (concentrate)**	350 centipoise
Reactivity with Water	None	**Viscosity (6% solution)**	1.5 centipoise
Evaporation Rate	Not determined	**Solubility in Water**	100%
Specific Gravity	1.01 gms/cc	**VOC Content**	Not determined
	8.43 lbs/U.S. gal	**pH**	9.1 +/- 0.3

*6% solution

Section 10 – Stability and Reactivity

Chemical Stability: Stable; will not decompose if used according to manufacturer's directions.

Conditions to Avoid: Prolonged exposure to heat may cause product degradation. Freezing should also be avoided as discussed in Section 7.

Incompatible Materials: Normally unreactive. Avoid strong alkalis, strong acids, strong oxidizing agents and materials with reactive hydroxyl compounds. These materials could damage the product and reduce its effectiveness during application.

Hazardous Decomposition Products: None are known.

Hazardous Polymerization: Will not occur.

Section 11 – Toxicological Information

Overview: No adverse acute or chronic health effects expected if product used in accordance with manufacturer's directions.

Carcinogenicity: No ingredient has been shown to cause cancer in laboratory animals.

Specific Organ Toxicity: None are known.

Section 12 – Ecological Considerations

Persistence and Degradability: The total of the organic components contained in this product is not classified as readily biodegradable (OECD-301 A-F). However, this product is inherently biodegradable with 60% degradation in 28 days (OECD-301B) and estimated >95% degradation in 120 days.

Bioaccumulation Potential: The bioaccumulation factor in fish has been estimated to be low, ranging from 87 to 344.

Mobility: No data available

Aquatic Toxicity:

LC_{50} of Concentrate (As shipped)		
Mysidopsis bahia	48-hours	3.6 mg/L
Menidia beryllina	96-hours	6.4 mg/L
LC50 of 3% Dilute Solution (As Used)		
Mysidopsis bahia	48-hours	185 mg/L
Menidia beryllina	96-hours	247 mg/L
LC50 of 6% Dilute Solution (As Used)		
Daphnia magna	48-hours	287 mg/L
Pimephales promelas	96-hours	124 mg/L
Onchorhynchus mykiss	96-hours	177 mg/L

Section 13 - Disposal

DO NOT DUMP INTO STORM DRAINS OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. As manufactured, BioSolve products do not meet the definition of a hazardous waste. Small quantities of unused and uncontaminated product may be discharged to a qualified wastewater treatment facility. Always obtain approval from local and Federal regulatory agencies prior to discarding this product into public sewers.

As your supplier, we have no control over your handling and use of this product. However, the intended use of this product as a remediation and/or surface washing agent may produce wastewater containing emulsified or dispersed hydrocarbons that may be classified as a hazardous waste and should be treated and disposed of accordingly.

Section 14 – Transportation Information

USDOT Freight Class 55 (Liquid Cleaning Compound, Non-Hazardous)
This product is not regulated by USDOT or Canadian TDG when shipped domestically by land.

North American Industry Classification System (NAICS) # 325613

U.S. ITC, Harmonized Tariff Schedule B Classification: 3402.90.30.00

Section 15 – Regulatory Information

This product is considered non-hazardous as defined by CERCLA, according to OSHA, Massachusetts Right to Know Law and California Prop 65.

Toxic Substances Control Act:	All components of this product are on the TSCA inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30.
CEPA – Domestic Substances List:	All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or not required to be listed.
Canadian CPR Compliance:	This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the SDS contains all the information required by the CPR
WHMIS Classification:	D2B Eye or skin irritant

Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with Federal, state or provincial and local laws.

Section 16 – Other Information

HMIS Rating	Health Hazard:	1 (Eye/Skin Irritant)
	Fire Hazard:	0
	Reactivity:	0
	Personal Protective Equipment:	Rubber gloves, safety glasses or face shield
NFPA Rating	Health:	1 (Eye/Skin Irritant)
	Flammability:	0
	Reactivity:	0
	Other Hazard:	None

BioSolve Pinkwater is listed on the US EPA's NCP Product Schedule (#SW-20). This listing does not mean that EPA approves, recommends, licenses, certifies or authorizes the use of BioSolve Pinkwater on any oil discharge. This listing means only that data has been submitted to EPA as required by Subpart J of the National Contingency Plan, Section 300.915.

SDS Effective Date: January1, 2015

The information contained herein is accurate to the best of our knowledge. The BioSolve Company makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or application or in combination with other substances.

For more information, visit: www.biosolve.com

Safety Data Sheet

Revision Date: 01/23/13
www.restek.com

1. IDENTIFICATION

Catalog Number / Product Name:	**30213, 30213-5XX, & 30313 / BTEX Standard**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-356-1688
Revision Number:	8
Intended use:	For Laboratory use only

2. HAZARD(S)INDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:

GHS Classification:

Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 1
Flammable Liquid Category 2
Acute Toxicity - Inhalation Dust / Mist Category 3
Acute Toxicity - Inhalation Vapour Category 3
Acute Toxicity - Inhalation Gas Category 3
Acute Toxicity - Dermal Category 3
Acute Toxicity - Oral Category 3
Flame
Skull and crossbones
Health Hazard

GHS Signal Word: Danger

GHS Hazard:

H225 - Highly flammable liquid and vapour.
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled.
H331 - Toxic if inhaled.
H370 - Causes damage to organs.

GHS Precautions:

Safety Precautions:

P210 - Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical/ventilating and lighting equipment.
P242 - Use only non-sparking tools.
P243 - Take precautionary measures against static discharge.
P260 - Do not breathe dust/fume/gas/mist/vapours/spray.
P264 - Wash hands and skin thoroughly after handling.
P270 - Do no eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures:

P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor/....
P302+P352 - IF ON SKIN: Wash with plenty of soap and water.
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P307+P311 - IF exposed: Call a POISON CENTER or doctor/physician.
P312 - Call a POISON CENTER or doctor/physician if you feel unwell.
P321 - Specific treatment see section 4.
P322 - Specific measures see section 4.
P330 - Rinse mouth.
P361 - Remove/Take off immediately all contaminated clothing.
P363 - Wash contaminated clothing before reuse.
P370+P378 - In case of fire: Use extinguishing media in section 5 for extinction.

Storage: P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.

Disposal: P501 - Dispose of contents/container according to section 13 of the SDS.

Single Exposure Target Organs: No data available.

Repeated Exposure Target Organs: No data available.

Physical Hazards: F - Highly flammable
Health Hazards: T - Toxic
Carcinogen, Category 1

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS #	EINEC #	% Composition
methanol	67-56-1	200-659-6	98.800000
p-xylene	106-42-3	215-535-7 203-396-5 203-576-3 202-422-2	0.200000
m-xylene	108-38-3	215-535-7 203-396-5 203-576-3 202-422-2	0.200000
Toluene	108-88-3	203-625-9	0.200000
o-xylene	95-47-6	215-535-7 203-396-5 203-576-3 202-422-2	0.200000
Benzene	71-43-2	200-753-7	0.200000
Ethylbenzene	100-41-4	202-849-4	0.200000

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Immediately flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention and monitor the eye daily as advised by your physician.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water

or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire.

Fire and/or Explosion Hazards: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Fire Fighting Methods and Protection: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions: Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

Storage Technical Measures and Conditions: Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition Keep away from heat, sparks, and flame

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
methanol	67-56-1	ND	250 ppm STEL	200 ppm TWA	200 ppm TWA; 260 mg/m3 TWA
p-xylene	106-42-3	ND	150 ppm STEL	No TLV	No data available.
m-xylene	108-38-3	ND	150 ppm STEL	No TLV	No data available.
Toluene	108-88-3	ND		No TLV	200 ppm TWA; C 300 ppm
o-xylene	95-47-6	ND	150 ppm STEL	No TLV	No data available.
Benzene	71-43-2	ND	2.5 ppm STEL; 8 mg/m3 STEL	0.5 ppm TWA; 1.6 mg/m3 TWA	10 ppm TWA (apply only to exempt industry segments)
Ethylbenzene	100-41-4	ND	125 ppm STEL; 543 mg/m3 STEL	100 ppm TWA; 434 mg/m3 TWA	100 ppm TWA; 435 mg/m3 TWA

United Kingdom:

Chemical Name	CAS No.	EINEC No.	WEL-STEL	WEL-TWA
methanol	67-56-1	200-659-6	250 ppm STEL; 333 mg/m3 STEL	200 ppm TWA; 266 mg/m3 TWA
p-xylene	106-42-3	215-535-7 203-396-5 203-576-3 202-422-2	No data available.	No data available.
m-xylene	108-38-3	215-535-7 203-396-5	No data available.	No data available.

		203-576-3 202-422-2		
Toluene	108-88-3	203-625-9	No data available.	No data available.
o-xylene	95-47-6	215-535-7 203-396-5 203-576-3 202-422-2	No data available.	No data available.
Benzene	71-43-2	200-753-7	3 ppm STEL (calculated); 9.75 mg/m3 STEL (calculated)	1 ppm TWA; 3.25 mg/m3 TWA
Ethylbenzene	100-41-4	202-849-4	125 ppm STEL; 552 mg/m3 STEL	100 ppm TWA; 441 mg/m3 TWA

Personal Protection:

Engineering Measures: Local exhaust ventilation is recommended when generating excessive levels of vapors from handling or thermal processing.

Respiratory Protection: Respiratory protection may be required to avoid overexposure when handling this product. General or local exhaust ventilation is the preferred means of protection. Use a respirator if general room ventilation is not available or sufficient to eliminate symptoms.If an exposure limit is exceeded or if an operator is experiencing symptoms of inhalation overexposure as explained in Section 3, provide respiratory protection.

Eye Protection: Wear chemically resistant safety glasses with side shields when handling this product. Wear additional eye protection such as chemical splash goggles and/or face shield when the possibility exists for eye contact with splashing or spraying liquid, or airborne material. Do not wear contact lenses. Have an eye wash station available.

Skin Protection: Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work

9. PHYSICAL AND CHEMICAL PROPERTIES

Odor:	Mild
pH:	No data available.
Vapor Density:	1.1 (air = 1)
Melting Point:	-98 ℃
Flash Point:	12
Flammability:	Highly Flammable
Upper Flammable/Explosive Limit, % in air:	36.0
Lower Flammable/Explosive Limit, % in air:	6.0
Autoignition Temperature:	464 deg C
Specific Gravity:	0.791 - 0.792 g/cm3 at 20 ℃
Evaporation Rate:	No data available.
Odor Threshold:	ND
Solubility:	Moderate; 50-99%
VOC % by weight:	99.00
Molecular Weight:	32.04

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion
Target Organs Potentially Affected By Exposure:	Eyes, Central nervous system stimulation, Skin, GI Tract, Respiratory Tract
Chemical Interactions That Change Toxicity:	None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation: Can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.

Inhalation Toxicity: Harmful! Can cause systemic damage (see "Target Organs)Methanol can cause central nervous system depression and overexposure can cause damage to the optic nerve resulting in visual impairment or blindness.

Skin Contact:	Can cause moderate skin irritation, defatting, and dermatitis. Not likely to cause permanent damage.
Eye Contact:	Can cause moderate irritation, tearing and reddening, but not likely to permanently injure eye tissue.
Ingestion Irritation:	Irritating to mouth, throat, and stomach. Can cause abdominal discomfort, nausea, vomiting and diarrhea.Highly toxic and may be fatal if swallowed.
Ingestion Toxicity:	Toxic if swallowed. May cause target organ failure and/or death.May be fatal if swallowed.

Long-Term (Chronic) Health Effects:

Carcinogenicity:	Contains a probable or known human carcinogen.
Reproductive and Developmental Toxicity:	Contains a known human reproductive and/or developmental hazard.
Inhalation:	Upon prolonged and/or repeated exposure, can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.Harmful! Can cause systemic damage upon prolonged and/or repeated exposure (see "Target Organs)
Skin Contact:	Upon prolonged or repeated contact, can cause moderate skin irritation, defatting, and dermatitis. Not likely to cause permanent damage.
Skin Absorption:	Upon prolonged or repeated exposure, toxic if absorbed through the skin. Likely to cause systemic damage.
Ingestion:	Toxic if swallowed. May cause target organ failure and/or death.

Component Toxicological Data:

NIOSH:

Chemical Name	CAS No.	LD50/LC50
Methanol	67-56-1	Inhalation LC50 Rat 83.2 mg/L 4 h; Inhalation LC50 Rat 64000 ppm 4 h; Oral LD50 Rat 5628 mg/kg; Dermal LD50 Rabbit 15800 mg/kg
Benzene	71-43-2	Inhalation LC50 Rat 13050-14380 ppm 4 h; Oral LD50 Rat 1800 mg/kg
Benzene, ethyl-	100-41-4	Oral LD50 Rat : 3500 mg/kg; Dermal LD50 Rabbit : 17800 uL/kg

Component Carcinogenic Data:

OSHA:

Chemical Name	CAS No.	
Benzene	71-43-2	Monograph 29, Supplement 7; 1987; {IARC - Group 1 (carcinogenic to humans)}; Known Carcinogen; {NTP Eighth Report - Known Carcinogens}; 1 ppm TWA; 5 ppm STEL; 0.5 ppm TWA action limit; Cancer hazard; Flammable (see 29 CFR 1910.1028); {OSHA - 29 CFR 1910 Specifically Regulated Chemicals}
Ethylbenzene	100-41-4	Present

ACGIH:

Chemical Name	CAS No.	
Benzene	71-43-2	A1 - Confirmed Human Carcinogen A1-confirmed human carcinogen
Ethyl benzene	100-41-4	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

NIOSH:

Chemical Name	CAS No.	
Benzene	71-43-2	potential occupational carcinogen

NTP:

Chemical Name	CAS No.	
Benzene	71-43-2	Known Carcinogen

IARC:

Chemical Name	CAS No.	Group No.
Monograph 29, Supplement 7; 1987	71-43-2	Group 1
No data.		Group 2A
Ethylbenzene	100-41-4	Group 2B

12. ECOLOGICAL INFORMATION

Overview: Moderate ecological hazard. This product may be dangerous to plants and/or wildlife.
Mobility: No data
Persistence: No data
Bioaccumulation: No data
Degradability: Biodegrades slowly.
Ecological Toxicity Data: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.
Disposal Methods: Dispose of by incineration following Federal, State, Local, or Provincial regulations.
Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:
DOT Proper Shipping Name: Flammable liquids, n.o.s. (Methanol, Xylenes)
UN Number: UN1993
Hazard Class: 3
Packing Group: II

International:
IATA Proper Shipping Name: Flammable liquids, n.o.s. (Methanol, Xylenes)
UN Number: UN1993
Hazard Class: 3
Packing Group: II

Marine Pollutant: No

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
methanol	67-56-1	X	X	-	X
p-xylene	106-42-3	X	X	-	X
m-xylene	108-38-3	X	X	-	X
Toluene	108-88-3	X	X	-	X
o-xylene	95-47-6	X	X	-	X
Benzene	71-43-2	X	X	-	X
Ethylbenzene	100-41-4	X	X	-	X

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Benzene	71-43-2	Prop 65 Cancer
Ethyl benzene	100-41-4	Prop 65 Cancer
Methanol	67-56-1	Prop 65 Devolop Tox
Toluene	108-88-3	Prop 65 Devolop Tox
Benzene	71-43-2	Prop 65 Devolop Tox
Toluene	108-88-3	Prop 65 Rep Female
Benzene	71-43-2	Prop 65 Rep Male

State Right To Know Listing:

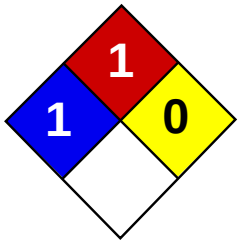
Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
methanol	67-56-1	X	X	X	X
p-xylene	106-42-3	X	X	X	X
m-xylene	108-38-3	X	X	X	X
Toluene	108-88-3	X	X	X	X
o-xylene	95-47-6	X	X	X	X
Benzene	71-43-2	X	X	X	X
Ethylbenzene	100-41-4	X	X	X	X

EU Directives Classification:
Hazard Symbols:

Risk Phrases:	R23/25 - Toxic by inhalation and if swallowed R45 - May cause cancer R11 - Highly flammable
Safety Phrases:	S16:Keep away from sources of ignition - No smoking S53:Avoid exposure - obtain special instruction before use S45:In case of accident or if you feel unwell, seek medical advice immediately S36/37:Wear suitable protective clothing and gloves S1/2:Keep locked up and out of the reach of children S7:Keep container tightly closed

16. OTHER INFORMATION

Prior Version Date:	02/26/10
Disclaimer:	Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only. Because many factors may affect processing or application/use, Restek Corporation recommends you perform an assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding prodcuts described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are assumed. All such being given and accepted at your risk.



Health	1
Fire	1
Reactivity	0
Personal Protection	A

Material Safety Data Sheet
Coal tar MSDS

Section 1: Chemical Product and Company Identification

Product Name: Coal tar

Catalog Codes: SLC1108

CAS#: 8007-45-2

RTECS: GF8600000

TSCA: TSCA 8(b) inventory: Coal tar

CI#: Not available.

Synonym: Estar; Lavatar; Zetar; Tar, coal; Pixalbol; Tar, coking; coke oven emissions

Chemical Name: Coal Tar

Chemical Formula: Not available.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Coal tar	8007-45-2	100

Toxicological Data on Ingredients: Coal tar LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, 1 (Clear evidence; known carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: CLOSED CUP: 96°C (204.8°F).

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: On ignition it burns with reddish, luminous, and very sooty flame.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe gas/ fumes/ vapor/spray. Wear suitable protective clothing. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Safety glasses. Lab coat.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Viscous liquid.)

Odor: Tar-like; naphthalene-like

Taste: Sharp burning.

Molecular Weight: Not available.

Color: Black

pH (1% soln/water): Not applicable.

Boiling Point: 66°C (150.8°F)

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: 1.2 (Water = 1)

Vapor Pressure: <0.1 kPa (@ 20°C)

Vapor Density: >1 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Partially soluble in methanol, diethyl ether, acetone. Insoluble in cold water, hot water. Soluble in benzene, nitrobenzene. Partly dissolves in alcohol, chloroform, carbon disulfide, petroleum ether, sodium hydroxide solution, hexane

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:

It reacts violently with strong oxidizers such as liquid chlorine, sodium or potassium hypochlorite, nitric acid and peroxides.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, 1 (Clear evidence; known carcinogen.) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: skin.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenic). May cause cancer

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: It can cause skin irritation. Existing skin disorders (e.g. eczema) may be aggravated by exposure to this material. Eyes: It can cause eye irritation. Inhalation: Inhalation of mist or vapor can irritate the respiratory tract. Ingestion: Ingestion can cause severe gastrointestinal tract irriation with nausea, vomiting. It may also affect behavior/ central nervous system and cause central nervous system depression. Aspiration can cause lung inflammation and damage. Chronic Potential Health Effects: Skin: Prolonged or repeated exposure to coal tar may cause irritation and dermatitis (including acne), melanosis, or photosensitization dermatitis. Eyes: Repeated or prolonged exposure may cause eye damage. Inhalation: Prolonged or repeated inhalation may contribute to gallbladder disease, pneumonitis, and pulmonary vessel thrombosis.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: No DOT per N50 Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Coal tar California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Coal tar (listed as coke oven emissions New York release reporting list: Coal tar Rhode Island RTK hazardous substances: Coal tar Pennsylvania RTK: Coal tar Massachusetts RTK: Coal tar California Director's List of Hazardous Substances: Coal tar TSCA 8(b) inventory: Coal tar

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Classification not yet available

DSCL (EEC):
R45- May cause cancer. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: a

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Not applicable. Lab coat. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 04:57 PM

Last Updated: 05/21/2013 12:00 PM

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Conductivity Standard, 447 µmho/cm

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 12/17/2013 Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : Conductivity Standard, 447 µmho/cm

Product code : LC18755

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	99.98	Not classified
Potassium Chloride	(CAS No) 7447-40-7	0.02	Not classified

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable.

Explosion hazard : Not applicable.

Reactivity : None.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses. Gloves.

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.

Incompatible products : Strong oxidizers.

Incompatible products : incompatible materials.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Personal protective equipment : Avoid all unnecessary exposure.

Hand protection : Wear protective gloves.

Eye protection : Chemical goggles or safety glasses.

Respiratory protection : Wear appropriate mask.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Appearance	: Clear, colorless liquid.
Colour	: Colourless.
Odour	: Odourless.
Odour threshold	: No data available
pH	: No data available
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: No data available
Freezing point	: No data available
Boiling point	: No data available
Flash point	: No data available
Self ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Density	: 1
Solubility	: Soluble in water.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: Not applicable.
Oxidising properties	: None.
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

None.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Strong acids. Strong oxidizers.

10.6. Hazardous decomposition products

Hydrogen chloride. Potassium oxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Potassium Chloride (7447-40-7)	
LD50 oral rat	2600 mg/kg

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Based on available data, the classification criteria are not met

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Based on available data, the classification criteria are not met

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Based on available data, the classification criteria are not met

Aspiration hazard : Not classified

Based on available data, the classification criteria are not met

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Potassium Chloride (7447-40-7)	
EC50 Daphnia 1	825 mg/l

12.2. Persistence and degradability

Conductivity Standard, 447 µmho/cm	
Persistence and degradability	Not established.

Potassium Chloride (7447-40-7)	
Persistence and degradability	Not established.

Water (7732-18-5)	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Conductivity Standard, 447 µmho/cm	
Bioaccumulative potential	Not established.

Potassium Chloride (7447-40-7)	
Bioaccumulative potential	Not established.

Water (7732-18-5)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

No dangerous good in sense of transport regulations

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Potassium Chloride (7447-40-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

15.2. International regulations

CANADA

Conductivity Standard, 447 µmho/cm	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Potassium Chloride (7447-40-7)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Water (7732-18-5)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Potassium Chloride (7447-40-7)
Not listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

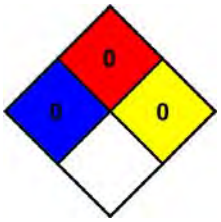
No additional information available

SECTION 16: Other information

Indication of changes : Revision - See : *.

Other information : None.

NFPA health hazard	: 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
NFPA fire hazard	: 0 - Materials that will not burn.
NFPA reactivity	: 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	: 0 Minimal Hazard - No significant risk to health
Flammability	: 0 Minimal Hazard
Physical	: 0 Minimal Hazard
Personal Protection	: A

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

SAFETY DATA SHEET

Version 5.4
Revision Date 06/27/2014
Print Date 04/15/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cyanide Standard for IC

Product Number : 90157
Brand : Fluka

CAS-No. : 14244-62-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute toxicity, Dermal (Category 3), H311
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H302 Harmful if swallowed.
H311 + H331 Toxic in contact with skin or if inhaled
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing.

P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P311	Call a POISON CENTER or doctor/ physician.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

No ingredients are hazardous according to OSHA criteria.
No components need to be disclosed according to the applicable regulations.
For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, nitrogen oxides (NOx), Hydrogen cyanide (hydrocyanic acid)

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Normal measures for preventive fire protection.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	10 - 11 - (as aqueous solution)
e)	Melting point/freezing point	no data available
f)	Initial boiling point and boiling range	no data available
g)	Flash point	no data available
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	no data available
l)	Vapour density	no data available
m)	Relative density	no data available
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
no data available

no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available
no data available

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3082 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Sodium cyanide)
Marine pollutant: Marine pollutant

IATA
UN number: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Sodium cyanide)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

H302	Harmful if swallowed.
H311	Toxic in contact with skin.
H331	Toxic if inhaled.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 06/27/2014 Print Date: 04/15/2015

Water

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 11/15/2013 Revision date: 09/12/2014 Supersedes: 11/15/2013 Version: 1.1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Substance

Substance name : Water

CAS No : 7732-18-5

Product code : LC26750

Formula : H2O

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name : Water

CAS No : 7732-18-5

EC no : 231-791-2

Name	Product identifier	%	GHS-US classification
Water (Main constituent)	(CAS No) 7732-18-5	100	Not classified

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest. Adverse effects not expected from this product.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse. Adverse effects not expected from this product.

First-aid measures after eye contact : Rinse immediately with plenty of water. Adverse effects not expected from this product.

First-aid measures after ingestion : Do NOT induce vomiting. Obtain emergency medical attention. Adverse effects not expected from this product.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

5.2. Special hazards arising from the substance or mixture

No additional information available

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.

Incompatible products : Metallic sodium.

Incompatible materials : Sources of ignition. Direct sunlight.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls : Provide adequate general and local exhaust ventilation.

Hand protection : Wear protective gloves.

Eye protection : Chemical goggles or safety glasses.

Respiratory protection : None necessary.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Molecular mass	:	18 g/mol
Colour	:	Colourless
Odour	:	None.
Odour threshold	:	No data available
pH	:	7
Relative evaporation rate (butylacetate=1)	:	No data available
Melting point	:	0 °C
Freezing point	:	No data available
Boiling point	:	100 °C
Flash point	:	No data available
Critical temperature	:	374.1 °C
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	No data available
Vapour pressure	:	17.535 mm Hg
Vapour pressure at 50 °C	:	92.51 mm Hg
Critical pressure	:	218.3 atm
Relative vapour density at 20 °C	:	No data available
Relative density	:	1
Density	:	0.99823 g/ml
Solubility	:	Soluble in acetic acid. Soluble in acetone. Soluble in ammonia. Soluble in ammoniumchloride. Soluble in ethanol. Soluble in glycerol. Soluble in hydrogenchloride. Soluble in methanol. Soluble in nitric acid. Soluble in sulfuric acid. Soluble in sodium hydroxide solution. Soluble in propyleneglycol. Water:
Log Pow	:	No data available
Log Kow	:	No data available
Viscosity, kinematic	:	1.004 cSt
Viscosity, dynamic	:	1.002 cP
Explosive properties	:	Not applicable.
Oxidising properties	:	None.
Explosive limits	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Extremely high or low temperatures.

10.5. Incompatible materials

Metallic sodium.

10.6. Hazardous decomposition products

Hydrogen. oxygen.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Water (\f)7732-18-5	
LD50 oral rat	≥ 90000 mg/kg
ATE US (oral)	90000 mg/kg bodyweight

Skin corrosion/irritation : Not classified
pH: 7

Serious eye damage/irritation : Not classified
pH: 7

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified
(Based on available data, the classification criteria are not met)

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

Water (7732-18-5)	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Water (7732-18-5)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Effect on ozone layer : No additional information available

Other information : No other effects known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

SECTION 14: Transport information

In accordance with DOT

Not regulated for transport

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

15.2. International regulations

CANADA

Water (7732-18-5)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Not classified

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Water (7732-18-5)
Not listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

No additional information available

SECTION 16: Other information

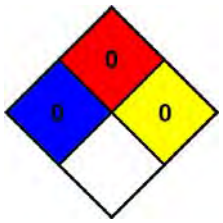
Revision date : 09/12/2014

Other information : None.

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0 Minimal Hazard - No significant risk to health

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : A

SDS US (GHS HazCom 2012)

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SAFETY DATA SHEET

Section 1. Identification

Product name	Diesel Fuel No. 2
Chemical name	Fuels, diesel
SDS #	11155
Code	11155

Relevant identified uses of the substance or mixture and uses advised against

Product use	Fuel.
Supplier	BP Products North America Inc. 150 West Warrenville Road Naperville, Illinois 60563-8460 USA
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 703-527-3887 (CHEMTREC)
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA)
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

Section 2. Hazards identification

OSHA/HCS status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	FLAMMABLE LIQUIDS - Category 4 ACUTE TOXICITY (inhalation) - Category 4 SKIN IRRITATION - Category 2 CARCINOGENICITY - Category 2 ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms

Signal word	Danger
Hazard statements	Combustible liquid. Harmful if inhaled. Causes skin irritation. Suspected of causing cancer. May be fatal if swallowed and enters airways.

Precautionary statements

Prevention	Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Do not breathe vapor. Wear protective gloves and eye protection. Avoid release to the environment.

Section 2. Hazards identification

Response	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting. IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.
Storage	Store locked up. Store in a well-ventilated place. Keep cool.
Disposal	Dispose of contents and container in accordance with all local, regional, national and international regulations.
Hazards not otherwise classified	This material may contain significant quantities of polycyclic aromatic hydrocarbons (PAHs), some of which have been shown by experimental studies to induce skin cancer. Note: High Pressure Applications Injections through the skin resulting from contact with the product at high pressure constitute a major medical emergency. See 'Notes to physician' under First-Aid Measures, Section 4 of this Safety Data Sheet.

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Ingredient name	CAS number	%
Petroleum distillates (Diesel Fuel No. 2)	68476-34-6	95 - 100
Contains one or more of the following biodiesels:	Varies	0 - 5
soybean oil, me ester	67784-80-9	.
Fatty acids, sunflower-oil, Me esters	68919-54-0	.
Fatty acids methyl esters	67762-38-3	.
Fatty acids, vegetable-oil, Methyl esters	68990-52-3	.
rape oil, me ester	73891-99-3	.
Fatty acids, canola-oil, Me esters	129828-16-6	.
fatty acids, tallow, me esters	61788-61-2	.
Contains:		
Naphthalene	91-20-3	1 - 3
May also contain small quantities of proprietary performance additives.		

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Get medical attention.
Skin contact	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention.
Inhalation	If inhaled, remove to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention.
Ingestion	Do not induce vomiting. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Aspiration hazard if swallowed. Can enter lungs and cause damage. Get medical attention immediately.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Most important symptoms/effects, acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	Treatment should in general be symptomatic and directed to relieving any effects. Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment. Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided. Gastric lavage should be undertaken only after endotracheal intubation. Monitor for cardiac dysrhythmias.
Specific treatments	No specific treatment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.
Unsuitable extinguishing media	Do not use water jet.
Specific hazards arising from the chemical	Flammable liquid and vapor. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. Runoff to sewer may create fire or explosion hazard.
Hazardous combustion products	Combustion products may include the following: carbon oxides (CO, CO_2) (carbon monoxide, carbon dioxide) other hazardous substances.
Special protective actions for fire-fighters	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
Special protective equipment for fire-fighters	Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	Immediately contact emergency personnel. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Floors may be slippery; use care to avoid falling. Eliminate all ignition sources.
For emergency responders	Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit. Chemical resistant boots. See also the information in "For non-emergency personnel".
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Collect spillage.

Methods and materials for containment and cleaning up

Small spill	Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres.

Section 6. Accidental release measures

Large spill

Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Dike spill area and do not allow product to reach sewage system and surface or ground water. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Use spark-proof tools and explosion-proof equipment. Contaminated absorbent material may pose the same hazard as the spilled product. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not swallow. Aspiration hazard if swallowed. Can enter lungs and cause damage. Never siphon by mouth.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/ containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Light hydrocarbon vapors can build up in the headspace of tanks. These can cause flammability/explosion hazards even at temperatures below the normal flash point (note: flash point must not be regarded as a reliable indicator of the potential flammability of vapor in tank headspaces). Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electrical discharge and all ignition sources during filling, ullaging and sampling from storage tanks. Do not enter storage tanks. If entry to vessels is necessary, follow permit to work procedures. Entry to any tanks or other confined space requires a full risk assessment and appropriate control measures to be put in place in conformance with appropriate regulations and industry practice on confined space entry. When the product is pumped (e.g. during filling, discharge or ullaging) and when sampling, there is a risk of static discharge. Ensure equipment used is properly earthed or bonded to the tank structure. Electrical equipment should not be used unless it is intrinsically safe (i.e. will not produce sparks). Explosive air/vapor mixtures may form at ambient temperature. If product comes into contact with hot surfaces, or leaks occur from pressurized fuel pipes, the vapor or mists generated will create a flammability or explosion hazard. Product contaminated rags, paper or material used to absorb spillages, represent a fire hazard, and should not be allowed to accumulate. Dispose of safely immediately after use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
fuel, diesel no. 2	**ACGIH TLV (United States). Absorbed through skin.** TWA: 100 mg/m³, (measured as total hydrocarbons) 8 hours. Issued/Revised: 1/2007 Form: Inhalable fraction and vapor
naphthalene	**ACGIH TLV (United States). Absorbed through skin.** TWA: 52 mg/m³ 8 hours. Issued/Revised: 5/1996 TWA: 10 ppm 8 hours. Issued/Revised: 5/1996 **OSHA PEL (United States).** TWA: 50 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 10 ppm 8 hours. Issued/Revised: 6/1993

While specific OELs for certain components may be shown in this section, other components may be present in any mist, vapor or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

Appropriate engineering controls

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained. Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards.
Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Recommended: Chemical splash goggles.

Skin protection

Hand protection

Wear chemical resistant gloves. Nitrile gloves.

Do not re-use gloves. Protective gloves must give suitable protection against mechanical risks (i.e. abrasion, blade cut and puncture). Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.

Consult your supervisor or Standard Operating Procedure (S.O.P) for special handling instructions.

Section 8. Exposure controls/personal protection

Body protection	Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required. Wear suitable protective clothing. Footwear highly resistant to chemicals. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For greatest effectiveness against static electricity, overalls, boots and gloves should all be anti-static. When there is a risk of ignition wear inherently fire resistant protective clothes and gloves. Work clothing / overalls should be laundered on a regular basis. Laundering of contaminated work clothing should only be done by professional cleaners who have been told about the hazards of the contamination. Always keep contaminated work clothing away from uncontaminated work clothing and uncontaminated personal clothes. When the risk of skin exposure is high (from experience this could apply to the following tasks: cleaning work, maintenance and service, filling and transfer, taking samples and cleaning up spillages) then a chemical protective suit and boots will be required. Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: overall
Other skin protection	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: nitrile rubber
Respiratory protection	Use only with adequate ventilation. If ventilation is inadequate, use a NIOSH certified respirator with an organic vapor cartridge and P95 particulate filter. If operating conditions cause high vapor concentrations or the TLV is exceeded, use NIOSH-certified, supplied-air respirator. Use with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. If there is a requirement for the use of a respiratory protective device, but the use of breathing apparatus (independent of ambient atmosphere) is not required, then a suitable filtering device must be worn. The filter class must be suitable for the maximum contaminant concentration (gas/vapor/aerosol/particulates) that may arise when handling the product. The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Section 9. Physical and chemical properties

Appearance	
Physical state	Liquid.
Color	Colorless. to Various Color. (May be dyed Red., Light Green. ,Yellow.)
Odor	Petroleum
Odor threshold	Not available.
pH	Not available.
Melting point	Not available.
Boiling point	Not available.
Flash point	Closed cup: ≥52°C (≥125.6°F) [Pensky-Martens.]
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable. Based on - Physical state
Lower and upper explosive (flammable) limits	Lower: 0.6% Upper: 7.5%
Vapor pressure	Not available.
Vapor density	Not available.
Density	820 to 875 kg/m^3 (0.82 to 0.875 g/cm^3)
Relative density	<1 [Water = 1]

Section 9. Physical and chemical properties

Solubility	negligible <0.1%
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	257°C (494°F)
Decomposition temperature	Not available.
Viscosity	Kinematic: 1.7 to 4.1 mm^2/s (1.7 to 4.1 cSt) at 40°C

Section 10. Stability and reactivity

Reactivity	No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information.
Chemical stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame).
Incompatible materials	Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis. halogenated compounds.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Test	Species	Result	Exposure	Remarks
fuel, diesel no. 2	LC50 Inhalation Dusts and mists	Rat	4.1 mg/l	4 hours	Based on Diesel fuel
	LD50 Dermal	Rabbit	>4300 mg/kg	-	Based on No. 2 Heating Oil.
	LD50 Dermal	Rabbit	>4300 mg/kg	-	Based on Diesel fuel
	LD50 Oral	Rat	17900 mg/kg	-	Based on No. 2 Heating Oil.
	LD50 Oral	Rat	7600 mg/kg	-	Based on Diesel fuel
naphthalene	LC50 Inhalation Dusts and mists	Rat	>340 mg/m^3	1 hours	-
	LD50 Dermal	Rabbit	20 g/kg	-	-
	LD50 Oral	Rat	490 mg/kg	-	-

Conclusion/Summary Not available.

Irritation/Corrosion

Product/ingredient name	Species	Result	Score	Exposure	Observation	Conc.	Remarks

fuel, diesel no. 2	Rabbit	Skin - Irritation	-	-	-	-	Based on No. 2 Heating Oil.
	Rabbit	Skin - Irritation	-	-	-	-	Based on Diesel fuel
	Rabbit	Eyes - Non-irritating to the eyes.	-	-	-	-	Based on No. 2 Heating Oil.
	Rabbit	Eyes - Non-irritating to the eyes.	-	-	-	-	Based on Diesel fuel

Sensitizer

Product/ingredient name	Route of exposure	Species	Result	Remarks
fuel, diesel no. 2	skin	Guinea pig	Not sensitizing	Based on No. 2 Heating Oil.
	skin	Guinea pig	Not sensitizing	Based on Diesel fuel

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
fuel, diesel no. 2	Equivalent to OECD 476	Experiment: In vitro Subject: Mammalian-Animal	Positive	Based on Hydrodesulfurized gas oil
	OECD 471	Experiment: In vitro Subject: Non-mammalian species	Positive	Based on Diesel fuel
	Equivalent to OECD 471	Experiment: In vitro Subject: Non-mammalian species	Positive	Based on Cracked gas oil
	Equivalent to OECD 476	Experiment: In vitro Subject: Mammalian-Animal Cell: Germ	Negative	Based on Heating Oil.
	not guideline 475	Experiment: In vivo Subject: Unspecified Cell: Somatic	Negative	Based on Heating Oil.
	Equivalent to OECD 475	Experiment: In vivo Subject: Unspecified Cell: Germ	Negative	Based on Gas oil

Conclusion/Summary Not available.

Carcinogenicity

Product/ingredient name							
fuel, diesel no. 2	Equivalent to OECD	451	Mouse	Dermal	2 years	Positive - Dermal - Unspecified	Based on Heating Oil.
	not guideline	-	Mouse	Dermal	2 years	Positive - Dermal - Unspecified	Limited relevance to man. (Based

Section 11. Toxicological information

on Heating Oil.
)

Conclusion/Summary Suspected of causing cancer.

Classification

Product/ingredient name	OSHA	IARC	NTP
naphthalene	-	2B	Reasonably anticipated to be a human carcinogen.

OSHA:
+ - Potential occupational carcinogen

IARC:
1 - Carcinogenic to human.
2A - Probable human carcinogen.
2B - Possible carcinogen to human.
3 - Not classifiable as a human carcinogen.
4 - Probably not a human carcinogen.

NTP:
Proven - Known to be human carcinogens.
Possible - Reasonably anticipated to be human carcinogens.

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Result	Exposure
fuel, diesel no. 2	-	-	Negative	Rat	Dermal	20 days
	-	-	Negative	Rat	Dermal	10 days
	-	-	Negative	Rat	Dermal	10 days
	-	-	Negative	Rat	Dermal	20 days

Conclusion/Summary Development: Not classified. Based on available data, the classification criteria are not met.
Fertility: Not classified. Based on available data, the classification criteria are not met.
Effects on or via lactation: Not classified. Based on available data, the classification criteria are not met.

Aspiration hazard

Name	Result
fuel, diesel no. 2	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Eye contact No known significant effects or critical hazards.

Skin contact Causes skin irritation.

Inhalation Harmful if inhaled.

Ingestion Irritating to mouth, throat and stomach. Aspiration hazard if swallowed -- harmful or fatal if liquid is aspirated into lungs.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact Adverse symptoms may include the following:
pain or irritation
watering
redness

Skin contact Adverse symptoms may include the following:
irritation
redness

Inhalation Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Section 11. Toxicological information

Ingestion	Adverse symptoms may include the following: nausea or vomiting

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects	May be harmful by inhalation if exposure to vapor, mists or fumes resulting from thermal decomposition products occurs. Vapor, mist or fume may irritate the nose, mouth and respiratory tract.
Potential delayed effects	Not available.

Long term exposure

Potential immediate effects	Not available.
Potential delayed effects	Not available.

Potential chronic health effects

General	May be harmful by inhalation if exposure to vapor, mists or fumes resulting from thermal decomposition products occurs. Prolonged or repeated contact can defat the skin and lead to irritation and/or dermatitis.
Carcinogenicity	Suspected of causing cancer. Risk of cancer depends on duration and level of exposure.
Mutagenicity	No known significant effects or critical hazards.
Teratogenicity	No known significant effects or critical hazards.
Developmental effects	No known significant effects or critical hazards.
Fertility effects	No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Other information	Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Do not siphon by mouth.
Additional information	Middle distillate: From skin-painting studies of petroleum distillates of similar composition and distillate range, it has been shown that these types of materials often possess weak carcinogenic activity in laboratory animals. In these tests, the material is painted on the shaved backs of mice twice a week for their lifetime. The material is not washed off between applications. Therefore, there may be a potential risk of skin cancer from prolonged or repeated skin contact with this product in the absence of good personal hygiene. This particular product has not been tested for carcinogenic activity, but we have chosen to be cautious in light of the findings with other distillate streams. Occasional skin contact with this product is not expected to have serious effects, but good personal hygiene should be practiced and repeated skin contact avoided. This product can also be expected to produce skin irritation upon prolonged or repeated skin contact. Personal hygiene measures taken to prevent skin irritation are expected to be adequate to prevent risk of skin cancer. Diesel exhaust particulates have been classified by the National Toxicological Program (NTP) to be a reasonably anticipated human carcinogen. Exposure should be minimized to reduce potential risk. Naphthalene has been reported to cause developmental toxicity in mice after oral exposure to relatively high dose levels, but developmental toxicity was not observed in NTP (National Toxicology Program) sponsored studies in rats and rabbits. Ingestion or inhalation of naphthalene can result in hemolysis and other blood abnormalities, and individuals (and infants) deficient in glucose-6-phosphate dehydrogenase may be especially susceptible to these effects. Inhalation of naphthalene may cause headache and nausea. Airborne exposure can result in eye irritation. Naphthalene exposure has been associated with cataracts in animals and humans.

Section 12. Ecological information

Toxicity

No testing has been performed by the manufacturer.

Product/ingredient name	Species	Test/Result	Exposure	Effects	Remarks
fuel, diesel no. 2	Micro-organism	EL50 >1000 mg/l Nominal Fresh water	40 hours	growth inhibition	Based on Vacuum gas oil / Hydrocracked gas oil / Distillate Fuel
	Micro-organism	NOELR 3.217 mg/l Nominal Fresh water	40 hours	growth inhibition	Based on Vacuum gas oil / Hydrocracked gas oil / Distillate Fuel
	Algae	Acute EL50 22 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Diesel fuel
	Daphnia	Acute EL50 210 mg/l Nominal Fresh water	48 hours	Mobility	Based on Diesel fuel
	Daphnia	Acute EL50 68 mg/l Nominal Fresh water	48 hours	Mobility	Based on Diesel fuel
	Algae	Acute ErL50 78 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Diesel fuel
	Fish	Acute LL50 65 mg/l Nominal Fresh water	96 hours	Mortality	Based on Diesel fuel
	Fish	Acute LL50 21 mg/l Nominal Fresh water	96 hours	Mortality	Based on Diesel fuel
	Algae	Acute NOELR 10 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Diesel fuel
	Algae	Acute NOELR 1 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Diesel fuel
	Daphnia	Acute NOELR 46 mg/l Nominal Fresh water	48 hours	Mobility	Based on Diesel fuel
	Fish	Chronic NOEL 0.083 mg/l Nominal Fresh water	14 days	Mortality	Based on Vacuum gas oil / Hydrocracked gas oil / Distillate Fuel
	Daphnia	Chronic NOELR 0.2 mg/l Nominal Fresh water	21 days	Immobilization	Based on Vacuum gas oil / Hydrocracked gas oil / Distillate Fuel
naphthalene	Algae	EC50 0.4 mg/l	96 hours	-	-
	Crustaceans	EC50 2.16 mg/l	48 hours	-	-

Section 12. Ecological information

Conclusion/Summary Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

This product is not expected to bioaccumulate through food chains in the environment.

Mobility in soil

Soil/water partition coefficient (K_{OC})	Not available.
Mobility	Spillages may penetrate the soil causing ground water contamination.

Other ecological information Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

Section 13. Disposal considerations

Disposal methods The generation of waste should be avoided or minimized wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Naphthalene	91-20-3	Listed	U165

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	NA1993	UN1202	UN1202	UN1202
UN proper shipping name	Diesel fuel	Gas oil	Gas oil Marine pollutant	Gas oil
Transport hazard class(es)	Combustible liquid.	3 	3  	3 
Packing group	III	III	III	III

Section 14. Transport information

Environmental hazards	No.	No.	Yes.	No.
Additional information	Non-bulk packages (less than or equal to 119 gal) of combustible liquids are not regulated as hazardous materials in package sizes less than the product reportable quantity. **Reportable quantity** 100 lbs / 45.4 kg [14.152 gal / 53.569 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	-	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg. **Emergency schedules (EmS)** F-E, S-E	The environmentally hazardous substance mark may appear if required by other transportation regulations.

Special precautions for user Not available.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Proper shipping name MARPOL Annex 1 rules apply for bulk shipments by sea.
Category: gas oils, including ship's bunkers

Section 15. Regulatory information

U.S. Federal regulations

United States inventory (TSCA 8b) All components are listed or exempted.

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 311/312

Classification Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

SARA 313

Section 15. Regulatory information

	Product name	CAS number	Concentration
Form R - Reporting requirements	naphthalene	91-20-3	1 - 3
Supplier notification	naphthalene	91-20-3	1 - 3

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

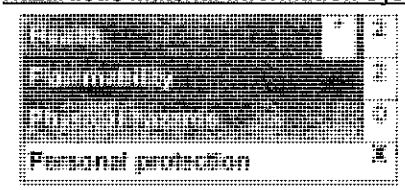
Massachusetts	The following components are listed: NAPHTHALENE
New Jersey	The following components are listed: NAPHTHALENE; MOTH FLAKES
Pennsylvania	The following components are listed: NAPHTHALENE
California Prop. 65	**WARNING:** This product contains a chemical known to the State of California to cause cancer. naphthalene; cumene; ethylbenzene; cumene; Propylene oxide; benzo[a]pyrene **WARNING:** This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Toluene; Methanol **WARNING:** This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm. Benzene Prop 65 chemicals will result under certain conditions from the use of this material. For example, burning fuels produces combustion products including diesel exhaust, a Prop 65 carcinogen, and carbon monoxide, a Prop 65 reproductive toxin.

Other regulations

Australia inventory (AICS)	At least one component is not listed.
Canada inventory	Not determined.
China inventory (IECSC)	At least one component is not listed.
Japan inventory (ENCS)	At least one component is not listed.
Korea inventory (KECI)	At least one component is not listed.
Philippines inventory (PICCS)	At least one component is not listed.
Taiwan inventory (CSNN)	Not determined.
REACH Status	For the REACH status of this product please consult your company contact, as identified in Section 1.

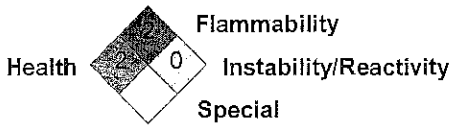
Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

National Fire Protection Association (U.S.A.)



Section 16. Other information

History

Date of issue/Date of revision	01/06/2015.
Date of previous issue	01/06/2015.
Key to abbreviations	ACGIH = American Conference of Industrial Hygienists ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor CAS Number = Chemical Abstracts Service Registry Number GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) OEL = Occupational Exposure Limit SDS = Safety Data Sheet STEL = Short term exposure limit TWA = Time weighted average UN = United Nations UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.

Indicates information that has changed from previously issued version.

Notice to reader

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

MATERIAL SAFETY DATA SHEET

EHC® ISCR Amendment

MSDS #: EHC-C
Revision date: 2014-06-25
Version 3.03

This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200
And Canadian Workplace Hazardous Materials Information System (WHMIS) requirements.

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **EHC® ISCR Amendment**

Recommended Use: Bioremediation product for the remediation of contaminated soil and groundwater
Restrictions on Use: Not for drinking water purification treatment

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CONTAINMENT HAZARD:
Any vessel that contains wet wet EHC must be vented due to potential pressure build up from fermentation gases

Potential Health Effects

Acute toxicity No significant health effects anticipated
Eyes Product dust may cause mechanical eye irritation.
Skin None known.
Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.
Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic toxicity No known chronic effects of components present at greater than 1%.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical name	CAS-No	Weight %
Iron	7439-89-6	18-48
Organic amendment	Proprietary	52-82

4. FIRST AID MEASURES

Eye Contact In case of contact, immediately flush skin with plenty of water. Get medical attention if irritation develops and persists.

Skin Contact Wash off with soap and water.

Inhalation Remove person to fresh air. If signs/symptoms continue, get medical attention.

Ingestion Rinse mouth with water and afterwards drink plenty of water or milk. Call a poison control center or doctor immediately for treatment advice. Never give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

Flammable properties Combustible material.

Suitable Extinguishing Media Dry chemical, CO2, sand, earth, water spray or regular foam.

Explosion data
Sensitivity to Mechanical Impact Not applicable
Sensitivity to Static Discharge Not applicable

Specific Hazards Arising from the Chemical Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ignitable and explosive. Minimize airborne dust generation and eliminate sources of ignition.

NFPA	Health Hazards 1	Flammability 1	Stability 0	Special Hazards -

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Avoid dust formation. For personal protection see section 8.

Methods for Containment Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.

Methods for cleaning up Sweep or vacuum up spillage and return to container. The waste may be recovered and recycled.

7. HANDLING AND STORAGE

Handling Minimize dust generation and accumulation. Keep away from open flames, hot surfaces and sources of ignition. Refer to Section 8.

Storage Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition. Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines Local nuisance dust standards apply.

Occupational exposure controls

Engineering measures None under normal use conditions. Provide appropriate exhaust ventilation at places where dust is formed.

Respiratory Protection Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.

Eye/Face Protection Safety glasses with side-shields

Skin and Body Protection No special precautions required

Hand Protection Use gloves if extended exposure is anticipated Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion and the contact time. If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves

Hygiene measures Handle in accordance with good industrial hygiene and safety practice Wash hands before breaks and immediately after handling the product

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Tan Brown flakes,
Physical State	Solid
Odor	odorless
Odor threshold	Not applicable
pH	5.6 (as aqueous solution)
Boiling Point/Range	Not applicable
Flash point	Not applicable
Flammable properties	Combustible material
Density	0.80 g/mL
Bulk Density	No data available
Water solubility	practically insoluble
Decomposition temperature	No information available
Autoignition temperature	No information available

10. STABILITY AND REACTIVITY

Stability Stable.

Conditions to Avoid Heat, flames and sparks

Materials to avoid Oxidizing agents Strong acids

Hazardous Decomposition Products Burning produces obnoxious and toxic fumes.

Hazardous polymerization Hazardous polymerization does not occur.

Hazardous reactions May react with water to release flammable hydrogen gas.

11. TOXICOLOGICAL INFORMATION

Acute Effects

Remarks	The product has not been tested. Data is based on component.
Eye irritation	No data available for the formulation. Non-irritating (rabbit) (based on components)
Skin irritation	No data available for the formulation. Non-irritating (rabbit) (based on components)
LD50 Oral	Iron: 98.6 g/kg (rat)
LD50 Dermal	No information available
LC50 Inhalation	Iron: > 100 mg/m^3 6 hr (rat)

Chronic toxicity

Chronic toxicity	No known chronic effects of components present at greater than 1%.
Carcinogenicity	Contains no ingredient listed as a carcinogen

12. ECOLOGICAL INFORMATION

Ecotoxicity
Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Persistence and degradability	Biodegradability does not pertain to inorganic substances
Bioaccumulation	Does not bioaccumulate.
Mobility	Is not likely mobile in the environment due its low water solubility.
Other Adverse Effects	None known

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.
Contaminated Packaging	Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT	NOT REGULATED
TDG	Not regulated
ICAO/IATA	Not regulated
IMDG/IMO	Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA (United States)	-
DSL (Canada)	Complies
NDSL (Canada)	Complies
EINECS/ELINCS (Europe)	Complies
ENCS (Japan)	-
China (IECSC)	Complies
KECL (Korea)	-
PICCS (Philippines)	Complies
AICS (Australia)	Complies
NZIoC (New Zealand)	Complies

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic health hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

International Regulations

Mexico - Grade No information available

CANADA

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

Not determined

16. OTHER INFORMATION

HMIS	Health Hazards 1	Flammability 1	Stability 0	Special precautions -

NFPA/HMIS Ratings Legend
Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Revision date: 2014-06-25
Reason for revision: Initial Release.

Disclaimer
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Prepared By:

PeroxyChem

End of Safety Data Sheet

SAFETY DATA SHEET

Version 5.5
Revision Date 02/09/2015
Print Date 04/17/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Ethylbenzene

Product Number : 03079
Brand : Fluka
Index-No. : 601-023-00-4

CAS-No. : 100-41-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Acute toxicity, Inhalation (Category 4), H332
Specific target organ toxicity - repeated exposure (Category 2), H373
Aspiration hazard (Category 1), H304
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H332 Harmful if inhaled.
H373 May cause damage to organs through prolonged or repeated exposure.
H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.

P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P314	Get medical advice/ attention if you feel unwell.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C_8H_{10}
Molecular weight	:	106.17 g/mol
CAS-No.	:	100-41-4
EC-No.	:	202-849-4
Index-No.	:	601-023-00-4

Hazardous components

Component	Classification	Concentration
Ethylbenzene		
	Flam. Liq. 2; Acute Tox. 4; STOT RE 2; Asp. Tox. 1; Aquatic Chronic 3; H225, H304, H332, H373, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

hygroscopic
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Ethylbenzene	100-41-4	TWA	20.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Cochlear impair Kidney damage (nephropathy)		

		Upper Respiratory Tract irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		STEL	125.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		TWA	100.000000 ppm 435.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	125.000000 ppm 545.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	100.000000 ppm 435.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Ethylbenzene	100-41-4	Sum of mandelic acid and phenyl glyoxylic acid	0.7g/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		Ethylbenzene		In end-exhaled air	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm

Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -95 °C (-139 °F) - lit.
f)	Initial boiling point and boiling range	136 °C (277 °F) - lit.
g)	Flash point	15.0 °C (59.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6.7 %(V) Lower explosion limit: 1 %(V)
k)	Vapour pressure	13.3 hPa (10.0 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.867 g/mL at 25 °C (77 °F)
n)	Water solubility	0.2 g/l at 25 °C (77 °F) - slightly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 3.6 at 20 °C (68 °F)
p)	Auto-ignition	432.0 °C (809.6 °F)

	temperature	
q)	Decomposition temperature	No data available
r)	Viscosity	0.773 mm2/s at 20 °C (68 °F) -
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension	71.2 mN/m at 23 °C (73 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - 3,500 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 15,433 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Moderate skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Hamster
ovary
Result: negative

Mouse - male and female
Result: negative

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Ethylbenzene)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information

Repeated dose toxicity - Rat - male and female - No observed adverse effect level - 75 mg/kg
RTECS: DA0700000

Central nervous system depression, Nausea, Headache, Vomiting, Ataxia., Tremors

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Menidia menidia (Atlantic silverside) - 5.1 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 1.8 - 2.4 mg/l - 48 h
Toxicity to algae	static test EC50 - Skeletonema costatum - 4.9 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability: aerobic - Exposure time 28 d
Result: 70 - 80 % - Readily biodegradable

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1175 Class: 3 Packing group: II
Proper shipping name: Ethylbenzene
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1175 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: ETHYLBENZENE

IATA
UN number: 1175 Class: 3 Packing group: II
Proper shipping name: Ethylbenzene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Ethylbenzene	100-41-4	2007-07-01

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Ethylbenzene	100-41-4	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Ethylbenzene	100-41-4	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Ethylbenzene	100-41-4	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Ethylbenzene	100-41-4	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Chronic	Chronic aquatic toxicity

Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H332	Harmful if inhaled.
H373	May cause damage to organs through prolonged or repeated exposure.
H412	Harmful to aquatic life with long lasting effects.
STOT RE	Specific target organ toxicity - repeated exposure

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 02/09/2015 Print Date: 04/17/2015

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

CHEVRON and TEXACO PREMIUM UNLEADED GASOLINES

Product Use: Fuel
Product Number(s): CPS201019 [See Section 16 for Additional Product Numbers]
Synonyms: Calco Premium Gasoline, Chevron Premium Unleaded Gasoline, Chevron Supreme Plus Unleaded Gasoline, Chevron Supreme Unleaded Gasoline, Gasolines, Automotive, Texaco Power Premium Unleaded Gasoline
Company Identification
Chevron Products Company
Marketing, MSDS Coordinator
6001 Bollinger Canyon Road
San Ramon, CA 94583
United States of America

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
MSDS Requests: http://www.chevron.com/contact
Technical Information: (510) 242-5357

SPECIAL NOTES: This MSDS applies to: all motor gasoline.

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Flammable liquid: Category 1. Aspiration toxicant: Category 1. Carcinogen: Category 1A. Target organ toxicant (repeated exposure): Category 1. Eye irritation: Category 2A. Germ Cell Mutagen: Category 1B. Skin irritation: Category 2. Reproductive toxicant (developmental): Category 2. Target organ toxicant (central nervous system): Category 3. Acute aquatic toxicant: Category 2. Chronic aquatic toxicant: Category 2.

Signal Word: Danger

Physical Hazards: Extremely flammable liquid and vapor.

Health Hazards: May be fatal if swallowed and enters airways. May cause genetic defects. May cause cancer. Causes skin irritation. Causes serious eye irritation. Suspected of damaging the unborn child. May cause drowsiness or dizziness.

Environmental Hazards: Toxic to aquatic life. Toxic to aquatic life with long lasting effects.

Target Organs: Causes damage to organs (Blood/Blood Forming Organs) through prolonged or repeated exposure.

PRECAUTIONARY STATEMENTS:
General: Keep out of reach of children. Read label before use.
Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. -- No smoking. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use explosion-proof electrical/ventilating/lighting/equipment. Do not breathe dust/fume/gas/mist/vapours/spray. Avoid breathing dust/fume/gas/mist/vapours/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Use personal protective equipment as required. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid release to the environment.
Response: IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. IF ON SKIN (or hair): Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower. IF SWALLOWED: Immediately call a poison center or doctor/physician. Do NOT induce vomiting. Call a poison center or doctor/physician if you feel unwell. Get medical advice/attention if you feel unwell. IF exposed or concerned: Get medical advice/attention. In case of fire: Use media specified in the SDS to extinguish. Specific treatment (see Notes to Physician on this label). Collect spillage.
Storage: Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store locked up.
Disposal: Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Gasoline	86290-81-5	100 %vol/vol
Toluene (methylbenzene)	108-88-3	1 - 35 %vol/vol
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	1330-20-7	1 - 15 %vol/vol
Pentane, 2,2,4-trimethyl- (Isooctane)	540-84-1	1 - 13 %vol/vol
Butane	106-97-8	1 - 12 %vol/vol

Ethanol	64-17-5	0 - 10 %vol/vol
Benzene	71-43-2	0.1 - 4.9 %vol/vol
Hexane	110-54-3	1 - 5 %vol/vol
Heptane	142-82-5	1 - 4 %vol/vol
Ethyl benzene	100-41-4	0.1 - 3 %vol/vol
Cyclohexane	110-82-7	1 - 3 %vol/vol
Naphthalene	91-20-3	0.1 - 2 %vol/vol
Methylcyclohexane	108-87-2	1 - 2 %vol/vol

Motor gasoline is considered a mixture by EPA under the Toxic Substances Control Act (TSCA). The refinery streams used to blend motor gasoline are all on the TSCA Chemical Substances Inventory. The appropriate CAS number for refinery blended motor gasoline is 86290-81-5. The product specifications of motor gasoline sold in your area will depend on applicable Federal and State regulations.

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: Flush eyes with water immediately while holding the eyelids open. Remove contact lenses, if worn, after initial flushing, and continue flushing for at least 15 minutes. Get immediate medical attention.
Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue or if any other symptoms develop.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Contact with the eyes causes severe irritation. Symptoms may include pain, tearing, reddening, swelling and impaired vision.
Skin: Contact with the skin causes irritation. Symptoms may include pain, itching, discoloration, swelling, and blistering. Skin contact may cause drying or defatting of the skin. Contact with the skin is not expected to cause an allergic skin response.
Ingestion: Highly toxic; may be fatal if swallowed. Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include pain, nausea, vomiting, and diarrhea.
Inhalation: Excessive or prolonged breathing of this material may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:
Reproduction and Birth Defects: Contains material that may cause harm to the unborn child if inhaled above the recommended exposure limit.
Cancer: Prolonged or repeated exposure to this material may cause cancer. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP) and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).
Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains ethylbenzene which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Genetic Toxicity: Contains material that may cause heritable genetic damage based on animal data.
Target Organs: Contains material that may cause damage to the following organ(s) following repeated inhalation at concentrations above the recommended exposure limit:Blood/Blood Forming Organs Risk depends on duration and level of exposure. See Section 11 for additional information.

Indication of any immediate medical attention and special treatment needed
Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Unusual Fire Hazards: See Section 7 for proper handling and storage.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to

collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: This product presents an extreme fire hazard. Liquid very quickly evaporates, even at low temperatures, and forms vapor (fumes) which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Never siphon gasoline by mouth.
Do not store in open or unlabeled containers. READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL. Do not get in eyes, on skin, or on clothing. Do not get in eyes. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling. Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

General Storage Information: DO NOT USE OR STORE near heat, sparks, flames, or hot surfaces . USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: Wear protective equipment to prevent eye contact. Selection of protective equipment may include safety glasses, chemical goggles, face shields, or a combination depending on the work operations conducted.
Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may

include gloves, apron, boots, and complete facial protection depending on operations conducted. Suggested materials for protective gloves include: Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Nitrile Rubber, Polyurethane, Viton.

Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors.

When used as a fuel, this material can produce carbon monoxide in the exhaust. Determine if airborne concentrations are below the occupational exposure limit for carbon monoxide. If not, wear an approved positive-pressure air-supplying respirator.

Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Gasoline	ACGIH	300 ppm (weight)	500 ppm (weight)	--	A3
Toluene (methylbenzene)	ACGIH	50 ppm (weight)	--	--	Skin A4
Toluene (methylbenzene)	OSHA Z-2	200 ppm (weight)	--	300 ppm (weight)	--
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	ACGIH	100 ppm (weight)	150 ppm (weight)	--	A4
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	OSHA Z-1	435 mg/m3	--	--	--
Pentane, 2,2,4-trimethyl- (Isooctane)	OSHA Z-1	2350 mg/m3	--	--	--
Pentane, 2,2,4-trimethyl- (Isooctane)	ACGIH	300 ppm (weight)	--	--	--
Butane	ACGIH	1000 ppm (weight)	--	--	--
Ethanol	ACGIH	1000 ppm (weight)	--	--	A4 A3
Ethanol	OSHA Z-1	1900 mg/m3	--	--	--
Benzene	ACGIH	.5 ppm (weight)	2.5 ppm (weight)	--	Skin A1 Skin
Benzene	OSHA SRS	1 ppm (weight)	5 ppm (weight)	--	--
Benzene	OSHA Z-2	10 ppm (weight)	--	25 ppm (weight)	--
Benzene	CVX	1 ppm (weight)	5 ppm (weight)	--	--
Hexane	ACGIH	50 ppm (weight)	--	--	Skin
Hexane	OSHA Z-1	1800 mg/m3	--	--	--
Heptane	ACGIH	400 ppm	500 ppm	--	--

		(weight)	(weight)		
Heptane	OSHA Z-1	2000 mg/m3	--	--	--
Ethyl benzene	ACGIH	20 ppm (weight)	125 ppm (weight)	--	A3
Ethyl benzene	OSHA Z-1	435 mg/m3	--	--	--
Cyclohexane	ACGIH	100 ppm (weight)	--	--	--
Cyclohexane	OSHA Z-1	1050 mg/m3	--	--	--
Naphthalene	ACGIH	10 ppm (weight)	15 ppm (weight)	--	Skin
Naphthalene	OSHA Z-1	50 mg/m3	--	--	--
Methylcyclohexane	ACGIH	400 ppm (weight)	--	--	--
Methylcyclohexane	OSHA Z-1	2000 mg/m3	--	--	--

Refer to the OSHA Benzene Standard (29 CFR 1910.1028) and Table Z-2 for detailed training, exposure monitoring, respiratory protection and medical surveillance requirements before using this product. Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Colorless to yellow
Physical State: Liquid
Odor: Petroleum odor
Odor Threshold: No data available
pH: Not Applicable
Vapor Pressure: 5 psi - 15 psi (Typical) @ 37.8 °C (100 °F)
Vapor Density (Air = 1): 3 - 4 (Typical)
Initial Boiling Point: 27.2°C (81°F) - 204.4°C (400°F) (Typical)
Solubility: Insoluble in water; miscible with most organic solvents.
Freezing Point: Not Applicable
Melting Point: Not Applicable
Specific Gravity: 0.7 g/ml - 0.8 g/ml @ 15.6°C (60.1°F) (Typical)
Viscosity: <1 SUS @ 37.8°C (100°F)
Evaporation Rate: No data available
Decomposition temperature: No Data Available
Octanol/Water Partition Coefficient: 2 - 7

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: (Tagliabue Closed Cup ASTM D56) < -45 °C (< -49 °F)
Autoignition: > 280 °C (> 536 °F)
Flammability (Explosive) Limits (% by volume in air): Lower: 1.4 Upper: 7.6

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: For a 4-hour exposure, the Primary Irritation Index (PII) in rabbits is: 4.8/8.0.

Skin Sensitization: This material did not cause skin sensitization reactions in a Buehler guinea pig test.

Acute Dermal Toxicity: LD50: >3.75g/kg (rabbit).

Acute Oral Toxicity: LD50: >5 ml/kg (rat)

Acute Inhalation Toxicity: 4 hour(s) LD50: >20000mg/m3 (rat).
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: Refer to ADDITIONAL TOXICOLOGY INFORMATION below. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP) and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).
Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains ethylbenzene which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:
Gasolines are highly volatile and can produce significant concentrations of vapor at ambient temperatures.

Gasoline vapor is heavier than air and at high concentrations may accumulate in confined spaces to present both safety and health hazards. When vapor exposures are low, or short duration and infrequent, such as during refueling and tanker loading/unloading, neither total hydrocarbon nor components such as benzene are likely to result in any adverse health effects. In situations such as accidents or spills where exposure to gasoline vapor is potentially high, attention should be paid to potential toxic effects of specific components. Information about specific components in gasoline can be found in Sections 2/3, 8 and 15 of this MSDS. More detailed information on the health hazards of specific gasoline components can be obtained calling the Chevron Emergency Information Center (see Section 1 for phone numbers).
Pathological misuse of solvents and gasoline, involving repeated and prolonged exposure to high concentrations of vapor is a significant exposure on which there are many reports in the medical literature. As with other solvents, persistent abuse involving repeated and prolonged exposures to high concentrations of vapor has been reported to result in central nervous system damage and eventually, death. In a study in which ten human volunteers were exposed for 30 minutes to approximately 200, 500 or 1000 ppm concentrations of gasoline vapor, irritation of the eyes was the only significant effect observed, based on both subjective and objective assessments.
Lifetime inhalation of wholly vaporized unleaded gasoline at 2056 ppm has caused increased liver tumors in female mice and kidney cancer in male rats. In their 1988 review of carcinogenic risk from gasoline, The International Agency for Research on Cancer (IARC) noted that, because published epidemiology studies did not include any exposure data, only occupations where gasoline exposure may have occurred were reviewed. These included gasoline service station attendants and automobile mechanics. IARC also noted that there was no opportunity to separate effects of combustion products from those of gasoline itself. Although IARC allocated gasoline a final overall classification of Group 2B, i.e. possibly carcinogenic to humans, this was based on limited evidence in experimental animals plus supporting evidence including the presence in gasoline of benzene. The actual evidence for carcinogenicity in humans was considered inadequate.
MUTAGENICITY: Gasoline was not mutagenic, with or without activation, in the Ames assay (Salmonella typhimurium), Saccharamyces cerevisesae, or mouse lymphoma assays. In addition, point mutations were not induced in human lymphocytes. Gasoline was not mutagenic when tested in the mouse dominant lethal assay. Administration of gasoline to rats did not cause chomosomal aberrations in their bone marrow cells.
EPIDEMIOLOGY: To explore the health effects of workers potentially exposed to gasoline vapors in the marketing and distribution sectors of the petroleum industry, the American Petroleum Institute sponsored a cohort mortality study (Publication 4555), a nested case-control study (Publication 4551), and an exposure assessment study (Publication 4552). Histories of exposure to gasoline were reconstructed for cohort of more than 18,000 employees from four companies for the time period between 1946 and 1985. The results of the cohort mortality study indicated that there was no increased mortality from either kidney cancer or leukemia among marketing and marine distribution employees who were exposed to gasoline in the petroleum industry, when compared to the general population. More importantly, based on internal comparisons, there was no association between mortality from kidney cancer or leukemia and various indices of gasoline exposure. In particular, neither duration of employment, duration of exposure, age at first exposure, year of first exposure, job category, cumulative exposure, frequency of peak exposure, nor average intensity of exposure had any effect on kidney cancer or leukemia mortality. The results of the nested case-control study confirmed the findings of the original cohort study. That is, exposure to gasoline at the levels experienced by this cohort of distribution workers is not a significant risk factor for leukemia (all cell types), acute myeloid leukemia, kidney cancer or multiple myeloma.

This product contains cyclohexane.
Cyclohexane primarily affects the central nervous systems of laboratory animals and humans. Acute or prolonged inhalation of cyclohexane at levels below the recommended exposure limits does not result in toxic effects while acute exposures to levels above these recommended limits can cause reversible central nervous system depression. Prolonged exposures of laboratory animals to high levels (up to low thousands of parts per million) have also caused reversible effects which included hyperactivity, diminished response to stimuli, and adaptive liver changes while very high levels (high thousands of parts per million) were fatal. No developmental effects were seen in rats or rabbits following exposures of up to 7000 ppm cyclohexane.

No reproductive effects occurred in rats, although postnatal pup growth was reduced at 7000 ppm in a similar manner as observed in the parental animals. Cyclohexane has not been shown to be mutagenic in several in vitro and in vivo assays and has not produced tumors in several dermal application long-term bioassays. Based on these results and the lack of any mutagenic or genotoxic metabolites, cyclohexane is not expected to be mutagenic or genotoxic. Following dermal exposure, cyclohexane is rapidly absorbed, metabolized,and excreted.

This product contains naphthalene.
GENERAL TOXICITY: Exposure to naphthalene has been reported to cause methemoglobinemia and/or hemolytic anemia, especially in humans deficient in the enzyme glucose-6-phosphate dehydrogenase. Laboratory animals given repeated oral doses of naphthalene have developed cataracts. REPRODUCTIVE TOXICITY AND BIRTH DEFECTS: Naphthalene did not cause birth defects when administered orally to rabbits, rats, and mice during pregnancy, but slightly reduced litter size in mice at dose levels that were lethal to the pregnant females. Naphthalene has been reported to cross the human placenta. GENETIC TOXICITY: Naphthalene caused chromosome aberrations and sister chromatid exchanges in Chinese hamster ovary cells, but was not a mutagen in several other in-vitro tests.CARCINOGENICITY: In a study conducted by the National Toxicology Program (NTP), mice exposed to 10 or 30 ppm of naphthalene by inhalation daily for two years had chronic inflammation of the nose and lungs and increased incidences of metaplasia in those tissues. The incidence of benign lung tumors (alveolar/bronchiolar adenomas) was significantly increased in the high-dose female group but not in the male groups. In another two-year inhalation study conducted by NTP, exposure of rats to 10, 30, and 60 ppm naphthalene caused increases in the incidences of a variety of nonneoplastic lesions in the nose. Increases in nasal tumors were seen in both sexes, including olfactory neuroblastomas in females at 60 ppm and adenomas of the respiratory epithelium in males at all exposure levels. The relevance of these effects to humans has not been established. No carcinogenic effect was reported in a 2-year feeding study in rats receiving naphthalene at 41 mg/kg/day.

This product contains ethanol (ethyl alcohol).
Chronic ingestion of ethanol can damage the liver, nervous system and heart. Chronic heavy consumption of alcoholic beverages has been associated with an increased risk of cancer. Ingestion of ethanol during pregnancy can cause human birth defects such as fetal alcohol syndrome.

This product contains butane.
An atmospheric concentration of 100,000 ppm (10%) butane is not noticeably irritating to the eyes, nose or respiratory tract, but will produce slight dizziness in a few minutes of exposure. No chronic systemic effect has been reported from occupational exposure.

This product contains n-hexane.
TARGET ORGAN TOXICITY: Prolonged or repeated ingestion, skin contact or breathing of vapors of n-hexane has been shown to cause peripheral neuropathy. Recovery ranges from no recovery to complete recovery depending upon the severity of the nerve damage. Exposure to 1000 ppm n-hexane for 18 hr/day for 61 days has been shown to cause testicular damage in rats. However, when rats were exposed to higher concentrations for shorter daily periods (10,000 ppm for 6 h/day, 5 days/wk for 13 weeks), no testicular lesions were seen.
CARCINOGENICITY: Chronic exposure to commercial hexane (52% n-hexane) at a concentration of 9000ppm was not carcinogenic to rats or to male mice, but did result in an increased incidence of liver tumors in female mice. No carcinogenic effects were observed in female mice exposed to 900 or 3000 ppm hexane or in male mice. The relevance for humans of these hexane-induced mouse liver tumors is questionable.
GENETIC TOXICITY: n-Hexane caused chromosome aberrations in bone marrow of rats, but was negative in the AMES and mouse lymphoma tests.

This product contains toluene.

GENERAL TOXICITY: The primary effects of exposure to toluene in animals and humans are on the central nervous system. Solvent abusers, who typically inhale high concentrations (thousands of ppm) for brief periods of time, in addition to experiencing respiratory tract irritation, often suffer permanent central nervous system effects that include tremors, staggered gait, impaired speech, hearing and vision loss, and changes in brain tissue. Death in some solvent abusers has been attributed to cardiac arrhythmias, which appear to be have been triggered by epinephrine acting on solvent sensitized cardiac tissue. Although liver and kidney effects have been seen in some solvent abusers, results of animal testing with toluene do not support these as primary target organs.
HEARING: Humans who were occupationally exposed to concentrations of toluene as low as 100 ppm for long periods of time have experienced hearing deficits. Hearing loss, as demonstrated using behavioral and electrophysiological testing as well as by observation of structural damage to cochlear hair cells, occurred in experimental animals exposed to toluene. It also appears that toluene exposure and noise may interact to produce hearing deficits.
COLOR VISION: In a single study of workers exposed to toluene at levels under 50 ppm, small decreases in the ability to discriminate colors in the blue-yellow range have been reported for female workers. This effect, which should be investigated further, is very subtle and would not likely have been noticed by the people tested.
REPRODUCTIVE/DEVELOPMENTAL TOXICITY: Toluene may also cause mental and/or growth retardation in the children of female solvent abusers who directly inhale toluene (usually at thousands of ppm) when they are pregnant. Toluene caused growth retardation in rats and rabbits when administered at doses that were toxic to the mothers. In rats, concentrations of up to 5000 ppm did not cause birth defects. No effects were observed in the offspring at doses that did not intoxicate the pregnant animals. The exposure level at which no effects were seen (No Observed Effect Level, NOEL) is 750 ppm in the rat and 500 ppm in the rabbit.

This product contains xylene.
ACUTE TOXICITY: The primary effects of exposure to xylene in animals and humans are on the central nervous system. In addition,in some individuals, xylene exposure can sensitize cardiac tissue to epinephrine which may precipitate fatal ventricular fibrillation. DEVELOPMENTAL TOXICITY: Xylene has been reported to cause developmental toxicity in rats and mice exposed by inhalation during pregnancy. The effects noted consisted of delayed development and minor skeletal variations. In addition, when pregnant mice were exposed by ingestion to a level that killed nearly one-third of the test group, lethality (resorptions) and malformations (primarily cleft palate) occurred. Since xylene can cross the placenta, it may be appropriate to prevent exposure during pregnancy. GENETIC TOXICITY/CARCINOGENICITY: Xylene was not genotoxic in several mutagenicity testing assays including the Ames test. In a cancer study sponsored by the National Toxicology Program (NTP),technical grade xylene gave no evidence of carcinogenicity in rats or mice dosed daily for two years. HEARING: Mixed xylenes have been shown to cause measurable hearing loss in rats exposed to 800 ppm in the air for 14 hours per day for six weeks. Exposure to 1450 ppm xylene for 8 hours caused hearing loss while exposure to 1700 ppm for 4 hours did not. Although no information is available for lower concentrations, other chemicals that cause hearing loss in rats at relatively high concentrations do not cause hearing loss in rats at low concentrations. Worker exposure to xylenes at the permissible exposure limit (100 ppm, time-weighted average) is not expected to cause hearing loss.

This product contains benzene.
GENETIC TOXICITY/CANCER: Repeated or prolonged breathing of benzene vapor has been associated with the development of chromosomal damage in experimental animals and various blood diseases in humans ranging from aplastic anemia to leukemia (a form of cancer). All of these diseases can be fatal. In some individuals, benzene exposure can sensitize cardiac tissue to epinephrine which may precipitate fatal ventricular fibrillation.
REPRODUCTIVE/DEVELOPMENTAL TOXICITY: No birth defects have been shown to occur in pregnant laboratory animals exposed to doses not toxic to the mother. However, some evidence of fetal toxicity such as delayed physical development has been seen at such levels. The available information on the effects of

benzene on human pregnancies is inadequate but it has been established that benzene can cross the human placenta.
OCCUPATIONAL: The OSHA Benzene Standard (29 CFR 1910.1028) contains detailed requirements for training, exposure monitoring, respiratory protection and medical surveillance triggered by the exposure level. Refer to the OSHA Standard before using this product.

This product contains ethylbenzene.
BIRTH DEFECTS AND REPRODUCTION: Ethylbenzene is not expected to cause birth defects or other developmental effects based on well-conducted studies in rabbits and rats sponsored by NIOSH. Other studies in rats and mice which reported urinary tract malformations have many deficiencies and have limited usefulness in evaluating human risk. Reproductive effects are not expected based on a NIOSH study of fertility, and lack of effects observed for sperm counts and motility, estrous cycle and pathology of reproductive organs following repeated exposures. HEARING: Statistically significant losses in outer hair cells (OHCs) were observed in rats exposed to >=200 ppm ethylbenzene, 6 hours/day, 6 days/week for 13 weeks, after an 8-week recovery period. Following longer exposure, inner hair cells losses were also observed in rats exposed to >= 600 ppm ethylbenzene, but only occasionally in rats exposed to 400 ppm. The Lowest Observed Adverse Effect Level in rats (LOAEL) was 200 ppm for losses of OHCs. Guinea pigs exposed to ethylbenzene at 2,500 ppm, 6 hours/day for 5 days did not show auditory deficits or losses in OHCs. The concentration of ethylbenzene used in the JP-8 study was approximately 10 ppm. GENETIC TOXICITY: Ethylbenzene tested negative in the bacterial mutation test, Chinese Hamster Ovary (CHO) cell in vitro assay, sister chromatid exchange assay and an unscheduled DNA synthesis assay. Conflicting results have been reported for the mouse lymphoma cell assay. Increased micronuclei were reported in an in vitro Syrian hamster embryo cell assay; however, two in vivo micronuclei studies in mice were negative. In Syrian hamster embryo cells in vitro, cell transformation was observed at 7 days of incubation but not at 24 hours. Based on these results, ethylbenzene is not expected to be mutagenic or clastogenic. CARCINOGENICITY: In studies conducted by the National Toxicology Program, rats and mice were exposed to ethylbenzene at 25, 250 and 750 ppm for six hours per day, five days per week for 103 weeks. In rats exposed to 750 ppm, the incidence of kidney tubule hyperplasia and tumors was increased. Testicular tumors develop spontaneously in nearly all rats if allowed to complete their natural life span; in this study, the development of these tumors appeared to be enhanced in male rats exposed to 750 ppm. In mice, the incidences of lung tumors in males and liver tumors in females exposed to 750 ppm were increased as compared to control mice but were within the range of incidences observed historically in control mice. Other liver effects were observed in male mice exposed to 250 and 750 ppm. The incidences of hyperplasia were increased in the pituitary gland in female mice at 250 and 750 ppm and in the thyroid in male and female mice at 750 ppm.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is expected to be toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

96 hour(s) LC50: 2.7 mg/l (Oncorhynchus mykiss)
96 hour(s) LC50: 1.8 mg/l (Mysidopsis bahia)
96 hour(s) LC50: 8.3 mg/l (Cyprinodon variegatus)
48 hour(s) LC50: 3.0 mg/l (Daphnia magna)

MOBILITY
No data available.

PERSISTENCE AND DEGRADABILITY
This material is expected to be readily biodegradable. Following spillage, the more volatile components of gasoline will be rapidly lost, with concurrent dissolution of these and other constituents into the water. Factors such as local environmental conditions (temperature, wind, mixing or wave action, soil type, etc), photo-oxidation, biodegradation and adsorption onto suspended sediments, can contribute to the weathering of spilled gasoline.

The aqueous solubility of non-oxygenated unleaded gasoline, based on analysis of benzene, toluene, ethylbenzene+xylenes and naphthalene, is reported to be 112 mg/l. Solubility data on individual gasoline constituents also available.

POTENTIAL TO BIOACCUMULATE
Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: 2 - 7

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by international, country, or local laws and regulations. Check governmental regulations and local authorities for approved disposal of this material.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: UN1203, GASOLINE, 3, II; OPTIONAL DISCLOSURE: UN1203, GASOLINE, 3, II, MARINE POLLUTANT (GASOLINE)

IMO/IMDG Shipping Description: UN1203, GASOLINE, 3, II, FLASH POINT SEE SECTION 5 OR 9, MARINE POLLUTANT (GASOLINE)

ICAO/IATA Shipping Description: UN1203, GASOLINE, 3, II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1. Immediate (Acute) Health Effects: YES
2. Delayed (Chronic) Health Effects: YES
3. Fire Hazard: YES
4. Sudden Release of Pressure Hazard: NO
5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Naphthalene	01-2B, 02, 03, 04, 05, 06, 07
Cyclohexane	03, 05, 06, 07
Heptane	05, 06, 07
Toluene (methylbenzene)	03, 04, 05, 06, 07
Ethyl benzene	01-2B, 03, 04, 05, 06, 07
Methylcyclohexane	05, 06, 07
Hexane	03, 05, 06, 07
Butane	05, 06, 07
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	03, 05, 06, 07
Pentane, 2,2,4-trimethyl- (Isooctane)	05, 06, 07
Ethanol	01-1, 02, 04, 05, 06, 07
Gasoline	01-2B, 06, 07
Benzene	01-1, 02, 03, 04, 05, 06, 07

CERCLA REPORTABLE QUANTITIES(RQ)/EPCRA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Benzene	10 lbs	None	186 lbs
Cyclohexane	1000 lbs	None	34188 lbs
Ethyl benzene	1000 lbs	None	34964 lbs
Hexane	5000 lbs	None	129149 lbs
Naphthalene	100 lbs	None	4000 lbs
Pentane, 2,2,4-trimethyl- (Isooctane)	1000 lbs	None	6270 lbs
Toluene (methylbenzene)	1000 lbs	None	2627 lbs
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	100 lbs	None	649 lbs

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), ENCS (Japan), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 1 Flammability: 4 Reactivity: 0

HMIS RATINGS: Health: 2* Flammability: 4 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index

recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

Additional Product Number(s): CPS201024, CPS201050, CPS201051, CPS201058, CPS201060, CPS201061, CPS201066, CPS201068, CPS201069, CPS201071, CPS201072, CPS201078, CPS201081, CPS201084, CPS201085, CPS201088, CPS201091, CPS201092, CPS201094, CPS201096, CPS201097, CPS201098, CPS201101, CPS201103, CPS201114, CPS201117, CPS201193, CPS201213, CPS201214, CPS201215, CPS201233, CPS201234, CPS201235, CPS201263, CPS201264, CPS201265, CPS201274, CPS201275, CPS201276, CPS201283, CPS201284, CPS201285, CPS201293, CPS201294, CPS201295, CPS201853, CPS201854, CPS201861, CPS201862, CPS201863, CPS204006, CPS204007, CPS204008, CPS204009, CPS204014, CPS204015, CPS204026, CPS204027, CPS204050, CPS204051, CPS204074, CPS204075, CPS204092, CPS204093, CPS204108, CPS204109, CPS204120, CPS204121, CPS204144, CPS204145, CPS204168, CPS204169, CPS204192, CPS204193, CPS204204, CPS204205, CPS204211, CPS204216, CPS204217, CPS204228, CPS204229, CPS204252, CPS204253, CPS204276, CPS204277, CPS204294, CPS204295, CPS204327, CPS204328, CPS204329, CPS204351, CPS204353, CPS204355, CPS204357, CPS204362, CPS204363, CPS204368, CPS204369, CPS204374, CPS204375, CPS204380, CPS204381, CPS204386, CPS204387, CPS204392, CPS204393, CPS204398, CPS204399, CPS204404, CPS204405, CPS204410, CPS204411, CPS204416, CPS204417, CPS204422, CPS204423, CPS204428, CPS204429, CPS204434, CPS204435, CPS204440, CPS204441, CPS204443, CPS204447, CPS204451, CPS204455, CPS204459, CPS204463, CPS204470, CPS204471, CPS204488, CPS204489, CPS204506, CPS204507, CPS204524, CPS204525, CPS204542, CPS204543, CPS204560, CPS204561, CPS204578, CPS204579, CPS204596, CPS204597, CPS204614, CPS204615, CPS204632, CPS204633, CPS204650, CPS204651, CPS204668, CPS204669, CPS204683, CPS204694, CPS204695, CPS204700, CPS204701, CPS204706, CPS204707, CPS204712, CPS204713, CPS204725, CPS204726, CPS204731, CPS204732, CPS204741, CPS241766

REVISION STATEMENT: This revision updates the following sections of this Safety Data Sheet: 1-16

Revision Date: MARCH 18, 2015

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct

as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **HOLEPLUG® 3/8**

Revision Date: 02-Apr-2015 **Revision Number:** 13

1. Identification

1.1. Product Identifier

Product Trade Name: HOLEPLUG® 3/8
Synonyms: None
Chemical Family: Mineral
Internal ID Code HM003667

1.2 Recommended use and restrictions on use

Application: Fluid Loss Additive

Uses Advised Against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier
Baroid Fluid Services
Product Service Line of Halliburton
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000

Prepared By
Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number

Emergency Telephone Number (281) 575-5000

2. Hazard(s) Identification

2.1 Classification in accordance with paragraph (d) of §1910.1200

Carcinogenicity	Category 1A - (H350)
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - (H372)

2.2. Label Elements

Hazard Pictograms

Signal Word Danger

Hazard Statements
H350 - May cause cancer
H372 - Causes damage to organs through prolonged or repeated exposure

Precautionary Statements

Prevention
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P280 - Wear protective gloves/eye protection/face protection

Response
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P314 - Get medical attention/advice if you feel unwell

Storage
P405 - Store locked up

Disposal
P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances	**CAS Number**
Crystalline silica, quartz	14808-60-7
Crystalline silica, cristobalite	14464-46-1
Crystalline silica, tridymite	15468-32-3

2.3 Hazards not otherwise classified
None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)

The exact percentage (concentration) of the composition has been withheld as proprietary.

4. First-Aid Measures

4.1. Description of first aid measures
Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Skin Wash with soap and water. Get medical attention if irritation persists.
Ingestion Under normal conditions, first aid procedures are not required.

4.2 Most important symptoms/effects, acute and delayed

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. Fire-fighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

5.2 Specific hazards arising from the substance or mixture

Special Exposure Hazards

Not applicable.

5.3 Special protective equipment and precautions for fire-fighters

Special Protective Equipment for Fire-Fighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid creating and breathing dust.
See Section 8 for additional information

6.2. Environmental precautions

None known.

6.3. Methods and material for containment and cleaning up

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 60 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA

Crystalline silica, quartz	14808-60-7	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$	TWA: 0.025 mg/m³
Crystalline silica, cristobalite	14464-46-1	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$	TWA: 0.025 mg/m³
Crystalline silica, tridymite	15468-32-3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$	0.05 mg/m³

8.2 Appropriate engineering controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

8.3 Individual protection measures, such as personal protective equipment

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid
Color: Various
Odor: Odorless
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	7.5
Freezing Point/Range	No information available.
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
upper flammability limit	No data available
lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.12
Water Solubility	Insoluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical Stability

Stable

10.3. Possibility of Hazardous Reactions

Will Not Occur

10.4. Conditions to Avoid

None anticipated

10.5. Incompatible Materials

Hydrofluoric acid.

10.6. Hazardous Decomposition Products

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information

11.1 Information on likely routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Acute Toxicity

Inhalation Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.

Skin Contact May cause mechanical skin irritation.

Ingestion None known

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	500 mg/kg (Rat) >15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	500 mg/kg (Rat)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	500 mg/kg (Rat)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Eye damage/irritation
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible.
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	Not regarded as a sensitizer.
Crystalline silica, cristobalite	14464-46-1	Not regarded as a sensitizer.
Crystalline silica, tridymite	15468-32-3	Not regarded as a sensitizer.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.

Crystalline silica, tridymite	15468-32-3	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity Effects

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	No information available	LL50 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L(Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil
No information available

12.5 Other adverse effects
No information available

13. Disposal Considerations

13.1. Waste treatment methods
Disposal Method If practical, recover and reclaim, recycle, or reuse by the guidelines of an approved local reuse program. Should contaminated product become a waste, dispose of in a licensed industrial landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. Transport Information

US DOT
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

US DOT Bulk
DOT (Bulk) Not applicable

Canadian TDG
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IMDG/IMO
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

Environmental Hazards: Not applicable

IATA/ICAO

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable
Special Precautions for User: None

15. Regulatory Information

US Regulations

US TSCA Inventory All components listed on inventory or are exempt.

EPA SARA Title III Extremely Hazardous Substances Not applicable

EPA SARA (311,312) Hazard Class Chronic Health Hazard

EPA SARA (313) Chemicals This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity Not applicable.

EPA RCRA Hazardous Waste Classification If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

California Proposition 65 The California Proposition 65 regulations apply to this product.

MA Right-to-Know Law One or more components listed.

NJ Right-to-Know Law One or more components listed.

PA Right-to-Know Law One or more components listed.

Canadian Regulations

Canadian DSL Inventory All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

Revision Date: 02-Apr-2015

Reason for Revision Update to Format SECTION: 2

Additional information
For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key or legend to abbreviations and acronyms
bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
UN – United Nations
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SAFETY DATA SHEET

1. Identification

Product identifier: HYDROCHLORIC ACID

Other means of identification
Synonyms: Muriatic Acid, Hydrogen Chloride, Aqueous
Product No.: 9385, 9538, 9165, V226, V187, V078, V001, 6900, 2624, 2515, H999, H987, H616, 5861, 2062, 5814, 2626, 2612, 5800, 9625, 5587, 9551, 9544, 9539, 9535, 9530, 9529, 5367, H613, 37825, 25496, 20620, H613

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor Information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard Classification

Physical Hazards

Corrosive to metals	Category 1

Health Hazards

Acute toxicity (Oral)	Category 4
Skin Corrosion/Irritation	Category 1
Serious Eye Damage/Eye Irritation	Category 1
Specific Target Organ Toxicity - Single Exposure (Inhalation - vapor)	Category 3

Label Elements

Hazard Symbol:

Signal Word: Danger

Hazard Statement: May be corrosive to metals.
Harmful if swallowed.
Causes severe skin burns and eye damage.
May cause respiratory irritation.

Precautionary Statement

Prevention: Keep only in original container. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Do not eat, drink or smoke when using this product.

Response: Absorb spillage to prevent material damage. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.

Storage: Store locked up. Store in a well-ventilated place. Keep container tightly closed. Store in corrosive resistant container with a resistant inner liner.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical Identity	Common name and synonyms	CAS number	Content in percent (%)*
HYDROCHLORIC ACID		7647-01-0	20 - 40%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.

Skin Contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms: Causes severe skin and eye burns. Harmful if swallowed.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General Fire Hazards: No data available.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: The product is non-combustible. Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical: Fire or excessive heat may produce hazardous decomposition products.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Ventilate closed spaces before entering them. Keep unauthorized personnel away. Evacuate area. Keep upwind. See Section 8 of the SDS for Personal Protective Equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Methods and material for containment and cleaning up: Neutralize with lime or soda ash. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Dike far ahead of larger spill for later recovery and disposal.

Notification Procedures: Inform authorities if large amounts are involved.

Environmental Precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. Handling and storage

Precautions for safe handling: Do not eat, drink or smoke when using the product. Do not get in eyes, on skin, on clothing. Wash hands thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use caution when adding this material to water.

Conditions for safe storage, including any incompatibilities: Keep container tightly closed. Store in a well-ventilated place. Unsuitable containers: metals.

8. Exposure controls/personal protection

Control Parameters

Occupational Exposure Limits

Chemical Identity	Type	Exposure Limit Values		Source
HYDROCHLORIC ACID	Ceiling	2 ppm		US. ACGIH Threshold Limit Values (2011)
	Ceil_Time	5 ppm	7 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	Ceiling	5 ppm	7 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceiling	5 ppm	7 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate Engineering Controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin Protection

Hand Protection: Chemical resistant gloves

Other: Wear suitable protective clothing and gloves.

Respiratory Protection: If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Air-purifying respirator with an appropriate, government approved (where applicable), air-purifying filter, cartridge or canister. Contact health and safety professional or manufacturer for specific information.

Hygiene measures: Provide eyewash station and safety shower. Observe good industrial hygiene practices. Wash hands before breaks and immediately after handling the product. Do not get in eyes. Wash contaminated clothing before reuse. Do not get this material in contact with skin.

9. Physical and chemical properties

Appearance

Physical state: Liquid
Form: Liquid
Color: Colorless
Odor: Pungent
Odor threshold: No data available.
pH: 0.1 (1 N aqueous solution)
Melting point/freezing point: -35 °C

Initial boiling point and boiling range:	48 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	14.1 kPa
Vapor density:	No data available.
Relative density:	1.18 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical Stability:	Material is stable under normal conditions.
Possibility of Hazardous Reactions:	Hazardous polymerization does not occur.
Conditions to Avoid:	Avoid contact with strong reducing agents. Strong oxidizing agents. Contact with alkalis.
Incompatible Materials:	Acids. Amines. Alkalies. Metals. Reducing agents. Oxidizing agents.
Hazardous Decomposition Products:	Chlorine. hydrogen chloride By heating and fire, corrosive vapors/gases may be formed.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	Harmful if swallowed.
Inhalation:	Causes severe burns.
Skin Contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product: ATEmix (Rat): 581 mg/kg

Dermal

Product: No data available.

Specified substance(s):

HYDROCHLORIC ACID	LD 50 (Mouse): 1,449 mg/kg

Inhalation

Product: No data available.

Specified substance(s):

HYDROCHLORIC ACID	LC 50 (Mouse, 1 h): 1108 ppm LC 50 (Rat, 1 h): 3124 ppm

Repeated Dose Toxicity

Product: No data available.

Skin Corrosion/Irritation

Product: Causes severe skin burns.

Serious Eye Damage/Eye Irritation

Product: Causes serious eye damage.

Respiratory or Skin Sensitization

Product: Not a skin sensitizer.

Carcinogenicity

Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ Cell Mutagenicity

In vitro

Product: No mutagenic components identified

In vivo

Product: No mutagenic components identified

Reproductive Toxicity

Product: No components toxic to reproduction

Specific Target Organ Toxicity - Single Exposure

Product: Respiratory tract irritation.

Specific Target Organ Toxicity - Repeated Exposure

Product: None known.

Aspiration Hazard

Product: Not classified

Other Effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product:	No data available.
Specified substance(s):	
HYDROCHLORIC ACID	LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 282 mg/l Mortality

Aquatic Invertebrates

Product:	No data available.
Specified substance(s):	
HYDROCHLORIC ACID	LC 50 (Green or European shore crab (Carcinus maenas), 48 h): 240 mg/l Mortality LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 260 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.

Aquatic Invertebrates

Product:	No data available.

Toxicity to Aquatic Plants

Product:	No data available.

Persistence and Degradability

Biodegradation

Product:	Expected to be readily biodegradable.

BOD/COD Ratio

Product:	No data available.

Bioaccumulative Potential

Bioconcentration Factor (BCF)

Product:	No data available on bioaccumulation.

Partition Coefficient n-octanol / water (log Kow)

Product:	No data available.

Mobility in Soil:	The product is water soluble and may spread in water systems.
Other Adverse Effects:	Large amounts of the product may affect the acidity (pH-factor) in water with possible risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws. Since emptied containers retain product residue, follow label warnings even after container is emptied.
Contaminated Packaging:	No data available.

14. Transport information

DOT

UN Number:	UN 1789
UN Proper Shipping Name:	Hydrochloric acid
Transport Hazard Class(es)	
Class(es):	8
Label(s):	8
Packing Group:	II
Marine Pollutant:	No

IMDG

UN Number:	UN 1789
UN Proper Shipping Name:	HYDROCHLORIC ACID
Transport Hazard Class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing Group:	II
Marine Pollutant:	No

IATA

UN Number:	UN 1789
Proper Shipping Name:	Hydrochloric acid
Transport Hazard Class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing Group:	II

15. Regulatory information

US Federal Regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

HYDROCHLORIC ACID Reportable quantity: 5000 lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [ ] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely Hazardous Substance

Chemical Identity	RQ	Threshold Planning Quantity
HYDROCHLORIC ACID	5000 lbs.	500 lbs.

SARA 304 Emergency Release Notification

Chemical Identity	RQ
HYDROCHLORIC ACID	5000 lbs.

SARA 311/312 Hazardous Chemical

Chemical Identity	Threshold Planning Quantity
HYDROCHLORIC ACID	500lbs

SARA 313 (TRI Reporting)

Chemical Identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
HYDROCHLORIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

HYDROCHLORIC ACID Reportable quantity: 5000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

HYDROCHLORIC ACID Threshold quantity: 15000 lbs

HYDROCHLORIC ACID Threshold quantity: 5000 lbs

US State Regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

HYDROCHLORIC ACID Listed

US. Massachusetts RTK - Substance List

HYDROCHLORIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances

HYDROCHLORIC ACID Listed

US. Rhode Island RTK

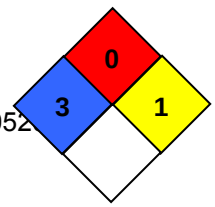
HYDROCHLORIC ACID Listed

Inventory Status:

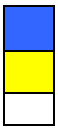
Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Flammability



Health
Reactivity
Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue Date:	02-02-2015
Revision Date:	No data available.
Version #:	4.0
Further Information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

MATHESON
ask. . .The Gas Professionals™

Safety Data Sheet

Material Name Isobutylene in Air Mixture **SDS ID: 00244506**

* * *Section 1 - IDENTIFICATION* * *

Product Identifier: Isobutylene in Air Mixture

Chemical Family

hydrocarbons, AIR mixture

Recommended Use

instrument calibration

Restrictions on Use

None known.

Manufacturer Information

MATHESON TRI-GAS, INC.
150 Allen Road, Suite 302
Basking Ridge, NJ 07920

General Information: 1-800-416-2505
Emergency #: 1-800-424-9300 (CHEMTREC)
Outside the US: 703-527-3887 (Call collect)

* * *Section 2 - HAZARDS IDENTIFICATION* * *

Classification in accordance with 29 CFR 1910.1200

Gas under pressure, Compressed gas

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

WARNING

Hazard Statement(s)

Contains gas under pressure; may explode if heated

Precautionary Statement(s)

Prevention

None needed according to classification criteria.

Response

None needed according to classification criteria.

Storage

Protect from sunlight. Store in a well-ventilated place.

Disposal

Dispose in accordance with all applicable regulations.

Hazard(s) Not Otherwise Classified

May cause frostbite upon sudden release of compressed gas.

* * *Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS* * *

CAS	Component	Percent
132259-10-0	Air	>98
115-11-7	Isobutylene	<1.8

* * *Section 4 - FIRST AID MEASURES* * *

Description of Necessary Measures

Inhalation

If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

Skin

If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

Eyes

Flush eyes with plenty of water for at least 15 minutes. Get immediate medical attention.

Ingestion

If swallowed, get medical attention.

Most Important Symptoms/Effects

Acute

frostbite

Delayed

No information on significant adverse effects.

Indication of Immediate Medical Attention and Special Treatment

Treat symptomatically and supportively.

* * *Section 5 - FIRE FIGHTING MEASURES* * *

Suitable Extinguishing Media

regular dry chemical, carbon dioxide

Large fires: Use water spray, fog or regular foam.

Unsuitable Extinguishing Media

None known.

Specific Hazards Arising from the Chemical

Negligible fire hazard. Containers may rupture or explode if exposed to heat.

Hazardous Combustion Products

Combustion: oxides of carbon

Fire Fighting Measures

Move container from fire area if it can be done without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with water spray until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Avoid inhalation of material or combustion by-products.

Special Protective Equipment and Precautions for Firefighters

Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

* * *Section 6 - ACCIDENTAL RELEASE MEASURES* * *

Personal Precautions, Protective Equipment and Emergency Procedures

Wear personal protective clothing and equipment, see Section 8.

Methods and Materials for Containment and Cleaning Up

Stop leak if possible without personal risk. Stay upwind and keep out of low areas. Damaged cylinders should be handled only by specialists. Reduce vapors with water spray. Ventilate closed spaces before entering. Keep unnecessary people away, isolate hazard area and deny entry.

* * *Section 7 - HANDLING AND STORAGE* * *

Precautions for Safe Handling

Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Conditions for Safe Storage, including any Incompatibilities

Store and handle in accordance with all current regulations and standards. Store in a well-ventilated area. Protect from sunlight. Protect from physical damage. Store in a cool, dry place. Do not store above 125 F (52 C). Cylinders should be stored upright (with valve protection cap in place). Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Keep separated from incompatible substances.

Incompatibilities oxidizing materials

* * *Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION* * *

Component Exposure Limits

Isobutylene (115-11-7)

ACGIH: 250 ppm TWA

Component Biological Limit Values

There are no biological limit values for any of this product's components.

Appropriate Engineering Controls

Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment

Eyes/Face Protection

Wear splash resistant safety glasses. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin Protection

For the gas: Protective clothing is not required, but recommended. For the liquid: Wear appropriate protective, cold insulating clothing.

Glove Recommendations

Wear insulated gloves.

Respiratory Protection

Under conditions of frequent use or heavy exposure, respiratory protection may be needed.

Respiratory protection is ranked in order from minimum to maximum.

Consider warning properties before use.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

* * *Section 9 - PHYSICAL AND CHEMICAL PROPERTIES* * *

Physical State:	Gas	**Appearance:**	colorless, gas
Color:	colorless	**Physical Form:**	gas
Odor:	unpleasant odor	**Odor Threshold:**	Not available
pH:	Not available	**Melting/Freezing Point:**	-216.2 °C (Air)
Boiling Point:	-194.3 °C (Air)	**Flash Point:**	not flammable
Decomposition:	Not available	**Evaporation Rate:**	Not available
OSHA Flammability Class:	Not available	**LEL:**	Not available
UEL:	Not available	**Vapor Pressure:**	760 mmHg @ -194 °C (Air)
Vapor Density (air = 1):	1 (Air)	**Density:**	0.0749 lbs/ft3 @ 21 °C (Air)
Specific Gravity (water=1):	1 (Air)	**Water Solubility:**	0.0231 grams Air/liter of water @ 101.325 kPa and 20°C
Log KOW:	Not available	**Auto Ignition:**	Not available
Viscosity:	0.01853 cP @26.85 °C (Air)		

Other Property Information

No additional information is available.

* * *Section 10 - STABILITY AND REACTIVITY* * *

Reactivity

No reactivity hazard is expected.

Chemical Stability

Stable at normal temperatures and pressure.

Possibility of Hazardous Reactions

Will not polymerize.

Conditions to Avoid

Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.

Incompatible Materials

oxidizing materials

Hazardous Decomposition

Combustion: oxides of carbon

* * *Section 11 - TOXICOLOGICAL INFORMATION* * *

Acute and Chronic Toxicity

Component Analysis - LD50/LC50

The components of this material have been reviewed in various sources and the following selected endpoints are published:

Isobutylene (115-11-7)

Inhalation LC50 Rat 620 mg/L 4 h

RTECS Acute Toxicity (selected)

The components of this material have been reviewed, and RTECS publishes the following endpoints:

Isobutylene (115-11-7)

Inhalation: 314000 mg/m3/2 hour Inhalation Mouse LC50
550000 mg/m3/4 hour Inhalation Rat LC50

Acute Toxicity Level

Isobutylene (115-11-7)

Non Toxic: inhalation

Information on Likely Routes of Exposure

Inhalation

irritation, nausea, vomiting, headache, drowsiness, dizziness, loss of coordination, disorientation, tingling sensation, suffocation, convulsions, coma

Ingestion

frostbite

Skin Contact

irritation, frostbite, dermatitis

Eye Contact

irritation, blurred vision, frostbite

Immediate Effects

frostbite

Delayed Effects

No information on significant adverse effects.

Medical Conditions Aggravated by Exposure

No data available.

Irritation/Corrosivity Data

No data available.

RTECS Irritation

The components of this material have been reviewed and RTECS publishes no data as of the date on this document.

Target Organs

Isobutylene (115-11-7)

central nervous system

Respiratory Sensitization

No data available.

Dermal Sensitization

No data available.

Carcinogenicity

Component Carcinogenicity

Isobutylene (115-11-7)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

RTECS Mutagenic

The components of this material have been reviewed, and RTECS publishes data for one or more components.

Reproductive Effects Data

No data available.

RTECS Tumorigenic

The components of this material have been reviewed, and RTECS publishes data for one or more components.

Specific Target Organ Toxicity - Single Exposure

No data available.

Specific Target Organ Toxicity - Repeated Exposure

No data available.

Aspiration Hazard

Not applicable.

* * *Section 12 - ECOLOGICAL INFORMATION* * *

Component Analysis - Aquatic Toxicity

No LOLI ecotoxicity data are available for this product's components.

Persistence and Degradability

No data available.

Bioaccumulative Potential

No data available.

Mobility

No data available.

* * *Section 13 - DISPOSAL CONSIDERATIONS* * *

Disposal Methods

Dispose in accordance with all applicable regulations.

Component Waste Numbers

The U.S. EPA has not published waste numbers for this product's components.

* * *Section 14 - TRANSPORT INFORMATION* * *

US DOT Information

Shipping Name: Compressed gas, n.o.s. (Contains: Air, Isobutylene)
UN/NA #: UN1956 **Hazard Class:** 2.2
Required Label(s): 2.2

IMDG Information

Shipping Name: Compressed gas, n.o.s. (Contains: Air, Isobutylene)
UN #: UN1956 **Hazard Class:** 2.2
Required Label(s): 2.2

* * *Section 15 - REGULATORY INFORMATION* * *

Component Analysis

U.S. Federal Regulations

None of this products components are listed under SARA Sections 302/304 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), or require an OSHA process safety plan.

SARA 311/312 Hazardous Categories

Acute Health: Yes **Chronic Health:** No **Fire:** No **Pressure:** Yes **Reactive:** No

U.S. State Regulations

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
Isobutylene	115-11-7	No	Yes	No	Yes	Yes

Not regulated under California Proposition 65

Component Analysis - Inventory

Component	CAS	US	CA	EU	AU	PH	JP	KR	CN	NZ
Air	132259-10-0	No	No	No	No	No	No	No	Yes	Yes
Isobutylene	115-11-7	Yes	DSL	EIN	Yes	Yes	Yes	Yes	Yes	Yes

* * *Section 16 - OTHER INFORMATION* * *

NFPA Ratings: Health: 3 **Fire:** 0 **Reactivity:** 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSL - Domestic Substances List; EEC - European Economic Community; EINECS - European Inventory of Existing Commercial Chemical Substances; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; JP - Japan; Kow - Octanol/water partition coefficient; KR - Korea; LEL - Lower Explosive Limit; LOLI - List Of LIsts™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PH - Philippines; RCRA - Resource Conservation and Recovery Act; RID - European Rail Transport; RTECS - Registry of Toxic Effects of Chemical Substances®; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act; TWA - Time Weighted Average; UEL - Upper Explosive Limit; US - United States

Other Information

Matheson Tri-Gas, Inc. makes no express or implied warranties, guarantees or representations regarding the product or the information herein, including but not limited to any implied warranty or merchantability or fitness for use. Matheson Tri-Gas, Inc. shall not be liable for any personal injury, property or other damages of any nature, whether compensatory, consequential, exemplary, or otherwise, resulting from any publication, use or reliance upon the information herein.

End of Sheet 00244506

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date 25.05.2012 Revision: 24.05.2012

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier
Trade name: LIQUINOX
Application of the substance / the preparation: Hand detergent
1.3 Details of the supplier of the Safety Data Sheet
Manufacturer/Supplier:
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040
Further information obtainable from: Product Safety Department

1.4 Emergency telephone number:
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008

GHS07

Skin Irrit. 2: H315: Causes skin irritation.
Eye Irrit. 2: H319: Causes serious eye irritation.

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

Xi; Irritant

R36/38: Irritating to eyes and skin.
Information concerning particular hazards for human and environment:
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
Classification system:
The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements
Labelling according to Regulation (EC) No 1272/2008
The product is classified and labelled according to the CLP regulation.

Hazard pictograms

GHS07

Signal word: Warning

Hazard-determining components of labelling:
Benzenesulfonic Acid, Sodium Salts
Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

(Contd. on page 2)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date 25.05.2012 Revision: 23.05.2012

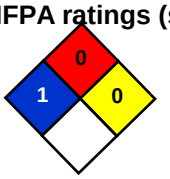
Trade name: LIQUINOX

(Contd. of page 1)

Precautionary statements:
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264 Wash thoroughly after handling.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P321 Specific treatment (see on this label).
P362 Take off contaminated clothing and wash before reuse.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P337+P313 If eye irritation persists: Get medical advice/attention.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.

Hazard description:
WHMIS-symbols:
D2B - Toxic material causing other toxic effects

NFPA ratings (scale 0 - 4)



Health = 1
Fire = 0
Reactivity = 0

HMIS-ratings (scale 0 - 4)

HEALTH	1
FIRE	0
REACTIVITY	0

Health = 1
Fire = 0
Reactivity = 0

2.3 Other hazards
Results of PBT and vPvB assessment
PBT: Not applicable.
vPvB: Not applicable.

3 Composition/Information on Ingredients

3.2 Mixtures
Description: Mixture of substances listed below with nonhazardous additions.

Dangerous components:

CAS: 68081-81-2	Benzenesulfonic Acid, Sodium Salts Xi R38-41 Eye Dam. 1, H318 Skin Irrit. 2, H315	10-25%
CAS: 1300-72-7 EINECS: 215-090-9	Sodium xylenesulphonate Xi R36/37/38 Skin Irrit. 2, H315; Eye Irrit. 2, H319; STOT SE 3, H335	2.5-10%
CAS: 84133-50-6	Alcohol Ethoxylate Xi R36/38 Skin Irrit. 2, H315	2.5-10%

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Trade name: LIQUINOX

(Contd. of page 2)

CAS: 68603-42-9 EINECS: 271-657-0	Coconut diethanolamide Xi R36/38	2.5-10%
CAS: 17572-97-3 EINECS: 241-543-5	Ethylenediaminetetraacetic acid, tripotassium salt Xi R36/37/38	2.5-10%

Additional information: For the wording of the listed risk phrases refer to section 16.

4 First Aid Measures

4.1 Description of first aid measures

General information:
Take affected persons out into the fresh air.

After inhalation:
Supply fresh air; consult doctor in case of complaints.

After skin contact:
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.

After eye contact:
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

After swallowing:
Do not induce vomiting; call for medical help immediately.
Rinse out mouth and then drink plenty of water.
A person vomiting while laying on their back should be turned onto their side.

4.2 Most important symptoms and effects, both acute and delayed:
No further relevant information available.

4.3 Indication of any immediate medical attention and special treatment needed:
No further relevant information available.

5 Firefighting Measures

5.1 Extinguishing media:

Suitable extinguishing agents:
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:
No further relevant information available.

5.3 Advice for firefighters:

Protective equipment:
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:
Ensure adequate ventilation
Particular danger of slipping on leaked/spilled product.

6.2 Environmental precautions:
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

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Trade name: LIQUINOX

(Contd. of page 3)

6.3 Methods and material for containment and cleaning up:
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust). Clean the affected area carefully; suitable cleaners are:
Warm water

6.4 Reference to other sections:
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information

7 Handling and Storage

7.1 Precautions for safe handling:
No special measures required.

Information about fire - and explosion protection:
No special measures required.

7.2 Conditions for safe storage, including any incompatibilities:
Storage:
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility: Not required.
Further information about storage conditions: None

7.3 Specific end use(s): No further relevant information available.

8 Exposure Controls/Personal Protection

Additional information about design of technical facilities: No further data; see item 7.

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls:
Personal protective equipment:
General protective and hygienic measures:
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.

Respiratory protection:
Not required.

Protection of hands:

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

(Contd. on page 5)

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Trade name: LIQUINOX

(Contd. of page 4)

Material of gloves:
Natural rubber, NR
Nitrile rubber, NBR
Neoprene gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material:
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:

Safety glasses

Goggles recommended during refilling

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:	
Appearance:	
Form:	Liquid
Colour:	Light yellow
Odour:	Odourless
Odour threshold:	Not determined.
pH-value at 20°C:	8.5
Change in condition:	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	100°C
Flash point:	Not applicable.
Flammability (solid, gaseous):	Not applicable.
Ignition temperature:	
Decomposition temperature:	Not determined.
Self-igniting:	Product is not selfigniting.
Danger of explosion:	Product does not present an explosion hazard.
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapour pressure at 20°C:	23 hPa
Density at 20°C:	1.08 g/cm³
Relative density:	Not determined.
Vapour density:	Not determined.
Evaporation rate:	Not determined.

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Trade name: LIQUINOX

(Contd. of page 5)

Solubility in / Miscibility with water:	Fully miscible.
Segregation coefficient (n-octanol/water):	Not determined.
Viscosity:	
Dynamic:	Not determined.
Kinematic:	Not determined.
9.2 Other information:	No further relevant information available

10 Stability and Reactivity

10.1 Reactivity:
10.2 Chemical stability:
Thermal decomposition / conditions to be avoided:
No decomposition if used according to specifications.
10.3 Possibility of hazardous reactions:
Reacts with strong oxidizing agents.
Reacts with strong acids.
10.4 Conditions to avoid:
No further relevant information available.
10.5 Incompatible materials:
No further relevant information available.
10.6 Hazardous decomposition products:
Carbon monoxide and carbon dioxide
Sulphur oxides (SOx)
Nitrogen oxides

11 Toxicological Information

11.1 Information on toxicological effects:
Acute toxicity:
Primary irritant effect:
On the skin: Irritant to skin and mucous membranes.
On the eye: Strong irritant with the danger of severe eye injury.
Sensitization: No sensitizing effects known.
Additional toxicological information:
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Irritant

12 Ecological Information

12.1 Toxicity:
Aquatic toxicity: No further relevant information available.
12.2 Persistence and degradability: No further relevant information available.
12.3 Bioaccumulative potential: No further relevant information available.
12.4 Mobility in soil: No further relevant information available.
Additional ecological information:
General notes:
Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach sewage water or drainage ditch undiluted or unneutralized.

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Trade name: LIQUINOX

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12.5 Results of PBT and vPvB assessment:
PBT: Not applicable.
vPvB: Not applicable.
12.6 Other adverse effects: No further relevant information available.

13 Disposal Considerations

13.1 Waste treatment methods:
Recommendation:
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.
Uncleaned packaging:
Recommendation: Disposal must be made according to official regulations.
Recommended cleansing agents: Water, if necessary together with cleansing agents.

14 Transport Information

14.1 UN-Number: **DOT, ADR, ADN, IMDG, IATA, ICAO:**	Not Regulated
14.2 UN proper shipping name: **DOT, ADR, ADN, IMDG, IATA, ICAO:**	Not Regulated
14.3 Transport hazard class(es): **DOT, ADR, ADN, IMDG, IATA, ICAO:**	Not Regulated
14.4 Packing group: **DOT, ADR, AND, IMDG, IATA, ICAO:**	Not Regulated
14.5 Environmental hazards: **Marine pollutant:**	No
14.6 Special precautions for user:	Not applicable.
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:	Not applicable.
UN "Model Regulation":	Not Regulated

15 Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:
United States (USA):
SARA:

Section 355 (extremely hazardous substances):
None of the ingredients is listed.
Section 313 (Specific toxic chemical listings):
None of the ingredients is listed.
TSCA (Toxic Substances Control Act):
All ingredients are listed.

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Trade name: LIQUINOX

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Proposition 65 (California):

Chemicals known to cause cancer:
None of the ingredients is listed.
Chemicals known to cause reproductive toxicity for females:
None of the ingredients is listed.
Chemicals known to cause reproductive toxicity for males:
None of the ingredients is listed.
Chemicals known to cause developmental toxicity:
None of the ingredients is listed.

Carcinogenic Categories:

EPA (Environmental Protection Agency):
None of the ingredients is listed.
TLV (Threshold Limit Value established by ACGIH):
None of the ingredients is listed.
NIOSH-Ca (National Institute for Occupational Safety and Health):
None of the ingredients is listed.
OSHA-Ca (Occupational Safety & Health Administration):
None of the ingredients is listed.

Canadá:

Canadian Domestic Substances List (DSL):
All ingredients are listed.
Canadian Ingredient Disclosure list (limit 0.1%):
None of the ingredients is listed.
Canadian Ingredient Disclosure list (limit 1%):
None of the ingredients is listed.

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevant phrases:

H315 Causes skin irritation.
H318 Causes serious eye damage.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
R36/37/38 Irritating to eyes, respiratory system and skin.
R36/38 Irritating to eyes and skin.
R38 Irritating to skin.
R41 Risk of serious damage to eyes.

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Trade name: LIQUINOX

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Abbreviations and Acronyms
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent

Material Safety Data Sheet

24 Hour Assistance:
1-847-367-7700
Rust-Oleum Corp.
www.rustoleum.com

1. Identification

Product Name: PRO LSPR 6PK MARK FLUORESCENT ORANGE

Revision Date: 5/21/2014

Product Number: 2554838

Product Use/Class: Marking Paint/Aerosols

Supplier:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Manufacturer:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Prepared by: Regulatory Department

2. Hazard Identification

EMERGENCY OVERVIEW: Harmful if swallowed. Extremely flammable liquid and vapor. Vapors may cause flash fire or explosion. Contents Under Pressure. Harmful if inhaled. May affect the brain or nervous system causing dizziness, headache or nausea. May cause eye, skin, or respiratory tract irritation. KEEP OUT OF REACH OF CHILDREN. Harmful if inhaled. Causes eye irritation. Use ventilation necessary to keep exposures below recommended exposure limits, if any. Vapor Harmful. Causes Eye, Skin, Nose, and Throat Irritation.

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: Substance may cause slight skin irritation. Prolonged or repeated contact may cause skin irritation. May cause skin irritation. Allergic reactions are possible.

EFFECTS OF OVEREXPOSURE - INHALATION: Harmful if inhaled. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Aspiration hazard if swallowed; can enter lungs and cause damage. Harmful if swallowed.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: IARC lists Ethylbenzene as a possible human carcinogen (group 2B). Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage.

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

3. Composition/Information On Ingredients

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Liquefied Petroleum Gas	68476-86-8	30.0	N.E.	N.E.	N.E.	N.E.
Aliphatic Hydrocarbon	64742-89-8	20.0	100 ppm	N.E.	100 ppm	N.E.
Limestone	1317-65-3	20.0	N.E.	N.E.	15 mg/m3 [Total Dust]	N.E.
Talc	14807-96-6	10.0	2 mg/m3	N.E.	0.1 mg/m3 [Respirable]	N.E.
Acetone	67-64-1	10.0	500 ppm	750 ppm	1000 ppm	N.E.
n-Butyl Acetate	123-86-4	5.0	150 ppm	200 ppm	150 ppm	N.E.
Hydrotreated Light Distillate	64742-47-8	5.0	200 mg/m3	N.E.	N.E.	N.E.

Naphtha, Petroleum, Hydrotreated Light	64742-49-0	5.0	200 mg/m3	N.E.	N.E.	N.E.
Stoddard Solvents	8052-41-3	5.0	100 ppm	N.E.	500 ppm	N.E.
Ethylbenzene	100-41-4	1.0	20 ppm	125 ppm	100 ppm	N.E.

4. First-aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately. Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-fighting Measures

Flash Point, °F -156 (Calculated)

Extinguishing Media: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20 °. F. - EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. Closed containers may explode when exposed to extreme heat due to buildup of steam. No unusual fire or explosion hazards noted.

SPECIAL FIREFIGHTING PROCEDURES: Evacuate area and fight fire from a safe distance. Full protective equipment including self-contained breathing apparatus should be used. Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Use only in a well-ventilated area. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Remove contaminated clothing and launder before reuse. Use only with adequate ventilation. Avoid contact with eyes, skin and clothing.

STORAGE: Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of NFPA Class I flammable liquids. Contents under pressure. Do not expose to heat or store above 120 ° F. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials. Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep away from heat, sparks, flame and sources of ignition. Avoid excess heat.

8. Exposure Controls/Personal Protection

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use impervious gloves to prevent skin contact and absorption of this material through the skin. Nitrile or Neoprene gloves may afford adequate skin protection. Use gloves to prevent prolonged skin contact.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further information regarding personal protective equipment and its application. Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

9. Physical and Chemical Properties

Vapor Density	Heavier than Air	**Odor:**	Solvent Like
Appearance:	Aerosolized Mist	**Evaporation Rate:**	Faster than Ether
Solubility in Water:	Slight	**Freeze Point:**	N.D.
Specific Gravity:	0.871	**pH:**	N.A.
Physical State:	Liquid		

(See section 16 for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120 ° F. Avoid all possible sources of ignition. Avoid contact with strong acid and strong bases.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological Information

Chemical Name	LD50	LC50
Liquefied Petroleum Gas	N.E.	N.E.
Aliphatic Hydrocarbon	>5000 mg/kg (Rat, Oral)	N.E.
Limestone	>5000 mg/kg (Rat, Oral)	N.E.
Talc	N.E.	TCLo: 11 mg/m3 (Inhalation)
Acetone	5800 mg/kg (Rat)	50100 mg/m3 (Rat, 8Hr)
n-Butyl Acetate	13100 mg/kg (Rat, Oral)	2000 ppm (Rat, Inhalation, 4Hr)
Hydrotreated Light Distillate	>3160 mg/kg (Skin)	N.E.
Naphtha, Petroleum, Hydrotreated Light	N.E.	N.E.
Stoddard Solvents	>5000 mg/kg (Rat, Oral)	N.E.
Ethylbenzene	3500 mg/kg (Rat, Oral)	N.E.

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components. Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Dispose of material in accordance to local, state and federal regulations and ordinances. Do not allow to enter waterways, wastewater. soil, storm drains or sewer systems.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Paint Products in Limited Quantities	Aerosols	Aerosols	Paint Products in Limited Quantities
Hazard Class:	N.A.	2.1	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Fire Hazard, Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Xylene	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(B) if exported from the United States:

No TSCA 12(b) components exist in this product.

International Regulations:

CANADIAN WHMIS:

This MSDS has been prepared in compliance with Controlled Product Regulations except for the use of the 16 headings.

Canadian WHMIS Class: AB5 D2A

16. Other Information

HMIS Ratings:

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA Ratings:

Health:	2	**Flammability:**	4	**Instability**	0

VOLATILE ORGANIC COMPOUNDS, g/L: 522

REASON FOR REVISION: Regulatory Update

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Rust-Oleum Corporation believes, to the best of its knowledge, information and belief, the information contained herein to be accurate and reliable as of the date of this safety data sheet. However, because the conditions of handling, use, and storage of these materials are beyond our control, we assume no responsibility or liability for personal injury or property damage incurred by the use of these materials. Rust-Oleum Corporation makes no warranty, expressed or implied, regarding the accuracy or reliability of the data or results obtained from their use. All materials may present unknown hazards and should be used with caution. The information and recommendations in this material safety data sheet are offered for the users' consideration and examination. It is the responsibility of the user to determine the final suitability of this information and to comply with all applicable international, federal, state, and local laws and regulations.

Material Safety Data Sheet

24 Hour Assistance:
1-847-367-7700
Rust-Oleum Corp.
www.rustoleum.com

1. Identification

Product Name: PRO LSPR 6PK MARK WHITE

Revision Date: 6/9/2014

Product Number: 2592838

Product Use/Class: Marking Paint/Aerosols

Supplier:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Manufacturer:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Prepared by: Regulatory Department

2. Hazard Identification

EMERGENCY OVERVIEW: Extremely flammable liquid and vapor. Vapors may cause flash fire or explosion. Harmful if inhaled. May affect the brain or nervous system causing dizziness, headache or nausea. Contents Under Pressure. May cause eye, skin, or respiratory tract irritation. KEEP OUT OF REACH OF CHILDREN. Harmful if inhaled. Harmful if swallowed. Causes eye irritation. Use ventilation necessary to keep exposures below recommended exposure limits, if any. Vapor Harmful. Causes Eye, Skin, Nose, and Throat Irritation.

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: May be absorbed through the skin in harmful amounts. May cause skin irritation. Allergic reactions are possible.

EFFECTS OF OVEREXPOSURE - INHALATION: High gas, vapor, mist or dust concentrations may be harmful if inhaled. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. IARC lists Ethylbenzene as a possible human carcinogen (group 2B). Contains Titanium Dioxide. Titanium Dioxide is listed as a Group 2B-"Possibly carcinogenic to humans" by IARC. No significant exposure to Titanium Dioxide is thought to occur during the use of products in which Titanium Dioxide is bound to other materials, such as in paints during brush application or drying. Risk of overexposure depends on duration and level of exposure to dust from repeated sanding of surfaces or spray mist and the actual concentration of Titanium Dioxide in the formula. (Ref: IARC Monograph, Vol. 93, 2010)May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage.

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

3. Composition/Information On Ingredients

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Liquefied Petroleum Gas	68476-86-8	30.0	N.E.	N.E.	N.E.	N.E.
Limestone	1317-65-3	15.0	N.E.	N.E.	15 mg/m3 [Total Dust]	N.E.
Titanium Dioxide	13463-67-7	10.0	10 mg/m3	N.E.	15 mg/m3 [Total Dust]	N.E.
Toluene	108-88-3	10.0	20 ppm	N.E.	200 ppm	300 ppm

Xylene	1330-20-7	10.0	100 ppm	150 ppm	100 ppm	N.E.
Naphtha, Hydrotreated Heavy	64742-48-9	10.0	400 ppm	N.E.	400 ppm	N.E.
Aliphatic Hydrocarbon	64742-89-8	5.0	100 ppm	N.E.	100 ppm	N.E.
Ethylbenzene	100-41-4	5.0	20 ppm	125 ppm	100 ppm	N.E.

4. First-aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-fighting Measures

Flash Point, °F -156 (Setaflash)

Extinguishing Media: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20 °. F. - EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. No unusual fire or explosion hazards noted. Keep containers tightly closed.

SPECIAL FIREFIGHTING PROCEDURES: Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only with adequate ventilation. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of NFPA Class I flammable liquids. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials. Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep away from heat, sparks, flame and sources of ignition. Avoid excess heat.

8. Exposure Controls/Personal Protection

ENGINEERING CONTROLS: Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

9. Physical and Chemical Properties

Vapor Density	Heavier than Air	**Odor:**	Solvent Like
Appearance:	Aerosolized Mist	**Evaporation Rate:**	Faster than Ether
Solubility in Water:	Slight	**Freeze Point:**	N.D.
Specific Gravity:	0.898	**pH:**	N.A.
Physical State:	Liquid		

(See section 16 for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120 ° F. Avoid contact with strong acid and strong bases. Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological Information

Chemical Name	LD50	LC50
Liquefied Petroleum Gas	N.E.	N.E.
Limestone	>5000 mg/kg (Rat, Oral)	N.E.
Titanium Dioxide	>7500 mg/kg (Rat, Oral)	N.E.
Toluene	636 mg/kg (Rat, Oral)	>26,700 ppm (Rat, Inhalation, 1Hr)
Xylene	4300 mg/kg (Rat, Oral)	5000 ppm (Rat, Inhalation, 4Hr)
Naphtha, Hydrotreated Heavy	N.E.	N.E.
Aliphatic Hydrocarbon	>5000 mg/kg (Rat, Oral)	N.E.
Ethylbenzene	3500 mg/kg (Rat, Oral)	N.E.

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Dispose of material in accordance to local, state and federal regulations and ordinances. Do not allow to enter waterways, wastewater. soil, storm drains or sewer systems.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Paint Products in Limited Quantities	Aerosols	Aerosols	Paint Products in Limited Quantities
Hazard Class:	N.A.	2.1	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Fire Hazard, Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Toluene	108-88-3
Xylene	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(B) if exported from the United States:

No TSCA 12(b) components exist in this product.

International Regulations:

CANADIAN WHMIS:

This MSDS has been prepared in compliance with Controlled Product Regulations except for the use of the 16 headings.

Canadian WHMIS Class: AB5 D2A

16. Other Information

HMIS Ratings:

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA Ratings:

Health:	2	**Flammability:**	4	**Instability**	0

VOLATILE ORGANIC COMPOUNDS, g/L: 536

REASON FOR REVISION: Regulatory Update

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Rust-Oleum Corporation believes, to the best of its knowledge, information and belief, the information contained herein to be accurate and reliable as of the date of this safety data sheet. However, because the conditions of handling, use, and storage of these materials are beyond our control, we assume no responsibility or liability for personal injury or property damage incurred by the use of these materials. Rust-Oleum Corporation makes no warranty, expressed or implied, regarding the accuracy or reliability of the data or results obtained from their use. All materials may present unknown hazards and should be used with caution. The information and recommendations in this material safety data sheet are offered for the users' consideration and examination. It is the responsibility of the user to determine the final suitability of this information and to comply with all applicable international, federal, state, and local laws and regulations.

Material Safety Data Sheet

Creation Date 27-Sep-2010 **Revision Date** 27-Sep-2010 **Revision Number** 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Naphthalene**

Cat No. **AC180900000; AC180900010; AC180900025; AC180902500**

Synonyms Tar camphor; Naphthalin; Coal tar camphor

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information in the US, call: 001-800-ACROS-01
For information in Europe, call: +32 14 57 52 11

Emergency Number, Europe: +32 14 57 52 99
Emergency Number, US: 001-201-796-7100

CHEMTREC Phone Number, US: 001-800-424-9300
CHEMTREC Phone Number, Europe: 001-703-527-3887

2. HAZARDS IDENTIFICATION

WARNING!

Emergency Overview

Flammable solid. Harmful if swallowed. Possible cancer hazard. May cause cancer based on animal data. May cause skin, eye, and respiratory tract irritation. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Appearance White **Physical State** Solid **odor** Characteristic

Target Organs Central nervous system (CNS), Liver, Kidney, spleen

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes	May cause irritation.
Skin	May cause irritation. May be harmful in contact with skin.
Inhalation	May cause irritation of respiratory tract. May be harmful if inhaled.
Ingestion	Harmful if swallowed. May cause central nervous system effects. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic Effects Possible cancer hazard based on tests with laboratory animals. Tumorigenic effects have been reported in experimental animals.. Experiments have shown reproductive toxicity effects on laboratory animals. May cause adverse liver effects. May cause adverse kidney effects.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Naphthalene	91-20-3	>95

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point 78°C / 172.4°F

Method No information available.

Autoignition Temperature 526°C / 978.8°F

Explosion Limits
Upper 5.9 vol %
Lower 0.9 vol %

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
Combustible material. Containers may explode when heated.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA **Health** 2 **Flammability** 2 **Instability** 0 **Physical hazards** N/A

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. HANDLING AND STORAGE

Handling Wear personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting/equipment.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Naphthalene	TWA: 10 ppm STEL: 15 ppm Skin	(Vacated) TWA: 10 ppm (Vacated) TWA: 50 mg/m^3 (Vacated) STEL: 15 ppm (Vacated) STEL: 75 mg/m^3 TWA: 50 mg/m^3 TWA: 10 ppm	IDLH: 250 ppm TWA: 10 ppm TWA: 50 mg/m^3 STEL: 15 ppm STEL: 75 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Naphthalene	TWA: 10 ppm TWA: 52 mg/m^3 STEL: 15 ppm STEL: 79 mg/m^3	TWA: 10 ppm TWA: 50 mg/m^3 STEL: 15 ppm STEL: 75 mg/m^3	TWA: 10 ppm TWA: 52 mg/m^3 STEL: 78 mg/m^3 STEL: 15 ppm

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	White
odor	Characteristic
Odor Threshold	No information available.
pH	No information available.
Vapor Pressure	0.08 mbar @ 20 °C
Vapor Density	4.4 (Air = 1.0)
Viscosity	No information available.
Boiling Point/Range	218°C / 424.4°F
Melting Point/Range	79 - 82°C / 174.2 - 179.6°F
Decomposition temperature	540 °C
Flash Point	78°C / 172.4°F
Evaporation Rate	No information available.
Specific Gravity	0.990
Solubility	No information available.
log Pow	No data available
Molecular Weight	128.17
Molecular Formula	C10 H8

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.
Incompatible Materials	Strong oxidizing agents
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO_2)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions .	None under normal processing..

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Naphthalene	490 mg/kg (Rat)	20 g/kg (Rabbit) 2500 mg/kg (Rat)	340 mg/m^3 (Rat) 1 h

Irritation No information available.

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	ACGIH	IARC	NTP	OSHA	Mexico
Naphthalene	Not listed	Group 2B	Reasonably Anticipated	X	Not listed

Sensitization No information available.

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects Developmental effects have occurred in experimental animals.

Teratogenicity Teratogenic effects have occurred in experimental animals..

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.. See actual entry in RTECS for complete information.

Endocrine Disruptor Information No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Naphthalene	0.4 mg/L EC50 = 72 h	LC50 96 h 1-6.5 mg/L (Pimephales promelas)	EC50 = 0.93 mg/L 30 min EC50 > 20 mg/L 18 h	1.96 mg/L EC50 = 48 h 2.16 mg/L LC50 = 48 h 1.09 - 3.4 mg/L EC50 48 h

Persistence and Degradability Not readily biodegradable.

Bioaccumulation/ Accumulation No information available

Mobility .

Component	log Pow
Naphthalene	3.3

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Naphthalene - 91-20-3	U165	-

14. TRANSPORT INFORMATION

DOT

UN-No	UN1334
Proper Shipping Name	NAPHTHALENE, CRUDE
Hazard Class	4.1
Packing Group	III

TDG

UN-No	UN1334
Proper Shipping Name	NAPHTHALENE, CRUDE
Hazard Class	4.1
Packing Group	III

IATA

UN-No	UN1334
Proper Shipping Name	NAPHTHALENE, CRUDE
Hazard Class	4.1
Packing Group	III

IMDG/IMO

UN-No	UN1334
Proper Shipping Name	NAPHTHALENE, CRUDE
Hazard Class	4.1
Packing Group	III

15. REGULATORY INFORMATION

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Naphthalene	T	X	-	202-049-5	-		X	X	X	X	KE-25545 X

Legend:

X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Component	TSCA 12(b)
Naphthalene	Section 4

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Naphthalene	91-20-3	>95	0.1

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Naphthalene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Naphthalene	X		-

OSHA
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Naphthalene	100 lb	-

California Proposition 65

This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL
Naphthalene	91-20-3	Carcinogen	5.8 µg/day

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Naphthalene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

B4 Flammable solid
D2A Very toxic materials

16. OTHER INFORMATION

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

Reviewed
2013.09.05
14:06:41
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Creation Date 27-Sep-2010

Print Date 27-Sep-2010

Revision Summary "***", and red text indicates revision

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

MATERIAL SAFETY DATA SHEET

Revision Number A96008F
03/04/11

1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND THE COMPANY / UNDERTAKING

Product name YSI 3682 Zobell Solution
Synonyms None
Chemical characterization White powder
Manufacturer, importer, supplier YSI Inc.
1725 Brannum Lane
Yellow Springs, OH 45387
USA
EMERGENCY TELEPHONE NUMBER (937) 767-7241

2. COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Chemical Name	% Weight	ACGIH TWA	Acute Toxicity	IARC*	NTP*	OSHA*
7447-40-7	Potassium chloride	72-78	None	N/A	N/A	N/A	N/A
14459-95-1	Potassium ferrocyanide	10-15			N/A	N/A	N/A
13746-66-2	Potassium ferrocyanide	10-15			N/A	N/A	N/A

* IARC - Group 1 (Carcinogenic to humans)
* NTP - Report on Carcinogens - Known Carcinogens
* OSHA - Regulated Carcinogens

3. HAZARDS IDENTIFICATION

Emergency Overview

- Use all necessary personal protection when handling this material.

Eye Contact	• Contact with eyes may cause irritation • Wear safety glasses with side shields, • In the event of exposure, flush eyes with water for at least 15 minutes. • Remove contacts and continue to flush eyes, including under the eye lids.
Skin Contact	• Exposure can cause skin irritation. • Wash exposed areas with soap and water for at least 15 minutes. • Remove contaminated clothing, laundry before re-using.
Inhalation	• Dust from this product may cause respiratory irritation • Use with adequate ventilation.
Ingestion	• No effects expected from normal use of this product. Ingestion may cause digestive system upset.
General Advice	• Users with skin conditions (eczema, psoriasis, etc) respiratory conditions (asthma, bronchitis, emphysema, etc) or with chemical sensitivities should take protective precautions
Principle Routes of Exposure	Eyes, absorption, ingestion

4. FIRST AID MEASURES

General Advice	• If exposure symptoms persist, seek medical attention.
Skin Contact	• Wash exposed area with soap and plenty of water. • If skin irritation develops, seek medical attention.
Eye Contact	• Immediately flush with plenty of water after initial flushing, remove any contact lenses and continue flushing for at least 15 minutes • Keep eyes wide open while rinsing

	• If eye irritation persists, seek medical attention
Inhalation	• Move to fresh air in case of accidental inhalation • If a person feels unwell or symptoms of respiratory irritation persist, consult a physician
Ingestion	• Do not swallow. Rinse mouth with water and afterwards drink plenty of water. • For ingestion of large amounts induce vomiting if person is conscious. If conditions persist, seek medical attention.
Notes to Physician	• Treat symptomatically
Protection of First-Aiders	• Use necessary personal protective equipment
Aggravated Medical Conditions	• Users with skin conditions, respiratory conditions, or with chemical sensitivities should take protective precautions.

5. FIRE-FIGHTING MEASURES

Flash Point	NA
Suitable Extinguishing Media	• Not applicable to this product
Extinguishing media which must not be used for safety reasons	• Not applicable to this product

Specific Hazards

Special exposure hazards rising from the substance or preparation itself, its combustion products, or released gases	• Material is not combustible. It may emit toxic fumes when heated, such as hydrogen cyanide, and hydrochloric acid.
Special protective equipment for firefighters	• As in any fire, wear self contained breathing apparatus and full protective gear

NFPA (National Fire Protection Association)	Health=3	Reactivity=2	Fire=0	Special=0 (none)
HMIS (Hazardous Material Information System)	Health=3	Reactivity=2	Fire=0	Special=0 (none)

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	• Use necessary personal protective equipment
Environmental precautions	• No information available
Methods for cleaning up	• Sweep up and collect in suitable container for disposal • Avoid formation of dust

7. HANDLING AND STORAGE

Handling

Technical Measures / Precautions	• Use only in areas provided with adequate ventilation
Safe Handling Advice	• Wear personal protective equipment • Avoid contact with skin and eyes. Take necessary personal protective precautions before using this product.

Storage

Technical Measures / Precautions	• Store in a tightly closed container. Store in a cool, dry, well ventilated area away from incompatible substances. • Store in properly labeled container
Incompatible Products	• Avoid strong acids, oxidizing agents

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures	• Ensure adequate ventilation, especially in confined areas • Ensure eyewash station is readily available

Personal protective equipment

Hand Protection	• Wear appropriate protective gloves
Eye protection	• Avoid contact with eyes • Wear safety glasses with side-shields or full face shield.
Respiratory Protection	• Ensure adequate ventilation is available before handling any chemical
Skin and Body Protection	• Lightweight protective clothing • Boots • Apron
Hygiene measures	• Handle in accordance with good industrial hygiene and safety practice • Keep away from food, drink and animal feeding material
Environmental exposure controls	• No information available

9. PHYSICAL AND CHEMICAL PROPERTIES

General Information

Form	Powder
Appearance	White
Odor	unknown

Important Health Safety and Environmental Information

pH	No information
Boiling Point / Range	No information
Flash Point	None
Water Solubility	Infinitely soluble
Specific Gravity	No information

10. STABILITY AND REACTIVITY

Stability	• Stable under normal conditions
Materials to Avoid	• Acids, oxidizing agents
Hazardous Decomposition Products	• When heated, possibly nitrogen oxides and hydrogen cyanide
Polymerization	• Polymerization does not occur

11. TOXICOLOGICAL INFORMATION

Local Effects

Skin Irritation	• May cause skin irritation
Eye Irritation	• Dust may cause eye irritation
Inhalation	• Inhalation of dust may cause irritation of respiratory tissue
Ingestion	• Ingestion of large amounts may cause digestive system upset

Specific Effects

Carcinogenic Effects	• No information available
Mutagenic Effects	• No information available
Reproductive Toxicity	• No information available
Target Organ Effects	• No information available

12. ECOLOGICAL INFORMATION

Component information

CAS	Chemical Name	% Weight	ACGIH*
7447-40-7	Potassium chloride	72-78	N/A
14459-95-1	Potassium ferrocyanide	10-15	N/A
13746-66-2	Potassium ferrocyanide	10-15	N/A

* ACGIH - Occupational Exposure Limits - TWA's
* OSHA - PELs

Product Information

Aquatic Toxicity	No information available.

Other Information

Ozone Depletion Potential; ODP; (R-11=1)	No information available.
Global Warming Potential (GWP)	No information available.
Additional Ecological Information	No information available
Mobility	No information available.
Bioaccumulative Potential	No information available.
Ecotoxicity Effects	No information available
Aquatic Toxicity	No information available.

13. DISPOSAL CONSIDERATIONS

Waste From Residues / Unused Products	Dispose of in accordance with local and state regulations
Contaminated Packaging	Empty containers should be rinsed and disposed of as appropriate for glass and plastic containers.

14. TRANSPORT INFORMATION

DOT Not regulated
UN-No
Proper shipping name
Packing group
Subsidiary Risk
Description

15. REGULATORY INFORMATION

U.S. Inventories

CAS	Chemical Name	% Weight	ACGIH*
7447-40-7	Potassium chloride	72-78	N/A
14459-95-1	Potassium ferrocyanide	10-15	N/A
13746-66-2	Potassium ferrocyanide	10-15	N/A

* ACGIH - Occupational Exposure Limits - TWA's

International Inventories

CAS	Chemical Name	% Weight	EUOED*
7447-40-7	Potassium chloride	72-78	N/A
14459-95-1	Potassium ferrocyanide	10-15	N/A
13746-66-2	Potassium ferrocyanide	10-15	N/A

* EUOED - EU Occupational Exposure Directive (98/24/EC) Indicative Occupational Exposure Limit Values (IOELV)

16. OTHER INFORMATION

Literary Reference None.
Prepared By YSI, Inc.
End of Safety Data Sheet.

1. IDENTIFICATION

Product Name	MidGrade Coal Tar Oil
Synonyms	Brown Coal Tar, Tar Oil
Intended Use	Fuel Blending
Supplier	J.P. Morgan Ventures Energy Corporation 383 Madison Avenue, 10th Floor New York, NY 10017
Chemical Family	An oil distilled from brown-coal tar. Composed primarily of aliphatic, naphthenic and one-to three-ring aromatic hydrocarbons, their alkyl derivates, heteroaromatics and one-and two-ring phenols boiling in the range of approximately 150 °C to 360 °C
24 Hour Emergency Numbers	**Chemtrec:** 800-424-9300 **JPMorgan Technical Information:** 212-834-5788 **California Poison Control:** 800-356-3219

2. HAZARD(S) IDENTIFICATION

Classification

H227	Combustible liquid – Category 3
H304	May be fatal if swallowed and enters airways – Category 1
H318	Causes serious eye damage – Category 1
H335	May cause respiratory irritation – Category 3
H336	May cause drowsiness or dizziness – Category 3
H351	Suspected of causing cancer – Category 2
H373	May cause damage to organs through prolonged or repeated exposure Category 2
H411	Toxic to aquatic life with long lasting effects – Category6 2

Label Elements

Precautionary Statements

P201	Obtain special instructions before use
P202	Do not handle until all safety precautions have been read and understood
P210	Keep away from heat/sparks/open flames/hot surfaces – no smoking
P233	Keep container tightly closed
P240	Ground/bond container and receiving equipment
P241	Use explosion-proof electrical/ventilating/lighting equipment
P242	Use only non-sparking tools
P243	Take precautionary measures against static discharge
P261	Avoid breathing dust/fume/gas/mist/vapours/spray
P264	Wash thoroughly after handling
P271	Use only outdoors or in a well-ventilated area
P280	Wear protective gloves / protective clothing / eye protection / face protection
P361, P353	IF ON SKIN OR HAIR: Remove/take off immediately all contaminated clothing. Rinse skin with water/shower
P305,P351,P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P313	If eye irritation persists, get medical advice/attention
P301,P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331	Do NOT induce vomiting
P304,P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

2. HAZARD(S) IDENTIFICATION

P312	Call a POISON CENTER or doctor/physician if you feel unwell
P370,P378	In case of fire: Use dry chemical, carbon dioxide, or foam for extinction
P405	Store locked up
P403	Store in a well-ventilated place
P501	Dispose of contents/container to approved facility

3. COMPOSITION / INFORMATION ON INGREDIENTS		
Components.	**CASRN**	**Concentration (%)**
Brown Coal Tar	101316-83-0	100
C-9 to C-28 Alkanes/Alkenes		5 – 10
Coal Tar Pitch Volatiles	65996-93-2	< 10
Water		< 10
Acetone	67-64-1	< 1
Benzene	71-43-2	< 1
Biphenyl	92-52-4	< 5
2-Butanone	78-93-3	< 1
Cresols, all isomers	1319-77-3	< 5
Ethyl Benzene	100-41-4	< 1
Fluorene	86-73-7	< 5
Indene	95-13-6	< 1
Methyl Pyridines		< 1
Naphthalene	91-20-3	< 5
Phenol	108-95-2	< 5
Polynuclear Aromatic Hydrocarbons (PAH) Mixture		< 25
Pyridine	110-86-1	< 1
Toluene	108-88-3	< 5
Xylene, all isomers	1330-20-7	< 5

4. FIRST AID MEASURES	
Inhalation	Move the exposed person to fresh air at once. If not breathing, clear airways and give artificial respiration. If breathing is difficult, humidified oxygen should be administered by qualified personnel. Keep exposed person warm and at rest. If patient is conscious, the irritation of the throat may be relieved by water in the mouthy. Seek medical attention if breathing difficulties continue.
Eye	Flush eyes with water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye. Remove contact lenses, if worn, after initial flushing. Do not use eye ointment. Seek medical attention.
Skin	Speedy action is of the utmost importance. Immediately remove contaminated shoes and clothing, flush affected areas with large amounts of water, wash affected area thoroughly for at least 15 minutes with mild soap and water, and seek medical assistance.. If skin surface is damaged, apply a clean dressing and seek medical attention. Seek medical attention if tissue appears damaged or if pain or irritation persists. Launder or discard contaminated clothing.
Ingestion	Aspiration hazard. Do not induce vomiting or give anything by mouth because the material can enter the lungs and cause severe lung damage. Wash mouth out with water. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended and observe closely for adequacy of breathing. If the patient is conscious and alert, provide water to drink. Seek medical attention.

4. FIRST AID MEASURES	
Most Important Symptom and Effects	Eye and respiratory irritant, skin burns. Overexposure may result in serious health effects. Treatment must be given promptly. See section 11 for a more complete discussion of potential signs and symptoms.
Notes to Physician	This material may be rapidly absorbed through the skin. Skin exposure may cause redness, blisters and/or minor to severe chemical burns. Symptoms of exposure may include nausea, headache, dizziness, respiratory failure, muscular weakness, vomiting, severe depression, collapse and death. Although the effects are primarily on the central nervous system, excess accumulation of fluid in the lungs and injury of the kidneys, liver, pancreas and spleen may occur.

5. FIRE FIGHTING MEASURES	
Flammability Classification	OSHA Classification (29 CFR 1910.1200): Combustible Liquid NFPA Class-II or IIIA Moderately Combustible Liquid NFPA Ratings: Health: 2, Flammability: 2, Reactivity: 0
Flash Point	49-93^{o}C, 120-200^{o}F (Pensky Martens Closed Cup (ASTM D-93))
Flammable Limits	Not Determined
Autoignition Temperature	Not Determined
Combustion Products	Highly dependent on combustion conditions. Fume, smoke, carbon monoxide, carbon dioxide, sulfur and nitrogen oxides, aldehydes and unburned hydrocarbons.
Fire and Explosion Hazards	This material is combustible and can be ignited by heat, sparks, flames or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment and electronic devices such as cell phones, computers, calculators and pagers which have not been certified as intrinsically safe). Vapors are heavier than air and can accumulate in low areas. May create vapor/air explosion hazard indoors, in confined spaces, outdoors or in sewers. Vapors may travel considerable distances to a remote source of ignition where they can ignite, flash back or explode. Product can accumulate a static charge that may cause a fire or explosion. A product container, if not properly cooled, can rupture in the heat of a fire. If stored under heat for extended periods for significantly agitated, this material might evolve or release hydrogen sulfide, a flammable and toxic gas, which can raise and widen this material's actually flammability limits and significantly lower its autoignition temperature.
Extinguishing Media	Dry chemical, carbon dioxide or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.
Fire Fighting	Long duration fires involving product stored in tanks may result in a boilover. The contents of the tank may be expelled beyond the containment dikes or ditches. All personnel should be kept back a safe distance when a boilover is anticipated. Use water spray to cool fire-exposed containers and to protect personnel. Isolate immediate hazard area and keep unauthorized personnel out. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water. Avoid spreading burning liquid with water used for cooling. For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by regulations, a self-contained breathing apparatus should be worn. Wear other appropriate protective equipment as conditions warrant.

6. ACCIDENTAL RELEASE MEASURES	
Protective Measures	Combustible. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. Isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment as conditions warrant per Exposure Controls/Personal Protection guidelines.
Spill Management	Stop the leak if it can be done without risk. Prevent spilled material from entering waterways, sewers, basements or confined areas. Contain release to prevent further contamination of soils, surface water or groundwater. Clean up spill as soon as possible using appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Dispose of contaminated materials in a manner consistent with applicable regulations.
Reporting	Report spills/releases as required, to appropriate local, state and federal authorities. US Coast Guard and Environmental Protection Agency regulations require immediate reporting of spills/release that could reach any waterway including intermittent dry creeks. Report spill/release to the National Response Center at (800) 424-8802. In case of accident or road spill, notify Chemtrec at (800) 424-9300.

7. HANDLING AND STORAGE	
Handling	Use non-sparking tools and explosion-proof equipment. Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. Explosion-proof electrical equipment is recommended and may be required by fire codes. Warning! Use of this material in spaces without adequate ventilation may result in the generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.
Storage	Use and store this material in dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces and all sources of ignition. Post area warnings: 'No Smoking or Open Flame'. Keep away from incompatible material. Outdoor or detached storage of portable containers is preferred. Indoor storage should meet OSHA standards and appropriate fire codes. In a tank, barge or other closed container, the vapor space above materials containing hydrogen sulfide may result in concentrations immediately dangerous to life or health.
Special Precautions	Personal exposures are to be limited by use of a full-face, NIOSH-certified organic vapor mask with particulate prefilter and an APF 25, along with other personal protective equipment outlined in Section 8. To prevent and minimize fire or explosion risk from static accumulation and discharge, effectively bond and/or ground product transfer system. Do not use electronic devices (such as cellular phones, computers, calculators, pagers, etc.) in or around any fueling operation or storage area unless the devices are certified as intrinsically safe. Electrical equipment and fittings should comply with local fire codes.
Portable Containers	Portable containers should never be filled while they are in or on a motor vehicle or marine craft. Static electricity may ignite vapors when filling non-grounded containers or vehicles on trailers. To avoid static buildup, do not use a nozzle lock open device. Use only approved containers. Keep containers tightly closed. Place the container on the ground before filling. Keep the nozzle in contact with the container during filling.
Empty Container Warning	Empty containers retain liquid and vapor residues and can be dangerous. Do NOT pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat, flame,

7. HANDLING AND STORAGE	
	sparks, static electricity or other sources of ignition; they may explode and cause injury or death. Do not attempt to refill or clean containers since residue is difficult to remove. Empty drums should be completely drained, properly closed and returned to the supplier or a qualified drum reconditioner. All containers should be disposed of in an environmentally safe manner in accordance with government regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION			
Component	**ACGIH Exposure Limits**	**OSHA Exposure Limits**	**NIOSH Exposure Limits**
Brown Coal Tar 101316-83-0	5 mg/m^3 TWA 10 mg/m^3 STEL	5 mg/m^3 TWA	2500 mg/m^3 IDLH
Coal Tar Pitch Volatiles 65996-93-2	0.2 mg/m^3 TWA	0.2 mg/m^3 TWA	80 mg/m^3 IDLH
	Limits Above Are Applicable to Coal Tar Pitch Volatiles as Benzene Solubles		
Acetone	500 ppm TWA 750 ppm STEL	1000 ppm TWA	250 ppm TWA 2500 ppm IDLH
Benzene 71-43-2	0.5 ppm TWA 2.5 ppm STEL Skin	1 ppm TWA 5 ppm STEL Skin	0.5 ppm TWA 1 ppm STEL Skin 500 ppm IDLH
Biphenyl 92-52-4	0.2 ppm TWA 1 ppm STEL Skin	0.2 ppm TWA	100 mg/m^3 IDLH
2-Butanone 78-93-3	200 ppm TWA 300 ppm STEL	200 ppm TWA	200 ppm TWA 300 ppm STEL 3000 ppm IDLH
Cresols, all isomers 1319-77-3	5 ppm TWA Skin	5 ppm TWA Skin	2.3 ppm TWA 250 ppm IDLH
Ethyl Benzene 100-41-4	100 ppm TWA 125 ppm STEL	100 ppm TWA 125 ppm STEL	100 ppm TWA 125 ppm STEL 800 ppm IDLH
Indene 95-13-6	5 ppm TWA		10 ppm TWA
Naphthalene 91-20-3	10 ppm TWA 15 ppm STEL Skin	10 ppm TWA	10 ppm TWA 15 ppm STEL Skin 250 ppm IDLH
Phenol 108-95-2	5 ppm TWA Skin	5 ppm TWA Skin	5 ppm STEL Skin
Polynuclear Aromatic Hydrocarbons (PAH) Mixture	0.2 mg/m^3 TWA	0.2 mg/m^3 TWA	80 mg/m^3 IDLH
	*Limits Above Are Applicable to Coal Tar Pitch Volatiles as Benzene Solubles		
Pyridine 110-86-1	1 ppm TWA	5 ppm TWA	5 ppm TWA 1000 ppm IDLH
Toluene 108-88-3	50 ppm TWA Skin	200 ppm TWA 300 ppm Ceiling 500 ppm Peak-10 min	100 ppm TWA 150 ppm STEL 500 ppm IDLH
Xylene, all isomers 1330-20-7	100 ppm TWA 150 ppm STEL	100 ppm TWA 150 ppm STEL	900 ppm IDLH

General Considerations	Consider the potential hazards of this material, applicable exposure limits, job activities and other substances in the work place when designing engineering controls and selecting personal protective equipment.

Engineering Controls		Use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below the recommended exposure limits. An emergency eye wash station and safety shower should be located near the work station.
Personal Protective Equipment		If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, personal protective equipment (PPE) is recommended. A hazard assessment of the work should be conducted by a qualified professional to determine what PPE is required.
	Respiratory Protection	When airborne concentrations are expected to exceed the established exposure limits given in Section 8, use a NIOSH certified tight full-face chemical cartridge respirator (APF 50) with an organic vapor cartridge and dust prefilter. Use a full-face positive-pressure supplied air respirator in circumstances where air-purifying respirators may not provide adequate protection or where they may be the potential for airborne exposure above the exposure limits. If exposure concentration is unknown or IDLH conditions exist, use a NIOSH approved self contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode. If internal combustion devices are used in an enclosed space, carbon monoxide will be present in the exhaust. If the airborne concentrations are above the occupational exposure limit for carbon monoxide, use a positive pressure air-supplying respirator.
	Eye Protection	Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing or spraying of this material.
	Skin and Body Protection	Avoid skin contact. Use impervious materials to prevent all exposures to the skin (Butyl rubber (IIR), Neoprene, Teflon). Wear long-sleeved fire-retardant garments while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, arm covers, impervious gloves, boots and additional facial protection.
	Hand Protection	Avoid skin contact. Use impervious gloves (e.g., PVC, viton, neoprene, nitrile rubber). Select the glove based on glove manufacturer's advice. Wash hands with plenty of mild soap and water before eating, drinking, smoking, using toilet facilities or leaving work.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Dark brown liquid	**Physical Form**	Liquid
Odor	Aromatic, must	**Odor Threshold**	Not established
pH	Neutral	**Vapor Pressure**	<1 psi RVP
Vapor Density	>1 (air = 1)	**Boiling Point/Range**	>350°F/>177°C
Percent Volatile	Negligible	**Partition Coefficient**	> 3.5
Specific Gravity	1.01-1.05 @ 60°F	**Density**	7.3 – 7.9 lb/gal @ 60°F
Molecular Weight	Not determined	**Evaporation Rate**	Not established
Flash Point	120-200°F/49-93°C	**Test Method**	Pensky Martens (ASTM D-93)
Explosive Limits	Not determined	**Autoignition Temperature**	Not determined
Solubility in Water	Negligible in water		

10. STABILITY AND REACTIVITY

Stability	Stable under normal anticipated storage and handling temperatures and pressures. Combustible liquid.
Conditions to Avoid	Avoid all possible sources of ignition.
Incompatibility (Materials to Avoid)	Avoid contact with strong oxidizing agents such as strong acids, alkalies, chlorine and other halogens, dichromates or permanganates, which can cause fire or explosion.

10. STABILITY AND REACTIVITY	
Hazardous Decomposition Products	The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., oxides of carbon, sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels.
Hazardous Polymerization	Will not occur

11. TOXICOLOGICAL INFORMATION		
Information on Toxicological Effects of Substance/Mixture		
Likely Routes of Entry		Inhalation, ingestion, skin or eye absorption
Symptoms of Exposure		Breathless, irritable, euphoric or giddy, headache, dizziness, nausea, intoxication, irritations of eyes, nose and respiratory tract. Severe exposures may lead to convulsions and loss of consciousness. Skin can become red, dry, scaly and fissured. Persons can become sensitized from skin contact, may cause photosensitization and dermatitis. Eye tissue may be damaged. Generally, the more serious the exposure the more severe the symptoms.
Potential Acute Health Effects		
	Inhalation	Breathing high concentrations may be harmful. Mist or vapor is destructive to tissue of the mucous membranes and upper respiratory tract. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness or unconsciousness. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, burning sensation, coughing, wheezing, laryngitis, shortness of breath, blurred vision and pulmonary edema (fluid accumulation in lungs). Severe exposures can result in nausea, vomiting, muscle weakness or convulsions, respiratory failure and death. Hydrogen sulfide and other hazardous vapors may evolve and collect in the headspace of storage tanks or other enclosed vessels.
	Eye Contact	This product has a strong corrosive effect on the eyes and can cause eye irritation from short-term contact with liquid, mists or vapors. Symptoms include stinging, watering, redness and inflammation. Effects may be more serious with repeated or prolonged contact. Direct contact with the eye may result in mild damage, conjunctivitis and keratitis, to severe damage, ranging from scarring of the cornea to total blindness.
	Skin Contact	This product is a skin irritant and may cause allergic skin reaction. Contact may cause redness, itching, burning, skin damage and chemical burns. This material contains polynuclear aromatic hydrocarbons (coal tar pitch volatiles) that have been known to produce a phototoxic reaction when contaminated skin is exposed to sunlight. The effect is similar in appearance to an exaggerated sunburn, and is temporary in duration if exposure is discontinued. Continued exposure to sunlight can result in more serious skin problems including pigmentation (discoloration), skin eruptions (pimples) and possible skin cancers. Contact with heated material may cause thermal burns.
	Ingestion	Ingestion may result in irritation to digestive tract. Symptoms may include headache, excitement, fatigue, nausea, vomiting, diarrhea, central nervous system depression, rapid heartbeat, cardiac arrhythmia, stupor and coma ultimately culminating in death. Contact with heated material may cause thermal burns.

11. TOXICOLOGICAL INFORMATION		
Potential Chronic Health Effects		
	Signs and Symptoms	Chronic effects of overexposure are similar to acute effects including central nervous system (CNS) effects and CNS depression. Effects of overexposure may also include irritation of the digestive tract, irritation of the respiratory tract, nausea, skin dermatitis and pigmentary disorder. Serious and sometimes fatal systemic injury can result from chronic exposure. Components may be photosensitizing.
	Carcinogenic Potential	Components of this product have been shown to be mutagenic and induce skin tumors. This material may contain benzene, ethyl benzene, naphthalene and polynuclear aromatic hydrocarbons (PAH) at concentrations above 0.1%. Benzene and PAH are considered to be known human carcinogens by OSHA, IARC and NTP. IARC has identified several individual PAH as probably carcinogenic to humans (Group 2A) and ethyl benzene, naphthalene and several individual PAH as possibly carcinogenic to humans (Group 2B) based on laboratory animal studies.
	Target Organs	May cause damage to blood, lungs, mucous membranes, eyes, the reproductive system, kidneys, liver, spleen, peripheral nervous system, cardiovascular system, respiratory system, skin, bone marrow, immune system and central nervous system.
	Conditions Aggravated by Overexposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include the skin, respiratory system, liver, kidneys, CNS, immune system, cardiovascular system and blood-forming system. Those attempting to conceive should avoid exposure. Many components of this product are both toxic and carcinogenic and may cause fetal defects.
Toxicological Information		
	Acute Toxicity	No test data available for this complex mixture
	Carcinogenicity	Extracted from *Report on Carcinogens, Twelfth Edition* (2011) for coal tar and coal tar pitches (CAS 8007-45-2): **Carcinogenicity:** Coal tars and coal-tar pitches are known to be human carcinogens based on sufficient evidence of carcinogenicity from studies in humans. ***Cancer Studies in Humans -*** Numerous studies, mostly case reports, have found that occupational exposure to coal tars or coal-tar pitches (coal-tar distillates) is associated with skin cancer, including scrotal cancer; workers in these studies have included patent-fuel (coal-briquette) workers, pitch loaders, workers in electrical trades, and optical-lens polishers (IARC 1985, 1987). A 1946 study in the United Kingdom found that patent-fuel workers were 500 times as likely as other workers to die of scrotal cancer. In addition, there have been many case reports of skin cancer among patients using therapeutic coal-tar preparations. Occupational exposure to coal tars or coal-tar pitches has also been associated with cancer at other tissue sites, including the lung, bladder, kidney, and digestive tract. Excesses of lung cancer were found in several epidemiological studies of workers exposed to coal-tar fumes in coal gasification and coke production, in studies of workers exposed to pitch fumes in aluminum production and calcium carbide production, and in a study of millwrights and welders exposed to coal-tar pitches and coal tars. The millwrights and welders also showed increased risks of digestive-tract cancer and leukemia. The risk of bladder cancer was increased in tar distillers and patent-fuel workers exposed to coal tars and coal-tar pitches and in aluminum production workers exposed to coal-tar pitches. The risk of kidney (renal-pelvis) cancer was increased in workers exposed to “petroleum or tar or pitch.” Studies of roofers, who are exposed to coal-tar pitches, have found increased risks of cancer at other tissue sites in addition to skin, bladder, and lung cancer and leukemia, including cancer

11. TOXICOLOGICAL INFORMATION

		of the oral cavity, larynx, esophagus, and stomach; however, roofers are also exposed to other potentially carcinogenic agents, such as asphalt. ***Cancer Studies in Experimental Animals*** **-** Dermal exposure to coal tars (including pharmaceutical and high-temperature coal tars) or coal-tar extracts caused skin tumors in mice and rabbits and lung cancer (but not skin tumors) in rats. Inhalation exposure to coal tar from coke ovens caused skin tumors in mice and lung tumors in mice and rats. An extract of a coal-tar fume condensate administered by intramuscular injection caused tumors at the injection site (sarcoma) in mice. Dermal exposure to coal-tar pitches or coal-tar pitch extracts caused benign and malignant skin tumors in mice (IARC 1985, 1987). ***Studies on Mechanisms of Carcinogenesis*** **-** Both coal tars and coal-tar pitches contain a number of known and potential carcinogens, including benzene, naphthalene, and other polycyclic aromatic hydrocarbons (PAHs). Coal-tar pitch extracts showed both tumor-initiating and tumor-promoting activity in mouse skin (IARC 1985, 1987)
	Mutagenicity	Components in this mixture have shown positive mutagenic effects in toxicological testing.

Information on Toxicological Effects of Components

Benzene 71-43-2

Acute Data:
Dermal LD50 > 9400 mg/kg (Rabbit), (Guinea Pig)
LC50 = 9980 ppm (Mouse); 10,000 ppm/7hr (Rat)
Oral LD50 = 4700 mg/kg (Mouse); 930 mg/kg (Rat); 5700 mg/kg (Mammal)
Carcinogenicity: Benzene is an animal carcinogen and is known to produce acute myelogenous leukemia (a form of cancer) in humans. Benzene has been identified as a human carcinogen by NTP, IARC and OSHA.
Target Organs: Prolonged or repeated exposures to benzene vapors has been linked to bone marrow toxicity which can result in blood disorders such as leukopenia, thrombocytopenia, and aplastic anemia. All of these diseases can be fatal.
Developmental: Exposure to benzene during pregnancy demonstrated limited evidence of developmental toxicity in laboratory animals. The effects seen include decreased body eight and increased skeletal variations in rodents. Alterations in hematopoeisis have been observed in the fetuses and offspring of pregnant mice.
Mutagenicity: Benzene exposure has resulted in chromosomal aberrations in human lymphocytes and animal bone marrow cells, and DNA damage in mammalian cells in vitro

Biphenyl 92-52-4

Acute Toxicity:
Oral LD50 = 2400 mg/kg (Rat)
TCLo = 4.4 mg/m^3 Inhalation Human Irritant Effects

Cresols, all isomers 1319-77-3

Acute Toxicity:
Dermal LD50 = 2000 mg/kg (Rabbit)
Oral LD50 = 760 mg/kg (Mouse)

Ethyl Benzene 100-41-4

Acute Toxicity:
Dermal LD50 = 17800 mg/kg (Rabbit)
LC50 = 4000 ppm/4 hr; 13367 ppm (Rat)
Oral LD50 = 3500 mg/kg (Rat)
Carcinogenicity: Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. Ethyl benzene has not been listed as a carcinogen by NTP or OSHA.
Target Organs: In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year

11. TOXICOLOGICAL INFORMATION
inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), thyroid (hyperplasia) and pituitary (hyperplasia).
Naphthalene 91-20-3
Acute Toxicity: Dermal LD50 = >2.5 g/kg (rat) LC50 = >340 mg/m^3/1H (rat) Oral LD50 = 490 mg/kg; 2.6 g/kg (rat) **Carcinogenicity:** Naphthalene has been evaluated in two year inhalation studies in both rats and rice. The National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has been identified as a carcinogen by IARC and NTP.
Phenol 108-95-2
Acute Toxicity: LC_{50} = 360 mg/m^3 inhalation (Rat) LDLo – 14 g/kg Oral, Human
Toluene 108-88-3
Acute Toxicity: Dermal LD50 = 14 g/kg (Rabbit) LC50 = 8,000 ppm (4-hr, Rat) Oral LD50 = 2.5 - 7.9 g/kg (Rat) **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Developmental:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. The effects seen include decreased fetal body weight and increased skeletal variations in both inhalation and oral studies.
Xylenes 1330-20-7
Acute Toxicity: Dermal LD50 >3.16 ml/kg (Rabbit) LC50= 5000 ppm/4 hr. (Rat) Oral LD50 = 4300 mg/kg (Rat) **Target Organs:** A six week inhalation study with xylene produced hearing loss in rats. **Developmental:** Both mixed xylenes and the individual isomers produced limited evidence of developmental toxicity in laboratory animals. Inhalation and oral administration of xylene resulted in decreased fetal weight, increased incidences of delayed ossification, skeletal variations and resorptions.

12. ECOLOGICAL INFORMATION	
Ecotoxicity	This material is expected to be toxic to aquatic organisms 96 hour(s) LC50 for phenol:11.6 mg/l (trout)
Persistance and Degradability	Persistent. The highest molecular weight components are persistent in water. The EPA estimates this material will persist in the environment for more than two months.
Bioaccumulation Potential	Bioaccumulative. Based upon spill investigation analysis, oils containing polynuclear aromatic hydrocarbon compounds similar to this material were shown to bioaccumulate in tissues of various aquatic organisms. The EPA estimates a bioaccumulation factor of greater than or equal to 1000.
Mobility in Soil	Mobile. The lower molecular weight are mobile in soil.
Environmental	Coating action can kill birds, plankton, aquatic life, algae and fish. The individual

12. ECOLOGICAL INFORMATION	
Fate	components of this material are differentially soluble in water with aromatic hydrocarbons tending to be more water soluble than aliphatic hydrocarbons. If spilled, the lighter components will generally evaporate but depending on local environmental conditions (temperature, wind, soil type, mixing or wave action in water, etc), photo-oxidation and biodegradation, some may become dispersed in the water column, and a significant portion may be or absorbed to soil or sediment. Because of their differential solubility, the occurrence of components in groundwater will be at different proportions than the parent material. This material is estimated to have a slow rate of biodegradation. Under anaerobic conditions, such as in anoxic sediments, rates of biodegradation are negligible.
Other Adverse Effects	None anticipated

13. DISPOSAL CONSIDERATIONS
This material, if discarded as produced, is not a RCRA "listed" hazardous waste. However, it should be fully characterized for toxicity and possibly ignitability or reactivity prior to disposal (40 CFR 261). Use which results in chemical or physical change or contamination may subject it to regulation as a hazardous waste. Along with properly characterizing all waste materials, consult state and local regulations regarding the proper disposal of this material. Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a qualified drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION	
United States Department of Transportation (US DOT) **Transportation of Dangerous Goods (TDG) Canada**	**Shipping Description:** Coal Tar Distillates, Flammable, UN1136 3, III RQ **Shipping Name:** Coal Tar Distillates, Flammable **Hazard Class and Division:** 3 **ID Number:** UN1136 **Packing Group:** III **Label:** Combustible Liquid **Placard:** Combustible **Reportable Quantity:** 500 lb, Benzopyrene **Emergency Response Guide:** 128 **MARPOL III Status:** DOT Marine Pollutant per 49 CFR 171.8
International Maritime Organization International Maritime Dangerous Goods Code (IMO/IMDG)	**Shipping Description:** UN1136, Coal Tar Distillates, Flammable, 3, III **Shipping Name:** Coal Tar Distillates, Flammable **Hazard Class and Division:** 3 **UN Number:** 1136 **Label:** Flammable Liquid **EMS Guide:** F-E, S-E, S-D **MARPOL III Status:** DOT Marine Pollutant per 49 CFR 71.8

15. REGULATORY INFORMATION		
United States Federal Regulatory Information		
	EPA TSCA Inventory	A Premanufacture Notice (PMN) was submitted to EPA 1/24/12 under the Toxic Substances Control Act (TSCA) Section 5 rules (P-12-0167). On

15. REGULATORY INFORMATION

2/13/12, the EPA website lists the status as 'drop with non-5(e) SNUR' indicating the PMN notice has been dropped from further review for the use(s) as submitted in the notice. A non-5(e) SNUR is one promulgated in the absence of a Consent Order that identifies potential new uses different from those represented in the PMN that could result in increased exposures or releases of the substance and an unreasonable risk to health or the environment. The PMN lists the uses of this product as (1) sold to off-site vendors for blending the existing tar oil with petroleum oil for feed to refineries and (2) sold to off-site vendors for feedstock to a hydrocracker process to make different cut of fuels to blend with other fuels. One of the block flow diagrams shows railcar offloading the product to tar oil storage in floating roof tanks and fuel blending.

The EPA intends to regulate the product with a Significant New Use Rule (SNUR) under the general provisions of 40 CFR 172.170. Recordkeeping requirements at 40 CFR 721.125(a), (b), (c) and (k) will be required. Each manufacturer, importer, and processor of the substance will be required to maintain records for 5 years of:

(a) the manufacture and importation volume of the substance and the corresponding dates of manufacture and import.

(b) the volumes of the substance purchased in the United States by processors of the substance, names and addresses of suppliers, and dates of purchase.

(c) names and addresses (including shipment destination address) of all persons outside the site of manufacture, importation, or processing to whom the manufacturer, importer, or processor directly sells or transfers the substance, the date of each sale or transfer, and the quantity of the substance sold or transferred

(k) establishment and implementation of procedures that ensure compliance with any applicable water discharge limitations under 40 CFR 721.90.

The chemical substance will have certain restrictions on releases and/or exposures under a non-5(e) SNUR. In an April 9, 2012 letter from EPA, the Agency indicated its intent to promulgate a SNUR in which the restrictions stated in 40 CFR 721.90 (a)(1), (b)(1) and (c)(1) apply to this substance. These restrictions define the minimum treatment processes required before there is a discharge to surface water, without this treatment the release would be considered subject to a SNUR. The SNUR will require submission of a Significant New Use Notice (SNUN) to EPA 90 days prior to the predictable or purposeful release containing the PMN substance into surface water, including any potential releases from cleaning equipment and transport containers. Personal exposures are to be limited by use of a full-face, NIOSH-certified organic vapor mask with particulate prefilter and an APF 25.

Export of this product triggers notification requirements under 40 CFR Part 707. Per 40 CFR 707.65, exporters must notify EPA of their export or intended export of each regulated chemical. For substances or mixtures subject to TSCA Section 4, 5(a)(2), 5(b) or 5(e) actions, the exporter must submit a notice to EPA only for the first export to a particular country.

The notice must be postmarked within seven days of forming the intent to export or on the date of export, whichever is earlier. A notice of intent to export must be based on a definite contractual obligation, or an equivalent intra-company agreement, to export the regulated chemical.

The notice must be submitted by letter to EPA and include the following

15. REGULATORY INFORMATION

	information: (1) name and address of the exporter, (2) name of the chemical substance or mixture, (3) date(s) of export or intended export, (4) country or countries of import, and (5) Section of TSCA (4, 5, 6, or 7) under which EPA has taken action..

EPA SARA 302/304 Emergency Planning and Notification

This material contains the following chemicals subject to reporting under the Superfund Amendments and Reauthorization Act of 1986 (SARA):

Section 302 EHS	TPQ (lb)	EPCRA RQ (lb)
Hydrogen Sulfide	500	100
o-Cresol	1000	100
Phenol	500	1000

EPA SARA 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: Yes
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

EPA SARA Toxic Chemical Notification and Release Reporting (40 CFR 372) and CERCLA Reportable Quantities (40 CFR 302.4)

Component	CAS Number	Concentration (%)	RQ (lb)
Benzene	71-43-2	< 1	10
Biphenyl	92-52-4	< 5	100
Cresols, all isomers	1319-77-3	< 5	100
Ethyl Benzene	100-41-4	< 1	1000
Methyl Pyridines	109-06-8	< 1	5000
Naphthalene	91-20-3	< 5	100
Phenol	108-95-2	< 5	1000
Polycyclic Aromatics	mixture	< 25	NA
Pyridine	110-86-1	< 1	1000
Toluene	108-88-3	< 5	1000
Xylene, all isomers	1330-20-7	< 5	100

EPA CWA and OPA

This product is not classified as an oil under Section 311 of the Clean Water Act (CWA) and Oil Pollution Act of 1990 (OPA), and is subject to spill reporting requirements.

Carcinogen Identification by International Agency for Research on Cancer

Group 1	Carcinogenic to Humans	Benzene, Coal Tar Pitch Volatiles (per 29 CFR 1910.1200.1002, OSHA has defined coat tar pitch volatiles to include the fused polycyclic hydrocarbons which volatize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter, Coal Tar Distillation,
Group 2A	Probably Carcinogenic to Humans	Several Individual Polycyclic Aromatic Hydrocarbons
Group 2B	Possibly Carcinogenic to Humans	Ethyl Benzene, Naphthalene, Several Individual Polycyclic Aromatic Hydrocarbons
Group 3	Not Classifiable	

16. OTHER INFORMATION

Prepared By J.P. Morgan Ventures Energy Corporation
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New York, NY 10017

16. OTHER INFORMATION

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Buffer Solution pH 4.00

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/19/2013 Revision date: 08/06/2014 Supersedes: 02/19/2014 Version: 1.2

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : Buffer Solution pH 4.00

Product code : LC12270

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	98.94	Not classified
Potassium Hydrogen Phthalate	(CAS No) 877-24-7	1.02	Eye Irrit. 2B, H320
Formaldehyde, 37% w/w	(CAS No) 50-00-0	0.04	Flam. Liq. 3, H226 Acute Tox. 4 (Oral), H302 Acute Tox. 3 (Inhalation), H331 Skin Corr. 1B, H314 Eye Dam. 1, H318 Skin Sens. 1A, H317 Carc. 1B, H350 Aquatic Acute 2, H401

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Reactivity : None.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses.

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.

Hygiene measures : Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.

Incompatible products : Strong oxidizers.

Incompatible materials : None known.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Formaldehyde, 37% w/w (50-00-0)		
USA ACGIH	ACGIH Ceiling (mg/m³)	0.37 mg/m³
USA ACGIH	ACGIH Ceiling (ppm)	0.3 ppm

Formaldehyde, 37% w/w (50-00-0)		
USA OSHA	OSHA PEL (TWA) (ppm)	0.75 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	2 ppm

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Personal protective equipment : Avoid all unnecessary exposure.

Hand protection : Wear protective gloves.

Eye protection : Chemical goggles or safety glasses.

Respiratory protection : Wear appropriate mask.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Colour : Colourless

Odour : Odourless

Odour threshold : No data available

pH : 4

Relative evaporation rate (butylacetate=1) : No data available

Melting point : No data available

Freezing point : No data available

Boiling point : No data available

Flash point : No data available

Auto-ignition temperature : No data available

Decomposition temperature : No data available

Flammability (solid, gas) : No data available

Vapour pressure : No data available

Relative vapour density at 20 °C : No data available

Relative density : No data available

Density : 1

Solubility : Soluble in water.
Water:

Log Pow : No data available

Log Kow : No data available

Viscosity, kinematic : No data available

Viscosity, dynamic : No data available

Explosive properties : Not applicable.

Oxidising properties : None.

Explosive limits : No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

None.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

None.

10.4. Conditions to avoid

Extremely high or low temperatures.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Formaldehyde. Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Potassium Hydrogen Phthalate (877-24-7)	
LD50 oral rat	≥ 3200 mg/kg
ATE US (oral)	3200 mg/kg bodyweight

Formaldehyde, 37% w/w (50-00-0)	
LD50 oral rat	500 mg/kg
ATE US (oral)	500 mg/kg bodyweight
ATE US (vapours)	0.578 mg/l/4h

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg
ATE US (oral)	90000 mg/kg bodyweight

Skin corrosion/irritation : Not classified
pH: 4

Serious eye damage/irritation : Not classified
pH: 4

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Formaldehyde, 37% w/w (50-00-0)	
IARC group	1 - Carcinogenic to humans

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Formaldehyde, 37% w/w (50-00-0)	
LC50 fishes 1	41 mg/l (96 h; Brachydanio rerio; Pure substance)
EC50 Daphnia 1	14.7 mg/l (24 h; Daphnia magna; Pure substance)
LC50 fish 2	62 - 109 mg/l (96 h; Salmo gairdneri (Oncorhynchus mykiss); Pure substance)
EC50 Daphnia 2	2 mg/l
TLM fish 1	50 - 200,96 h; Poecilia reticulata; Pure substance
TLM fish 2	10 - 100,Pisces; Pure substance
TLM other aquatic organisms 1	10 - 100,96 h
Threshold limit algae 1	2.5 mg/l (192 h; Scenedesmus quadricauda; Pure substance)
Threshold limit algae 2	0.39 mg/l (192 h; Microcystis aeruginosa; Solution <50%)

12.2. Persistence and degradability

Buffer Solution pH 4.00	
Persistence and degradability	Not established.

Potassium Hydrogen Phthalate (877-24-7)	
Persistence and degradability	Not established.

Formaldehyde, 37% w/w (50-00-0)	
Persistence and degradability	Readily biodegradable in water. Biodegradability in soil: no data available. No (test)data on mobility of the components available. Photodegradation in the air.
Biochemical oxygen demand (BOD)	0.64 g O˜/ g substance
Chemical oxygen demand (COD)	1.06 g O˜/ g substance
ThOD	1.068 g O˜/g substance
BOD (% of ThOD)	(5 day(s)) 0.60

Water (7732-18-5)	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Buffer Solution pH 4.00	
Bioaccumulative potential	Not established.

Potassium Hydrogen Phthalate (877-24-7)	
Bioaccumulative potential	Not established.

Formaldehyde, 37% w/w (50-00-0)	
Log Pow	-0.78 - 0.0
Bioaccumulative potential	Bioaccumulation: not applicable.

Water (7732-18-5)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

Formaldehyde, 37% w/w (50-00-0)	
Ecology - soil	Toxic to flora.

12.5. Other adverse effects

Effect on ozone layer : No additional information available

Effect on the global warming : No known ecological damage caused by this product.

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

Not regulated for transport

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Formaldehyde, 37% w/w (50-00-0)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	100 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard
SARA Section 313 - Emission Reporting	0.1 %

15.2. International regulations

CANADA

Buffer Solution pH 4.00	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Potassium Hydrogen Phthalate (877-24-7)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Class D Division 2 Subdivision B - Toxic material causing other toxic effects

Formaldehyde, 37% w/w (50-00-0)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Class B Division 3 - Combustible Liquid Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision A - Very toxic material causing other toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects Class E - Corrosive Material

Water (7732-18-5)	
Listed on the Canadian DSL (Domestic Sustances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

No additional information available

15.3. US State regulations

Formaldehyde, 37% w/w (50-00-0)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
Yes	Yes			

SECTION 16: Other information

Revision date : 08/06/2014

Other information : None.

Full text of H-phrases: see section 16:

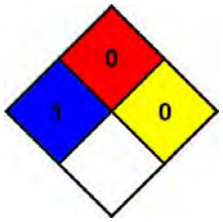
Acute Tox. 3 (Inhalation)	Acute toxicity (inhal.), Category 3
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 2	Hazardous to the aquatic environment — Acute Hazard, Category 2
Carc. 1B	Carcinogenicity, Category 1B
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Eye Irrit. 2B	Serious eye damage/eye irritation, Category 2B
Flam. Liq. 3	Flammable liquids, Category 3
Skin Corr. 1B	Skin corrosion/irritation, Category 1B

Skin Sens. 1A	Sensitisation — Skin, category 1A
H226	Flammable liquid and vapour
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H317	May cause an allergic skin reaction
H318	Causes serious eye damage
H320	Causes eye irritation
H331	Toxic if inhaled
H350	May cause cancer
H401	Toxic to aquatic life

NFPA health hazard : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : A

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

Buffer Solution pH 7.00

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/22/2013 Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : Buffer Solution pH 7.00

Product code : LC12370

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	99.24	Not classified
Potassium Phosphate, Monobasic	(CAS No) 7778-77-0	0.68	Not classified
Sodium Hydroxide	(CAS No) 1310-73-2	0.08	Acute Tox. 4 (Dermal), H312 Skin Corr. 1A, H314 Eye Dam. 1, H318 Aquatic Acute 3, H402

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

No additional information available

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses.

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.

Incompatible products : Strong oxidizers.

Incompatible materials : None known.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Sodium Hydroxide (1310-73-2)		
USA ACGIH	ACGIH Ceiling (mg/m³)	2 mg/m³
USA OSHA	OSHA PEL (TWA) (mg/m³)	2 mg/m³

8.2. Exposure controls

Appropriate engineering controls : Provide adequate general and local exhaust ventilation.

Personal protective equipment	:	Avoid all unnecessary exposure.
Hand protection	:	Wear protective gloves.
Eye protection	:	Chemical goggles or safety glasses.
Respiratory protection	:	None necessary.
Other information	:	Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	Clear, colorless liquid.
Colour	:	Colourless.
Odour	:	None.
Odour threshold	:	No data available
pH	:	7
Relative evaporation rate (butylacetate=1)	:	No data available
Melting point	:	No data available
Freezing point	:	No data available
Boiling point	:	No data available
Flash point	:	No data available
Self ignition temperature	:	No data available
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	No data available
Vapour pressure	:	No data available
Relative vapour density at 20 °C	:	No data available
Relative density	:	No data available
Solubility	:	Soluble in water.
Log Pow	:	No data available
Log Kow	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available
Explosive properties	:	No data available
Oxidising properties	:	No data available
Explosive limits	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Phosphorus oxides. Sodium oxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Potassium Phosphate, Monobasic (7778-77-0)	
LD50 dermal rabbit	4640 mg/kg

Sodium Hydroxide (1310-73-2)	
LD50 dermal rabbit	1350 mg/kg (Rabbit; Literature,Rabbit; Literature)

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg

Skin corrosion/irritation : Not classified
pH: 7

Serious eye damage/irritation : Not classified
pH: 7

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Sodium Hydroxide (1310-73-2)	
LC50 fishes 1	45.4 mg/l (96 h; Salmo gairdneri (Oncorhynchus mykiss); Solution >=50%)
EC50 Daphnia 1	40.4 mg/l (48 h; Ceriodaphnia sp.; Nominal concentration)
LC50 fish 2	189 mg/l (48 h; Leuciscus idus)
TLM fish 1	99 mg/l (48 h; Lepomis macrochirus)
TLM fish 2	125 ppm (96 h; Gambusia affinis)

12.2. Persistence and degradability

Buffer Solution pH 7.00	
Persistence and degradability	Not established.

Potassium Phosphate, Monobasic (7778-77-0)	
Persistence and degradability	Not established.

Sodium Hydroxide (1310-73-2)	
Persistence and degradability	Biodegradability: not applicable. No (test)data on mobility of the substance available.
Biochemical oxygen demand (BOD)	Not applicable
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

Water (7732-18-5)	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Buffer Solution pH 7.00	
Bioaccumulative potential	Not established.

Potassium Phosphate, Monobasic (7778-77-0)	
Bioaccumulative potential	Not established.

Sodium Hydroxide (1310-73-2)	
Bioaccumulative potential	Bioaccumulation: not applicable.

Water (7732-18-5)	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

No dangerous good in sense of transport regulations

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Potassium Phosphate, Monobasic (7778-77-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Sodium Hydroxide (1310-73-2)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	1000 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard

Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

15.2. International regulations

CANADA

Buffer Solution pH 7.00	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Potassium Phosphate, Monobasic (7778-77-0)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Sodium Hydroxide (1310-73-2)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Class E - Corrosive Material

Water (7732-18-5)
Listed on the Canadian DSL (Domestic Sustances List) inventory.

Water (7732-18-5)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Potassium Phosphate, Monobasic (7778-77-0)
Not listed on the Canadian Ingredient Disclosure List

Sodium Hydroxide (1310-73-2)
Listed on the Canadian Ingredient Disclosure List

Water (7732-18-5)
Not listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

No additional information available

SECTION 16: Other information

Other information : None.

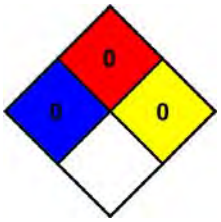
Full text of H-phrases: see section 16:

Acute Tox. 4 (Dermal)	Acute toxicity (dermal), Category 4
Aquatic Acute 3	Hazardous to the aquatic environment — AcuteHazard, Category 3
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Skin Corr. 1A	Skin corrosion/irritation, Category 1A
H312	Harmful in contact with skin
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H402	Harmful to aquatic life

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0 Minimal Hazard - No significant risk to health

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : A

SDS US (GHS HazCom 2012)

Buffer Solution pH 10.00 Blue

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 12/09/2013 Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : Buffer Solution pH 10.00 Blue

Product code : LC12510

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Repr. 1B H360

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :

GHS08

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : H360 - May damage fertility or the unborn child

Precautionary statements (GHS-US) : P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P280 - Wear protective gloves, eye protection
P308+P313 - IF exposed or concerned: Get medical advice/attention
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	99.57	Not classified
Sodium Tetraborate Decahydrate	(CAS No) 1303-96-4	0.38	Repr. 1B, H360

Name	Product identifier	%	GHS-US classification
Sodium Hydroxide	(CAS No) 1310-73-2	0.05	Acute Tox. 4 (Dermal), H312 Skin Corr. 1A, H314 Eye Dam. 1, H318 Aquatic Acute 3, H402

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. IF exposed or concerned: Get medical advice/attention.

First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.

First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.

First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : May damage fertility or the unborn child.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

No additional information available

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses. Gloves.

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use.

Hygiene measures : Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.
Incompatible products : Strong oxidizers. Strong acids.
Incompatible products : incompatible materials. Heat sources.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Sodium Tetraborate Decahydrate (1303-96-4)		
USA ACGIH	ACGIH TWA (mg/m³)	2 mg/m³
USA ACGIH	ACGIH STEL (mg/m³)	6 mg/m³

Sodium Hydroxide (1310-73-2)		
USA ACGIH	ACGIH Ceiling (mg/m³)	2 mg/m³
USA OSHA	OSHA PEL (TWA) (mg/m³)	2 mg/m³

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate general and local exhaust ventilation.
Personal protective equipment : Avoid all unnecessary exposure.
Hand protection : Wear protective gloves.
Eye protection : Chemical goggles or safety glasses.
Respiratory protection : Wear appropriate mask.
Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid
Colour : Blue.
Odour : None.
Odour threshold : No data available
pH : 10
Relative evaporation rate (butylacetate=1) : No data available
Melting point : No data available
Freezing point : No data available
Boiling point : No data available
Flash point : No data available
Self ignition temperature : No data available
Decomposition temperature : No data available
Flammability (solid, gas) : No data available
Vapour pressure : No data available
Relative vapour density at 20 °C : No data available
Relative density : No data available
Solubility : Miscible with water.
Log Pow : No data available
Log Kow : No data available
Viscosity, kinematic : No data available
Viscosity, dynamic : No data available
Explosive properties : No data available
Oxidising properties : No data available
Explosive limits : No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Incompatible materials. Extremely high or low temperatures.

10.5. Incompatible materials

Strong acids. Strong oxidizers.

10.6. Hazardous decomposition products

boron.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Sodium Tetraborate Decahydrate (1303-96-4)	
LD50 oral rat	2660 mg/kg
LD50 dermal rabbit	10000 mg/kg

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg

Sodium Hydroxide (1310-73-2)	
LD50 dermal rabbit	1350 mg/kg (Rabbit; Literature,Rabbit; Literature)

Skin corrosion/irritation : Not classified
pH: 10

Serious eye damage/irritation : Not classified
pH: 10

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : May damage fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Sodium Tetraborate Decahydrate (1303-96-4)	
EC50 Daphnia 1	1085 mg/l

Sodium Hydroxide (1310-73-2)	
LC50 fishes 1	45.4 mg/l (96 h; Salmo gairdneri (Oncorhynchus mykiss); Solution >=50%)
EC50 Daphnia 1	40.4 mg/l (48 h; Ceriodaphnia sp.; Nominal concentration)

Sodium Hydroxide (1310-73-2)	
LC50 fish 2	189 mg/l (48 h; Leuciscus idus)
TLM fish 1	99 mg/l (48 h; Lepomis macrochirus)
TLM fish 2	125 ppm (96 h; Gambusia affinis)

12.2. Persistence and degradability

Buffer Solution pH 10.00 Blue	
Persistence and degradability	Not established.

Sodium Tetraborate Decahydrate (1303-96-4)	
Persistence and degradability	Not established.

Water (7732-18-5)	
Persistence and degradability	Not established.

Sodium Hydroxide (1310-73-2)	
Persistence and degradability	Biodegradability: not applicable. No (test)data on mobility of the substance available.
Biochemical oxygen demand (BOD)	Not applicable
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

12.3. Bioaccumulative potential

Buffer Solution pH 10.00 Blue	
Bioaccumulative potential	Not established.

Sodium Tetraborate Decahydrate (1303-96-4)	
Bioaccumulative potential	Not established.

Water (7732-18-5)	
Bioaccumulative potential	Not established.

Sodium Hydroxide (1310-73-2)	
Bioaccumulative potential	Bioaccumulation: not applicable.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose of contents/container to comply with local, state and federal regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

No dangerous good in sense of transport regulations

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Sodium Tetraborate Decahydrate (1303-96-4)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Sodium Hydroxide (1310-73-2)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	1000 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard

15.2. International regulations

CANADA

Buffer Solution pH 10.00 Blue	
WHMIS Classification	Class D Division 2 Subdivision A - Very toxic material causing other toxic effects

Sodium Tetraborate Decahydrate (1303-96-4)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Class D Division 2 Subdivision A - Very toxic material causing other toxic effects

Water (7732-18-5)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Sodium Hydroxide (1310-73-2)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Class E - Corrosive Material

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Sodium Tetraborate Decahydrate (1303-96-4)
Listed on the Canadian Ingredient Disclosure List

Sodium Hydroxide (1310-73-2)
Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

No additional information available

SECTION 16: Other information

Other information : None.

Full text of H-phrases: see section 16:

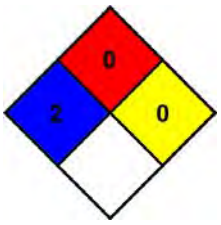
Acute Tox. 4 (Dermal)	Acute toxicity (dermal), Category 4
Aquatic Acute 3	Hazardous to the aquatic environment — AcuteHazard, Category 3

Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Repr. 1B	Reproductive toxicity, Category 1B
Skin Corr. 1A	Skin corrosion/irritation, Category 1A
H312	Harmful in contact with skin
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H360	May damage fertility or the unborn child
H402	Harmful to aquatic life

NFPA health hazard : 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 2 Moderate Hazard - Temporary or minor injury may occur

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : B

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

QUIKRETE®
CEMENT & CONCRETE PRODUCTS™

Cements

MATERIAL SAFETY DATA SHEET
(Complies with OSHA 29 CFR 1910.1200)

SECTION I: PRODUCT IDENTIFICATION

The QUIKRETE® Companies
One Securities Centre
3490 Piedmont Road, Suite 1300
Atlanta, GA 30329

Emergency Telephone Number
(770) 216-9580

Information Telephone Number
(770) 216-9580

MSDS K1
Revision: Jul-12

QUIKRETE® Product Name	Code #
QUIKRETE® PORTLAND CEMENT	1124
PORTLAND/POZZOLAN CEMENT	1118-35
QUIKRETE® PORTLAND T-I AND T-III CEMENT	2126-53
QUIKRETE® PORTLAND T-10 AND T-30 CEMENT	
QUIKRETE® PORTLAND T-III W FLY ASH	1125-22
ALL-STAR PORTLAND CEMENT TYPE-I	1121-94
ZIA PORTLAND CEMENT	2124-97

PRODUCT USE: HYDRAULIC CEMENTS FOR GENERAL CONSTRUCTION AND REPAIR

SECTION II - HAZARD IDENTIFICATION

Route(s) of Entry: Inhalation, Skin, Ingestion
Acute Exposure: Product becomes alkaline when exposed to moisture. Exposure can dry the skin, cause alkali burns and affect the mucous membranes. Dust can irritate the eyes and upper respiratory system. Toxic effects noted in animals include, for acute exposures, alveolar damage with pulmonary edema.
Chronic Exposure: Dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis.
Carcinogenicity: Since Portland cement and blended cements are manufactured from raw materials mined from the earth (limestone, marl, sand, shale, etc.) and process heat is provided by burning fossil fuels, trace, but detectable, amounts of naturally occurring, and possibly harmful, elements may be found during chemical analysis. Under ASTM standards, Portland cement may contain 0.75 % insoluble residue. A fraction of these residues may be free crystalline silica. Respirable crystalline silica (quartz) can cause silicosis, a fibrosis (scarring) of the lungs and possibly cancer. There is evidence that exposure to respirable silica or the disease silicosis is associated with an increased incidence of Scleroderma, tuberculosis and kidney disorders.

Carcinogenicity Listings:

NTP:	Known carcinogen
OSHA:	Not listed as a carcinogen
IARC Monographs:	Group 1 Carcinogen
California Proposition 65:	Known carcinogen

NTP: The National Toxicology Program, in its "Ninth Report on Carcinogens" (released May 15, 2000) concluded that "Respirable crystalline silica (RCS), primarily quartz dusts occurring in industrial and occupational settings, is *known to be a human carcinogen*, based on sufficient evidence of carcinogenicity from studies in humans indicating a causal relationship between exposure to RCS and increased lung cancer rates in workers exposed to crystalline silica dust (reviewed in IAC, 1997; Brown *et al*., 1997; Hind *et al*., 1997)

IARC: The International Agency for Research on Cancer ("IARC") concluded that there was "*sufficient evidence* in humans for the carcinogenicity of crystalline silica in the forms of quartz or cristobalite from occupational sources", and that there is "*sufficient evidence* in experimental animals for the carcinogenicity of quartz or cristobalite." The overall IARC evaluation was that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans (*Group 1)." The IARC evaluation noted that "carcinogenicity was not detected in all industrial circumstances or studies. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." For further information on the IARC evaluation, see IARC Monographs on the Evaluation of carcinogenic Risks to Humans, Volume 68, "Silica, Some Silicates." (1997)

Signs and Symptoms of Exposure: Symptoms of excessive exposure to the dust include shortness of breath and reduced pulmonary function. Excessive exposure to skin and eyes especially when mixed with water can cause caustic burns as severe as third degree.

Medical Conditions Generally Aggravated by Exposure: Individuals with sensitive skin and with pulmonary and/or respiratory disease, including, but not limited to, asthma and bronchitis, or subject to eye irritation, should be precluded from exposure. Exposure to crystalline silica or the disease silicosis is associated with increased incidence of scleroderma, Tuberculosis and possibly increased incidence of kidney lesions.

Chronic Exposure: Dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis. (May contain trace (<0.05 %) amounts of chromium salts or compounds including hexavalent chromium, or other metals found to be hazardous or toxic in some chemical forms. These metals are mostly present as trace substitutions within the principal minerals)

Medical Conditions Generally Aggravated by Exposure: Individuals with sensitive skin and with pulmonary and/or respiratory disease, including, but not limited to, asthma and bronchitis, or subject to eye irritation, should be precluded from exposure.

SECTION III - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components	CAS No.	PEL (OSHA)	TLV (ACGIH)

		mg/M^3	mg/M^3
Portland Cement	65997-15-1	5	5
May contain:			
Silica Sand, crystalline	14808-60-7	$\frac{10}{\%SiO_2+2}$	0.05 (respirable)
Pulverized Limestone	01317-65-3	5	5
Fly Ash	68131-74-8	5	5
Gypsum	10101-41-4	5	5
Lime	01305-62-0	5	5

Although these products contain no intentionally added Silica, they may contain small amounts of silica occurring as natural impurities in the other raw materials.

Other Limits: National Institute for Occupational Safety and Health (NIOSH). Recommended standard maximum permissible concentration=0.05 mg/M^3 (respirable free silica) as determined by a full-shift sample up to 10-hour working day, 40-hour work week. See NIOSH Criteria for a Recommended Standard Occupational Exposure to Crystalline Silica.

SECTION IV – First Aid Measures

Eyes: Immediately flush eye thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.
Skin: Wash skin with cool water and pH-neutral soap or a mild detergent. Seek medical treatment if irritation or inflammation develops or persists. Seek immediate medical treatment in the event of burns.
Inhalation: Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. Seek medical help if coughing and other symptoms do not subside. Inhalations of large amounts of Portland cement require immediate medical attention.
Ingestion: Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.

SECTION V - FIRE AND EXPLOSION HAZARD DATA

Flammability: Noncombustible and not explosive.
Auto-ignition Temperature: Not Applicable
Flash Points: Not Applicable

SECTION VI – ACCIDENTAL RELEASE MEASURES

If spilled, use dustless methods (vacuum) and place into covered container for disposal (if not contaminated or wet). Use adequate ventilation to keep exposure to airborne contaminants below the exposure limit.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND STORAGE

Do not allow water to contact the product until time of use. DO NOT BREATHE DUST. In dusty environments, the use of an OSHA, MSHA or NIOSH approved respirator and tight fitting goggles is recommended.

SECTION VIII – EXPOSURE CONTROL MEASURES

Engineering Controls: Local exhaust can be used, if necessary, to control airborne dust levels.

Personal Protection: The use of barrier creams or impervious gloves, boots and clothing to protect the skin from contact is recommended. Following work, workers should shower with soap and water. Precautions must be observed because burns occur with little warning -- little heat is sensed.

WARN EMPLOYEES AND/OR CUSTOMERS OF THE HAZARDS AND REQUIRED OSHA PRECAUTIONS ASSOCIATED WITH THE USE OF THIS PRODUCT.

Exposure Limits: Consult local authorities for acceptable exposure limits

SECTION IX - PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance: Gray to gray-brown colored powder. Some products available in white and other colors.

Specific Gravity:	2.6 to 3.15	**Melting Point:**	>2700°F
Boiling Point:	>2700°F	**Vapor Pressure:**	Not Applicable
Vapor Density:	Not Applicable	**Evaporation Rate:**	Not Applicable
Solubility in Water:	Slight	**Odor:**	Not Applicable

SECTION X - REACTIVITY DATA

Stability: Stable.
Incompatibility (Materials to Avoid): Material when mixed with water will react with Aluminum and other alkali and alkaline earth elements liberating hydrogen gas.
Hazardous Decomposition or By-products: None
Hazardous Polymerization: Will Not Occur.
Condition to Avoid: Keep dry until used to preserve product utility.

SECTION XI – TOXICOLOGICAL INFORMATION

Routes of Entry: Inhalation, Ingestion
Toxicity to Animals:
LD50: Not Available
LC50: Not Available
Chronic Effects on Humans: Conditions aggravated by exposure include eye disease, skin disorders and Chronic Respiratory conditions.
Special Remarks on Toxicity: Not Available

SECTION XII – ECOLOGICAL INFORMATION

Ecotoxicity: Not Available
BOD5 and COD: Not Available
Products of Biodegradation: Not available
Toxicity of the Products of Biodegradation: Not available
Special Remarks on the Products of Biodegradation: Not available

SECTION XIII – DISPOSAL CONSIDERATIONS

Waste Disposal Method: The packaging and material may be land filled; however, material should be covered to minimize generation of airborne dust. This product is not classified as a hazardous waste under the authority of the RCRA (40CFR 261) or CERCLA (40CFR 117&302).

SECTION XIV – TRANSPORT INFORMATION

DOT/UN Shipping Name: Non-regulated
DOT Hazard Class: Non-regulated
Shipping Name: Non-regulated
Non-Hazardous under U.S. DOT and TDG Regulations

SECTION XV – OTHER REGULATORY INFORMATION

US OSHA 29CFR 1910.1200: Considered hazardous under this regulation and should be included in the employers hazard communication program
SARA (Title III) Sections 311 & 312: Qualifies as a hazardous substance with delayed health effects
SARA (Title III) Section 313: Not subject to reporting requirements
TSCA (May 1997): All components are on the TSCA inventory list
Federal Hazardous Substances Act: Is a hazardous substance subject to statues promulgated under the subject act
California Regulation: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.
Canadian Environmental Protection Act: Not listed
Canadian WHMIS Classification: Considered to be a hazardous material under the Hazardous Products Act as defined by the Controlled Products Regulations (Class D2A, E- Corrosive Material) and subject to the requirements of Health Canada's Workplace Hazardous Material Information (WHMIS). This product has been classified according to the hazard criteria of the Controlled Products Regulation (CPR). This document complies with the WHMIS requirements of the Hazardous Products Act (HPA) and the CPR.

SECTION XVI – OTHER INFORMATION

HMIS-III: Health – 0 = No significant health risk
1 = Irritation or minor reversible injury possible

2 = Temporary or minor injury possible
3 = Major injury possible unless prompt action is taken
4 = Life threatening, major or permanent damage possible

Flammability- 0 = Material will not burn
1 = Material must be preheated before ignition will occur
2 = Material must be exposed to high temperatures before ignition
3 = Material capable of ignition under normal temperatures
4 = Flammable gases or very volatile liquids; may ignite spontaneously

Physical Hazard- 0 = Material is normally stable, even under fire conditions
1 = Material normally stable but may become unstable at high temps
2 = Materials that are unstable and may undergo react at room temp
3 = Materials that may form explosive mixtures with water
4 = Materials that are readily capable of explosive water reaction

Abbreviations:

ACGIH	American Conference of Government Industrial Hygienists
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CFR	Code of Federal Regulations
CPR	Controlled Products Regulations (Canada)
DOT	Department of Transportation
IARC	International Agency for Research
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicity Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
TLV	Threshold Limit Value
TWA	Time-weighted Average
WHMIS	Workplace Hazardous Material Information System

Last Updated: July 25, 2012

NOTE: The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to silica contained in our products. END OF MSDS.

Fisher Scientific

Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 21-Jan-2011 **Revision Date** 16-May-2014 **Revision Number** 1

1. Identification

Product Name **Potassium cyanide**

Cat No. : **AC388310000; AC388310025; AC388311000; AC388315000**

Synonyms Cyanide of potassium; Hydrocyanic acid, potassium salt; KCN.

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Acute oral toxicity	Category 1
Acute dermal toxicity	Category 1
Acute Inhalation Toxicity - Dusts and Mists	Category 1
Specific target organ toxicity (single exposure) Target Organs - Central nervous system (CNS).	Category 1
Specific target organ toxicity - (repeated exposure) Target Organs - Heart, Cardiovascular system.	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals

Fatal if swallowed
Fatal in contact with skin
Fatal if inhaled
May cause drowsiness or dizziness
Causes damage to organs
Causes damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Do not get in eyes, on skin, or on clothing
Wear protective gloves/protective clothing/eye protection/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear respiratory protection
Keep only in original container
Response
IF exposed: Call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Immediately call a POISON CENTER or doctor/physician
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
Immediately call a POISON CENTER or doctor/physician
IF ON SKIN: Gently wash with plenty of soap and water
Remove/Take off immediately all contaminated clothing
Wash contaminated clothing before reuse
Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Rinse mouth
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects
Contact with acids liberates very toxic gas

3. Composition / information on ingredients

Component	CAS-No	Weight %
Potassium cyanide	151-50-8	>95

4. First-aid measures

General Advice Immediately call a POISON CENTER or doctor/physician. Show this safety data sheet to the doctor in attendance. Take off contaminated clothing and shoes immediately.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects Breathing difficulties. Systemic Toxicity: Respiratory disorders: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock: May cause cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood): Exposure may result in death

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Dry powder.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature Not applicable
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Non-combustible. Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous Combustion Products
Nitrogen oxides (NOx) Hydrogen cyanide (hydrocyanic acid) Potassium oxides
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
4	0	1	N/A

6. Accidental release measures

Personal Precautions Evacuate personnel to safe areas. Ensure adequate ventilation. Use personal protective equipment. Avoid contact with skin, eyes and clothing. Do not touch or walk through spilled material. If spilled, take caution, as material can cause surfaces to become very slippery.

Environmental Precautions Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained. See Section 12 for additional ecological Information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Provide adequate ventilation. Avoid dust formation. Sweep up or vacuum up spillage and collect in suitable container for disposal. Do not expose spill to water.

7. Handling and storage

Handling Do not breathe dust. Do not get in eyes, on skin, or on clothing. Use only in area provided with appropriate exhaust ventilation. Keep container tightly closed. Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

Storage Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep locked-up. Keep away from acids. Keep away from combustible material. Do not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Potassium cyanide	Ceiling: 5 mg/m³ Skin	(Vacated) TWA: 5 mg/m³	IDLH: 25 mg/m³ Ceiling: 4.7 ppm Ceiling: 5 mg/m³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Potassium cyanide 151-50-8 (>95)	Ceiling: 10 ppm Ceiling: 11 mg/m³ Skin	TWA: 5 mg/m³ Ceiling: 5 mg/m³	CEV: 5 mg/m³ Skin

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	White
Odor	bitter almond
Odor Threshold	No information available
pH	11-12 20 g/l aq.sol.(20°C)
Melting Point/Range	634 °C / 1173.2 °F
Boiling Point/Range	1625 °C / 2957 °F

Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Relative Density	1.52 @ 16°C
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	Not applicable
Decomposition temperature	No information available
Viscosity	Not applicable
Molecular Formula	C K N
Molecular Weight	65.12

10. Stability and reactivity

Reactive Hazard Yes

Stability Moisture sensitive.

Conditions to Avoid Burning produces obnoxious and toxic fumes. Excess heat. Exposure to light. Incompatible products. Exposure to moist air or water. Exposure to air.

Incompatible Materials Acids, Strong oxidizing agents, Bases, Powdered metal salts, Aldehydes, Peroxides, Metals

Hazardous Decomposition Products Nitrogen oxides (NOx), Hydrogen cyanide (hydrocyanic acid), Potassium oxides

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions Corrosive to metals.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Potassium cyanide	5 mg/kg (Rat)	14.3 - 33.3 mg/kg (Rat)	0.16 mg/L (Rat) 1 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Potassium cyanide	151-50-8	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Heart Cardiovascular system

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Systemic Toxicity: Respiratory disorders: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock: May cause cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood): Exposure may result in death

Endocrine Disruptor Information No information available

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Potassium cyanide	Group III Chemical	Not applicable	Not applicable

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Potassium cyanide	Not listed	0.45 - 0.57 mg/L LC50 96 h 0.31 - 0.37 mg/L LC50 96 h 0.044 - 0.084 mg/L LC50 96 h 0.04 - 0.046 mg/L LC50 96 h 0.01 - 0.08 mg/L LC50 96 h 0.45 mg/L LC50 96 h 0.0588 mg/L LC50 96 h	Not listed	0.53 mg/L EC50 = 24 h

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Potassium cyanide - 151-50-8	-	not otherwise specified

14. Transport information

DOT

UN-No UN1680
Proper Shipping Name POTASSIUM CYANIDE, SOLID
Hazard Class 6.1
Packing Group I

TDG

UN-No UN1680
Proper Shipping Name POTASSIUM CYANIDE, SOLID
Hazard Class 6.1
Packing Group I

IATA

UN-No	1680
Proper Shipping Name	POTASSIUM CYANIDE, SOLID
Hazard Class	6.1
Packing Group	I

IMDG/IMO

UN-No	1680
Proper Shipping Name	POTASSIUM CYANIDE, SOLID
Hazard Class	6.1
Packing Group	I

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Potassium cyanide	X	X	-	205-792-3	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313 Not applicable

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Potassium cyanide	151-50-8	>95	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	Yes

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Potassium cyanide	X	10 lb	X	X

Clean Air Act Not applicable

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Potassium cyanide	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Potassium cyanide	10 lb	10 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Potassium cyanide	151-50-8	Carcinogen Male Reproductive	-	Carcinogen

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Potassium cyanide	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard	Potassium cyanide
2000 lb STQ		

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class E Corrosive material
D1A Very toxic materials

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 21-Jan-2011
Revision Date 16-May-2014
Print Date 16-May-2014
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **QUIK-GEL®**

Revision Date: 02-Apr-2015 **Revision Number:** 18

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-GEL®
Synonyms: None
Chemical Family: Mineral
Internal ID Code HM003747

1.2 Recommended use and restrictions on use

Application: Viscosifier
Uses Advised Against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier Baroid Fluid Services
Product Service Line of Halliburton
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number

Emergency Telephone Number (281) 575-5000

2. Hazard(s) Identification

2.1 Classification in accordance with paragraph (d) of §1910.1200

Carcinogenicity	Category 1A - (H350)
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - (H372)

2.2. Label Elements

Hazard Pictograms

Signal Word Danger

Hazard Statements H350 - May cause cancer
H372 - Causes damage to organs through prolonged or repeated exposure

Precautionary Statements

Prevention	P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P260 - Do not breathe dust/fume/gas/mist/vapors/spray P264 - Wash face, hands and any exposed skin thoroughly after handling P270 - Do not eat, drink or smoke when using this product P280 - Wear protective gloves/protective clothing/eye protection/face protection
Response	P308 + P313 - IF exposed or concerned: Get medical advice/attention P314 - Get medical attention/advice if you feel unwell
Storage	P405 - Store locked up
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances	**CAS Number**
Crystalline silica, quartz	14808-60-7
Crystalline silica, cristobalite	14464-46-1
Crystalline silica, tridymite	15468-32-3

2.3 Hazards not otherwise classified

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT)
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)

The exact percentage (concentration) of the composition has been withheld as proprietary.

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Eyes	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Skin	Wash with soap and water. Get medical attention if irritation persists.
Ingestion	Rinse mouth with water many times.

4.2 Most important symptoms/effects, acute and delayed

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. Fire-fighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

5.2 Specific hazards arising from the substance or mixture

Special Exposure Hazards

None anticipated

5.3 Special protective equipment and precautions for fire-fighters

Special Protective Equipment for Fire-Fighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

See Section 8 for additional information

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet. Use appropriate protective equipment.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Keep from excessive heat. Do not reuse empty container. Product has a shelf life of 36 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	10 mg/m³ %SiO2 + 2	TWA: 0.025 mg/m³

Crystalline silica, cristobalite	14464-46-1	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$	TWA: 0.025 mg/m^3
Crystalline silica, tridymite	15468-32-3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$	0.05 mg/m^3

8.2 Appropriate engineering controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

8.3 Individual protection measures, such as personal protective equipment

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder

Color: Various

Odor: Mild earthy

Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	8-10
Freezing Point/Range	No information available.
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
upper flammability limit	No data available
lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.6
Water Solubility	Partly soluble
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical Stability

Stable

10.3. Possibility of Hazardous Reactions

Will Not Occur

10.4. Conditions to Avoid

None anticipated

10.5. Incompatible Materials

Hydrofluoric acid.

10.6. Hazardous Decomposition Products

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information

11.1 Information on likely routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Acute Toxicity

Inhalation Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.

Skin Contact May cause mechanical skin irritation.

Ingestion None known

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	500 mg/kg (Rat) >15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	500 mg/kg (Rat)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	500 mg/kg (Rat)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Eye damage/irritation
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible.
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	Not regarded as a sensitizer.
Crystalline silica, cristobalite	14464-46-1	Not regarded as a sensitizer.
Crystalline silica, tridymite	15468-32-3	Not regarded as a sensitizer.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.

Crystalline silica, tridymite	15468-32-3	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity Effects

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	No information available	LL50 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L(Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil

12.5 Other adverse effects
No information available

13. Disposal Considerations

13.1. Waste treatment methods
Disposal Method If practical, recover and reclaim, recycle, or reuse by the guidelines of an approved local reuse program. Should contaminated product become a waste, dispose of in a licensed industrial landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. Transport Information

US DOT
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

US DOT Bulk
DOT (Bulk) Not applicable

Canadian TDG
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IMDG/IMO
UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

Environmental Hazards: Not applicable

IATA/ICAO

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable
Special Precautions for User: None

15. Regulatory Information

US Regulations

US TSCA Inventory All components listed on inventory or are exempt.

EPA SARA Title III Extremely Hazardous Substances Not applicable

EPA SARA (311,312) Hazard Class Chronic Health Hazard

EPA SARA (313) Chemicals This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity Not applicable.

EPA RCRA Hazardous Waste Classification If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

California Proposition 65 The California Proposition 65 regulations apply to this product.

MA Right-to-Know Law One or more components listed.

NJ Right-to-Know Law One or more components listed.

PA Right-to-Know Law One or more components listed.

Canadian Regulations

Canadian DSL Inventory All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

Revision Date: 02-Apr-2015

Reason for Revision Update to Format SECTION: 2 3 4 6 7 10 12 16

Additional information
For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key or legend to abbreviations and acronyms
bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
UN – United Nations
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SAFETY DATA SHEET

Issuing Date 13-Sept-2013 **Revision Date** 31-Mar-2015 **Revision Number** 2

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS product identifier

Product Name **SCRUBS® In-A-Bucket**

Other means of identification

Product Code(s) **42201, 42230, 42256, 42272**

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended Use Heavy Duty Hand Cleaner

Uses advised against None reasonably foreseeable

Supplier's details

Supplier Address
ITW Pro Brands
805 E. Old 56 Highway
Olathe, KS 66061
TEL: 1-800-443-9536

Emergency telephone number

Emergency Telephone Number 800-535-5053 Infotrac

2. HAZARDS IDENTIFICATION

Classification

This chemical is not considered hazardous according to the OSHA Hazard Communication Standard 2012 (29 CFR 1910.1200).

GHS Label elements, including precautionary statements

Emergency Overview

Signal Word	**None**

The product contains no substances which at their given concentration are considered to be hazardous to health

Appearance Colorless-blue/white **Physical State** Liquid. **Odor** Citrus

Precautionary Statements

Prevention

• None

General Advice

• None

Storage

• None

Disposal

• None

Hazard Not Otherwise Classified (HNOC)

Not applicable

Other information

Toxic to aquatic life. Harmful to aquatic life with long lasting effects

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %	Trade secret
Alcohols, C12-15, ethoxylated	68131-39-5	1-5	*
Isoparaffinic Hydrocarbon	64742-47-8	1-5	*
Dimethyl adipate	627-93-0	1-5	*
Diethylhexyl sodium sulfosuccinate	577-11-7	1-5	*
D-Limonene	5989-27-5	1-5	*

**The exact percentage (concentration) of composition has been withheld as a trade secret.*

4. FIRST AID MEASURES

Description of necessary first-aid measures

Eye Contact Rinse thoroughly with plenty of water, also under the eyelids. If symptoms persist, call a physician.

Skin Contact None normally required. Material is designed for skin cleansing. Get medical attention if irritation develops and/or persists.

Inhalation Move to fresh air. If symptoms persist, call a physician.

Ingestion Not an expected route of exposure. If large quantities of this material are swallowed, call a physician immediately.

Most important symptoms/effects, acute and delayed

Most Important Symptoms/Effects Not expected to give rise to an acute hazard under normal condition of use.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Dry chemical. Carbon dioxide (CO_2). Foam. Water spray or fog.

Unsuitable Extinguishing Media None

Specific Hazards Arising from the Chemical
None in particular

Hazardous Combustion Products Carbon dioxide (CO_2). Carbon monoxide. Hydrocarbons. Hydrogen sulfide. Sulfur dioxide. Soot.

Explosion Data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Protective Equipment and Precautions for Firefighters
Use water spray to cool surrounding containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Use personal protective equipment.

Environmental Precautions

Environmental Precautions Prevent entry into waterways, sewers, basements or confined areas. Avoid release to the environment. See Section 12 for additional Ecological Information Dispose of contents/container to an approved waste disposal plant.

Methods and materials for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Small spillage: Wipe up with absorbent material (e.g. cloth, fleece). Large spillage: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Avoid contact with eyes. Do not smoke. Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Keep container closed when not in use. Keep container tightly closed in a dry and well-ventilated place. Keep away from heat and sources of ignition. Do not contaminate food or feed stuffs. Keep out of the reach of children.

Incompatible Products Strong oxidizing agents. Strong acids.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Measures Eyewash stations.

Individual protection measures, such as personal protective equipment

Eye/Face Protection No special protective equipment required.
Skin and Body Protection No special protective equipment required.
Respiratory Protection None required under normal usage. If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid	**Appearance**	Colorless-blue/white
Odor	Citrus	**Odor Threshold**	No information available

Property	Values	Remarks/ - Method
pH	6	None known
Melting Point/Range	No data available	None known
Boiling Point/Boiling Range	212 °F	None known
Flash Point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	>1	None known
Relative Density	No data available	None known
Specific Gravity	0.995	None known
Water Solubility	Miscible with water	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known

Flammable Properties Not flammable

Explosive Properties No data available
Oxidizing Properties No data available

Other information

VOC Content (%) 0%

10. STABILITY AND REACTIVITY

Reactivity

Not reactive under normal conditions.

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

None under normal processing.

Conditions to avoid

Incompatible products.

Incompatible materials

Strong oxidizing agents. Strong acids.

Hazardous decomposition products

Carbon dioxide (CO_2). Carbon monoxide (CO). Hydrocarbons. Hydrogen sulfide. Sulfur dioxide. Soot.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	Not an expected route of exposure
Eye Contact	Contact with eyes may cause irritation.
Skin Contact	May cause mild skin irritation.
Ingestion	Not an expected route of exposure.

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms No information available.

Delayed and immediate effects and also chronic effects from short and long term exposure

Sensitization	No information available.
Mutagenic Effects	No information available.
Carcinogenicity	Contains no ingredients above reportable quantities listed as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
D-Limonene		Group 3	-	-

IARC: (International Agency for Research on Cancer)
Group 3: Not Classifiable as to its Carcinogenicity to Humans

Reproductive Toxicity	This product does not contain any known or suspected reproductive hazards.
STOT - single exposure	None of the ingredients are known to cause specific target organ effects from a single exposure.
STOT - repeated exposure	None of the ingredients are known to cause specific target organ effects through prolonged or repeated exposure.
Aspiration Hazard	None of the ingredients are known to be an aspiration hazard.

Numerical measures of toxicity - Product

The following values are calculated based on chapter 3.1 of the GHS document:

LD50 Oral	42888 mg/kg; Acute toxicity estimate
LD50 Dermal	329859 mg/kg; Acute toxicity estimate

12. ECOLOGICAL INFORMATION

Ecotoxicity

Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Isoparaffinic Hydrocarbon 64742-47-8		LC50 96 h: = 45 mg/L flow-through (Pimephales promelas) LC50 96 h: = 2.2 mg/L static (Lepomis macrochirus) LC50 96 h: = 2.4 mg/L static (Oncorhynchus mykiss)		LC50 96 h: = 4720 mg/L (Den-dronereides heteropoda)
Diethylhexyl sodium sulfosuccinate 577-11-7		LC50 96 h: 20 - 40 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: < 24 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 37 mg/L static (Lepomis macrochirus)		EC50 48 h: = 36 mg/L (Daphnia magna)
D-Limonene 5989-27-5		LC50 96 h: 0.619 - 0.796 mg/L flow-through (Pimephales promelas) LC50 96 h: = 35 mg/L (Oncorhynchus mykiss)		
Dimethyl glutarate 1119-40-0		LC50 96 h: 19.6-26.2 mg/L static (Pimephales promelas)		EC50 48 h: 122.1 - 163.5 mg/L (Daphnia magna)
1,3-Propanediol, 2,2-dimethyl- 126-30-7	EC50 72 h: > 1000 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: > 1000 mg/L semi-static (Oryzias latipes)		EC50 24 h: > 1000 mg/L (Daphnia magna)
Isopropyl myristate 110-27-0	EC50 72 h: > 100 mg/L (Desmodesmus subspicatus)	LC50 96 h: = 8400 mg/L (Brachydanio rerio) LC50 96 h: = 8400 mg/L semi-static (Brachydanio rerio)	-	EC50 48 h: = 100 mg/L (Daphnia magna)
2-Phenoxyethanol 122-99-6	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 337 - 352 mg/L flow-through (Pimephales promelas) LC50 96 h: = 366 mg/L static (Pimephales promelas) LC50 96 h: 220 - 460 mg/L static (Leuciscus idus)	EC50 = 32.4 mg/L 5 min EC50 = 880 mg/L 17 h	EC50 48 h: > 500 mg/L (Daphnia magna)
Propylene glycol 57-55-6	EC50 96 h: = 19000 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 51600 mg/L static (Oncorhynchus mykiss) LC50 96 h: 41 - 47 mL/L static (Oncorhynchus mykiss) LC50 96 h: = 51400 mg/L static (Pimephales promelas) LC50 96 h: = 710 mg/L (Pimephales promelas)	EC50 = 710 mg/L 30 min	EC50 24 h: > 10000 mg/L (Daphnia magna) EC50 48 h: > 1000 mg/L Static (Daphnia magna)
Glycerin 56-81-5	-	LC50 96 h: 51 - 57 mL/L static (Oncorhynchus mykiss)	-	EC50 24 h: > 500 mg/L (Daphnia magna)
Iodopropynyl butylcarbamate 55406-53-6		LC50 96 h: 0.049-0.079 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: 0.05-0.089 mg/L (Oncorhynchus mykiss) LC50 96 h: 0.14-0.32 mg/L flow-through (Lepomis macrochirus) LC50 96 h: 0.18-0.23 mg/L flow-through (Pimephales promelas)		

Persistence and Degradability No information available.

Bioaccumulation No information available.

Other Adverse Effects

No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging Do not re-use empty containers.

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste
D-Limonene	Toxic

14. TRANSPORT INFORMATION

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory. All components of this product are either listed or are exempt on the TSCA inventory.
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated by state right-to-know regulations.

U.S. EPA Label Information

EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

NFPA	**Health Hazard**	1	**Flammability**	0	**Instability** 0	**Physical and Chemical Hazards**	-
HMIS	**Health Hazard**	1	**Flammability**	0	**Physical Hazard** 0	**Personal Protection**	X

**Indicates a chronic health hazard.*

Prepared By
Product Stewardship
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Issuing Date 13-Sep-2013
Revision Date 31-Mar-2015
Revision Note Initial Release.

General Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

SAFETY DATA SHEET

1. Identification

Product identifier: TOLUENE

Other means of identification
Product No.: 9457, 4483, V560, 8604, 9476, 9466, 9460, 9456, 9364, 9351, 9336, 8608

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Flammable liquids	Category 2

Health hazards

Acute toxicity (Oral)	Category 4
Acute toxicity (Inhalation - vapor)	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A
Toxic to reproduction	Category 2
Specific target organ toxicity - single exposure	Category 3
Specific target organ toxicity - repeated exposure	Category 2
Aspiration hazard	Category 1

Environmental hazards

Acute hazards to the aquatic environment	Category 2

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement:
Highly flammable liquid and vapor.
Harmful if swallowed or if inhaled.
Causes skin irritation.
Causes serious eye irritation.
Suspected of damaging fertility or the unborn child.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
May cause damage to organs through prolonged or repeated exposure.
Toxic to aquatic life.

Precautionary statement

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection. Use only outdoors or in a well-ventilated area. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment.

Response: In case of fire: Use water spray, foam, dry powder or carbon dioxide for extinction. IF exposed or concerned: Get medical advice/attention. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting.

Storage: Store locked up. Store in a well-ventilated place. Keep cool. Keep container tightly closed.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
TOLUENE		108-88-3	99 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Get medical attention immediately.

Skin contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention.

Most important symptoms/effects, acute and delayed

Symptoms: Harmful if swallowed. May be fatal if swallowed. Harmful if inhaled. Irritating to eyes, respiratory system and skin.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards: In case of fire and/or explosion do not breathe fumes.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Water spray, foam, dry powder or carbon dioxide.

Unsuitable extinguishing media: Avoid water in straight hose stream; will scatter and spread fire.

Specific hazards arising from the chemical: Vapors may cause a flash fire or ignite explosively. Vapors may travel considerable distance to a source of ignition and flash back. Prevent buildup of vapors or gases to explosive concentrations.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Use water spray to keep fire-exposed containers cool. Cool containers exposed to flames with water until well after the fire is out. Water may be ineffective in fighting the fire. Fight fire from a protected location. Move containers from fire area if you can do so without risk.

Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. See Section 8 of the MSDS for Personal Protective Equipment.
Methods and material for containment and cleaning up:	Eliminate all ignition sources if safe to do so. Take precautionary measures against static discharges. Stop leak if possible without any risk. Use only non-sparking tools. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Prevent entry into waterways, sewer, basements or confined areas. Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. Handling and storage

Precautions for safe handling:	DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Take precautionary measures against static discharges. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Wear protective gloves/protective clothing/eye protection/face protection. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Wash hands thoroughly after handling.
Conditions for safe storage, including any incompatibilities:	Keep away from food, drink and animal feeding stuffs. Keep container tightly closed in a cool, well-ventilated place. Ground container and transfer equipment to eliminate static electric sparks. Comply with all national, state, and local codes pertaining to the storage, handling, dispensing, and disposal of flammable liquids.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values		Source
TOLUENE	TWA	20 ppm		US. ACGIH Threshold Limit Values (2011)
	STEL	150 ppm	560 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	REL	100 ppm	375 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	TWA	100 ppm	375 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	150 ppm	560 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	200 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)
	Ceiling	300 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)
	MAX. CONC	500 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)

Biological limit values

Chemical identity	Exposure Limit values	Source
TOLUENE (o-Cresol, with hydrolysis: Sampling time: End of shift.)	0.3 mg/g (Creatinine in urine)	ACGIH BEL (2011)
TOLUENE (toluene: Sampling time: Prior to last shift of work week.)	0.02 mg/l (Blood)	ACGIH BEL (2011)
TOLUENE (toluene: Sampling time: End of shift.)	0.03 mg/l (Urine)	ACGIH BEL (2011)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area. Use explosion-proof ventilation equipment.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator.

Hygiene measures: Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Sweet aromatic odor
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	-94.9 °C
Initial boiling point and boiling range:	110 °C
Flash Point:	4 °C (Closed Cup)
Evaporation rate:	2.24 (butyl acetate=1)
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	7.1 %(V)
Flammability limit - lower (%):	1.1 %(V)
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	3.8 kPa (25 °C)
Vapor density:	3.1 AIR=1
Relative density:	0.86 (20 °C)
Solubility(ies)	
Solubility in water:	0.7 g/l (23.3 °C)
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	2.73
Auto-ignition temperature:	480 °C
Decomposition temperature:	No data available.
Viscosity:	No data available.

Other information

Molecular weight:	92.14 g/mol (C7H8)

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Heat, sparks, flames.
Incompatible materials:	Strong oxidizing agents. Chlorine.
Hazardous decomposition products:	Thermal decomposition may release oxides of carbon.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	Harmful if swallowed.
Inhalation:	Harmful if inhaled. May cause irritation to the mucous membranes and upper respiratory tract.

Skin contact: Causes skin irritation.

Eye contact: Causes serious eye irritation.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: LD 50 (Rat): 636 mg/kg

Dermal
Product: LD 50 (Rabbit): 12,124 mg/kg

Inhalation
Product: LC 50 (Mouse, 24 h): 400 mg/l
LC 50 (Rat, 4 h): 8,000 mg/l

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: Causes skin irritation.

Serious eye damage/eye irritation
Product: Causes serious eye irritation.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: May damage fertility or the unborn child.

Specific target organ toxicity - single exposure
Product: Narcotic effect. Respiratory tract irritation.

Specific target organ toxicity - repeated exposure
Product: Peripheral nervous system Central nervous system. Kidneys. auditory organs

Aspiration hazard
Product: May be fatal if swallowed and enters airways.

Other effects: No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):

TOLUENE — LC 50 (Fathead minnow (Pimephales promelas), 96 h): 12.6 mg/l Mortality
LC 50 (Coho salmon,silver salmon (Oncorhynchus kisutch), 96 h): 5.5 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

TOLUENE — EC 50 (Brine shrimp (Artemia sp.), 24 h): 22.1 - 54.1 mg/l Intoxication
EC 50 (Water flea (Daphnia magna), 48 h): 5.46 - 9.83 mg/l Intoxication

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: Expected to be readily biodegradable.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: Bioaccumulation is unlikely to be significant because of the low water solubility of this product.

Partition coefficient n-octanol / water (log Kow)

Product: Log Kow: 2.73

Mobility in soil: The product is insoluble in water and will spread on the water surface.

Other adverse effects: Toxic to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws. Residual vapors may explode on ignition; do not cut, drill, grind, or weld on or near this container.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1294
UN proper shipping name:	Toluene
Transport hazard class(es)	
Class(es):	3
Label(s):	3
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1294
UN proper shipping name:	TOLUENE
Transport hazard class(es)	
Class(es):	3
Label(s):	3
EmS No.:	F-E, S-D
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1294
Proper Shipping Name:	Toluene
Transport hazard class(es):	
Class(es):	3
Label(s):	3
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

TOLUENE Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [X] Chronic (Delayed) [X] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
TOLUENE	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
TOLUENE	500 lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
TOLUENE	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

TOLUENE Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

TOLUENE Developmental toxin.
TOLUENE Female reproductive toxin.

US. New Jersey Worker and Community Right-to-Know Act

TOLUENE Listed

US. Massachusetts RTK - Substance List

TOLUENE Listed

US. Pennsylvania RTK - Hazardous Substances

TOLUENE Listed

US. Rhode Island RTK

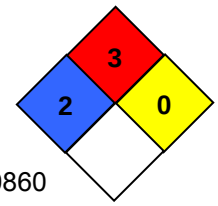
TOLUENE Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	On or in compliance with the inventory
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Flammability
Health


Reactivity
Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date:	06-12-2014
Revision date:	No data available.
Version #:	1.0
Further information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

SAFETY DATA SHEET

1. Identification

Product identifier: XYLENES

Other means of identification
Product No.: X516, 8802, 8668, 8664, 9516, 9493, 9490, 5377, 9483

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Flammable liquids	Category 3

Health hazards

Acute toxicity (Dermal)	Category 4
Acute toxicity (Inhalation - vapor)	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A
Carcinogenicity	Category 2
Specific target organ toxicity - single exposure	Category 3
Specific target organ toxicity - repeated exposure	Category 1
Aspiration hazard	Category 1

Environmental hazards

Acute hazards to the aquatic environment	Category 2

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement:
Flammable liquid and vapor.
Harmful if swallowed, in contact with skin or if inhaled.
Causes skin irritation.
Causes serious eye irritation.
Suspected of causing cancer.
Causes damage to organs through prolonged or repeated exposure.
Toxic to aquatic life.

Precautionary statement

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Wear protective gloves/protective clothing/eye protection/face protection. Wash hands thoroughly after handling.

Response: IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting.

Other hazards which do not result in GHS classification: Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
M-XYLENE		108-38-3	30 - 60%
P-XYLENE		106-42-3	10 - 30%
ETHYL BENZENE		100-41-4	10 - 30%
O-XYLENE		95-47-6	10 - 30%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation:	Move to fresh air. Get medical attention if symptoms persist.
Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention if irritation persists after washing. Wash contaminated clothing before reuse.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention if irritation persists after washing.

Most important symptoms/effects, acute and delayed

Symptoms:	Irritating to eyes, respiratory system and skin.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards:	Flammable liquid and vapor. In case of fire and/or explosion do not breathe fumes.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Water spray, fog, CO2, dry chemical, or alcohol resistant foam.
Unsuitable extinguishing media:	Avoid water in straight hose stream; will scatter and spread fire.
Specific hazards arising from the chemical:	Vapors may cause a flash fire or ignite explosively. Vapors may travel considerable distance to a source of ignition and flash back. Heat may cause the containers to explode. Prevent buildup of vapors or gases to explosive concentrations.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Fight fire from a protected location. Use water spray to keep fire-exposed containers cool. Move containers from fire area if you can do so without risk. Water may be ineffective in fighting the fire.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). See Section 8 of the MSDS for Personal Protective Equipment. Keep unauthorized personnel away. Keep upwind. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Use personal protective equipment.
Methods and material for containment and cleaning up:	Eliminate all ignition sources if safe to do so. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal. Take precautionary measures against static discharges. Use only non-sparking tools. Stop leak if possible without any risk.

Notification Procedures:	Prevent entry into waterways, sewer, basements or confined areas. Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid release to the environment.

7. Handling and storage

Precautions for safe handling:	Wash hands thoroughly after handling. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use personal protective equipment as required. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Ground/bond container and receiving equipment. Take precautionary measures against static discharges. Do not breathe mist or vapor. Use only with adequate ventilation. Avoid contact with eyes. Avoid contact with skin.
Conditions for safe storage, including any incompatibilities:	Keep away from food, drink and animal feeding stuffs. Keep container tightly closed. Store in a well-ventilated place. Ground container and transfer equipment to eliminate static electric sparks. Comply with all national, state, and local codes pertaining to the storage, handling, dispensing, and disposal of flammable liquids.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
M-XYLENE	TWA	100 ppm	US. ACGIH Threshold Limit Values (02 2012)
	STEL	150 ppm	US. ACGIH Threshold Limit Values (02 2012)
	STEL	150 ppm 655 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	REL	100 ppm 435 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	100 ppm 435 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	150 ppm 655 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	100 ppm 435 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
P-XYLENE	STEL	150 ppm	US. ACGIH Threshold Limit Values (02 2012)
	TWA	100 ppm	US. ACGIH Threshold Limit Values (02 2012)
	STEL	150 ppm 655 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	REL	100 ppm 435 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	100 ppm 435 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	150 ppm 655 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	100 ppm 435 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
ETHYL BENZENE	TWA	20 ppm	US. ACGIH Threshold Limit Values (2011)
	REL	100 ppm 435 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	STEL	125 ppm 545 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	100 ppm 435 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	100 ppm 435 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	125 ppm 545 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
O-XYLENE	TWA	100 ppm	US. ACGIH Threshold Limit Values (2011)
	STEL	150 ppm	US. ACGIH Threshold Limit Values (2011)
	REL	100 ppm 435 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	STEL	150 ppm 655 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	100 ppm 435 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	150 ppm 655 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	100 ppm 435 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Biological limit values

Chemical identity	Exposure Limit values	Source
M-XYLENE (Methylhippuric acids: Sampling time: End of shift.)	1.5 g/g (Creatinine in urine)	ACGIH BEL (02 2012)
P-XYLENE (Methylhippuric acids: Sampling time: End of shift.)	1.5 g/g (Creatinine in urine)	ACGIH BEL (02 2012)
ETHYL BENZENE (Sum of mandelic acid and phenylglyoxylic acid: Sampling time: End of shift at end of work week.)	0.7 g/g (Creatinine in urine)	ACGIH BEL (2011)
O-XYLENE (Methylhippuric acids: Sampling time: End of shift.)	1.5 g/g (Creatinine in urine)	ACGIH BEL (02 2012)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area. Use explosion-proof ventilation equipment.

Eye/face protection: Wear safety glasses with side shields (or goggles). Wear face shield if there is risk of splashes.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator.

Hygiene measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned. Provide eyewash station and safety shower. Wash hands before breaks and immediately after handling the product. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Wash contaminated clothing before reuse.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Characteristic
Odor threshold:	No data available.
pH:	Not applicable
Melting point/freezing point:	-41.5 °C
Initial boiling point and boiling range:	139 °C
Flash Point:	29 °C
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	7 %(V)
Flammability limit - lower (%):	1 %(V)
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	1.1 kPa
Vapor density:	No data available.
Relative density:	0.86 (20 °C)
Solubility(ies)	
Solubility in water:	Insoluble in water
Solubility (other):	No data available.

Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	464 °C
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Heat, sparks, flames. Contact with incompatible materials.
Incompatible materials:	Strong oxidizing agents. Strong acids.
Hazardous decomposition products:	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapors.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May be harmful if swallowed.
Inhalation:	Harmful if inhaled.
Skin contact:	Harmful in contact with skin. Causes skin irritation.
Eye contact:	Causes serious eye irritation.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	ATEmix (Rat): 3,190 mg/kg

Dermal

Product:	No data available.
Specified substance(s): M-XYLENE	LD 50 (Rabbit): 12,100 mg/kg
Specified substance(s): ETHYL BENZENE	LD 50 (Rabbit): 17,800 mg/kg

Inhalation

Product:	No data available.
Specified substance(s): M-XYLENE	LC 50 (Mouse, 6 h): 5,300 mg/l
Specified substance(s): P-XYLENE	LC 50 (Mouse, 6 h): 3,900 mg/l
Specified substance(s): O-XYLENE	LC 50 (Mouse, 6 h): 4,600 mg/l LC 50 (Rat, 4 h): 6,350 mg/l

Repeated dose toxicity

Product: No data available.

Skin corrosion/irritation
Product: Causes skin irritation.

Serious eye damage/eye irritation
Product: Causes serious eye irritation.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: Suspected of causing cancer.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

ETHYL BENZENE	Overall evaluation: 2B. Possibly carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: May damage fertility or the unborn child.

Specific target organ toxicity - single exposure
Product: Narcotic effect. Respiratory tract irritation.

Specific target organ toxicity - repeated exposure
Product: Central nervous system. auditory organs Lungs.

Aspiration hazard
Product: May be fatal if swallowed and enters airways.

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Specified substance(s):

M-XYLENE	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 14.31 - 18.01 mg/l Mortality LC 50 (Rainbow trout,donaldson trout (Oncorhynchus mykiss), 96 h): 8.4 mg/l Mortality

P-XYLENE	LC 50 (Rainbow trout,donaldson trout (Oncorhynchus mykiss), 96 h): 2.6 mg/l Mortality LC 50 (Fathead minnow (Pimephales promelas), 96 h): 7.2 - 9.9 mg/l Mortality
ETHYL BENZENE	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 9.1 - 15.6 mg/l Mortality LC 50 (Bluegill (Lepomis macrochirus), 96 h): 93 - 211 mg/l Mortality LC 50 (Carp (Leuciscus idus melanotus), 48 h): 44 mg/l Mortality
O-XYLENE	LC 50 (Goldfish (Carassius auratus), 24 h): 13 mg/l Mortality LC 50 (Guppy (Poecilia reticulata), 96 h): 12 mg/l Mortality LC 50 (Bluegill (Lepomis macrochirus), 96 h): 11.6 - 22.4 mg/l Mortality LC 50 (Fathead minnow (Pimephales promelas), 96 h): 11.6 - 22.4 mg/l Mortality LC 50 (Goldfish (Carassius auratus), 96 h): 11.6 - 22.4 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

M-XYLENE	LC 50 (Water flea (Daphnia magna), 48 h): 28.1 - 87.4 mg/l Mortality LC 50 (Brine shrimp (Artemia sp.), 48 h): 5.29 - 11.7 mg/l Mortality
P-XYLENE	LC 50 (Brine shrimp (Artemia sp.), 24 h): 22.1 - 39.4 mg/l Mortality LC 50 (Water flea (Daphnia magna), 48 h): 11.3 - 51.8 mg/l Mortality
ETHYL BENZENE	EC 50 (Water flea (Daphnia magna), 48 h): 1.37 - 4.4 mg/l Intoxication EC 50 (Brine shrimp (Artemia sp.), 48 h): 3.58 - 9.46 mg/l Intoxication LC 50 (Water flea (Daphnia magna), 48 h): 10.6 - 17.2 mg/l Mortality LC 50 (Brine shrimp (Artemia sp.), 48 h): 3.91 - 13.7 mg/l Mortality
O-XYLENE	EC 50 (Water flea (Daphnia magna), 48 h): 0.78 - 2.51 mg/l Intoxication LC 50 (Water flea (Daphnia magna), 48 h): 5.26 - 33.9 mg/l Mortality LC 50 (Brine shrimp (Artemia sp.), 48 h): 13.4 - 31.1 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: There are no data on the degradability of this product.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product: No data available.

Specified substance(s):

M-XYLENE	Log Kow: 3.20

P-XYLENE	Log Kow: 3.15
ETHYL BENZENE	Log Kow: 3.15
O-XYLENE	Log Kow: 3.12

Mobility in soil: The product is insoluble in water and will spread on the water surface.

Other adverse effects: Toxic to aquatic life.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws. Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1307
UN proper shipping name:	Xylenes
Transport hazard class(es)	
Class(es):	3
Label(s):	3
Packing group:	III
Marine Pollutant:	No

IMDG

UN number:	UN 1307
UN proper shipping name:	XYLENES
Transport hazard class(es)	
Class(es):	3
Label(s):	3
EmS No.:	F-E, S-D
Packing group:	III
Marine Pollutant:	No

IATA

UN number:	UN 1307
Proper Shipping Name:	Xylenes
Transport hazard class(es):	
Class(es):	3
Label(s):	3
Marine Pollutant:	No
Packing group:	III

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

M-XYLENE	Reportable quantity: 1000 lbs.
P-XYLENE	Reportable quantity: 100 lbs.
ETHYL BENZENE	Reportable quantity: 1000 lbs.
O-XYLENE	Reportable quantity: 1000 lbs.
TOLUENE	Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

X	Acute (Immediate)	X	Chronic (Delayed)	X	Fire		Reactive		Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
M-XYLENE	1000 lbs.
P-XYLENE	100 lbs.
ETHYL BENZENE	1000 lbs.
O-XYLENE	1000 lbs.
TOLUENE	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
M-XYLENE	500 lbs
P-XYLENE	500 lbs
ETHYL BENZENE	500 lbs
O-XYLENE	500 lbs
TOLUENE	500 lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
M-XYLENE	10000 lbs	25000 lbs.
P-XYLENE	10000 lbs	25000 lbs.
ETHYL BENZENE	10000 lbs	25000 lbs.
O-XYLENE	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

M-XYLENE	Reportable quantity: 100 lbs.
P-XYLENE	Reportable quantity: 100 lbs.
ETHYL BENZENE	Reportable quantity: 1000 lbs.
O-XYLENE	Reportable quantity: 100 lbs.
TOLUENE	Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

ETHYL BENZENE	Carcinogenic.
TOLUENE	Developmental toxin.
TOLUENE	Female reproductive toxin.

US. New Jersey Worker and Community Right-to-Know Act

M-XYLENE	Listed
P-XYLENE	Listed
ETHYL BENZENE	Listed
O-XYLENE	Listed

US. Massachusetts RTK - Substance List

M-XYLENE	Listed
P-XYLENE	Listed
ETHYL BENZENE	Listed
O-XYLENE	Listed

US. Pennsylvania RTK - Hazardous Substances

M-XYLENE	Listed
P-XYLENE	Listed
ETHYL BENZENE	Listed
O-XYLENE	Listed

US. Rhode Island RTK

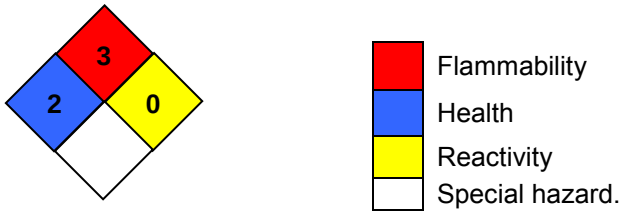
M-XYLENE	Listed
P-XYLENE	Listed
ETHYL BENZENE	Listed
O-XYLENE	Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date:	07-10-2014
Revision date:	No data available.
Version #:	1.0
Further information:	No data available.

Disclaimer:

THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

APPENDIX F

DAILY HEALTH AND SAFETY
TAILGATE MEETING FORM

DAILY TAILGATE SAFETY MEETING FORM

Instructions:

- **Conduct a Daily Tailgate Safety Meeting with site personnel prior to commencing daily activities. Safety topics can be selected from the attached table.**
- **Address potential hazards and controls for tasks that will be conducted.**
- **Discuss air monitoring, training, PPE and other appropriate requirements.**
- **Follow-up on noted items and document the resolution of any action items.**

Date: _____

Meeting conducted by: _____

Project/Site: _____

Safety topics/information reviewed: _____

_____

_____

_____

_____

_____

Follow-up action items/comments: _____

_____

_____

_____

_____

_____

Attendance:

NAME	SIGNATURE	COMPANY/AGENCY/OTHER ORG.

In the event of serious emergency, dial 911 and for non-life-threatening injuries call WorkCare at (888) 449-7787.

DAILY TAILGATE SAFETY MEETING TOPICS GUIDE

1. ACCIDENT REPORTING
2. AIR MONITORING
3. AIR MONITORING AND ACTION LEVELS
4. ALCOHOL CONSUMPTION AND WORKSITE SAFETY
5. COLD STRESS
6. CONFINE SPACE ENTRY
7. CRANE SAFETY
8. DAILY WORK TASK HAZARDS
9. DECONTAMINATION
10. DISCIPLINARY POLICY FOR NOT FOLLOWING SAFETY RULES/SAFE WORK PRACTICES
11. DRILL RIG SAFETY
12. ELECTRICAL SAFETY
13. EMERGENCY RESPONSE
14. ERGONOMICS
15. EXCAVATION/TRENCHING HAZARDS
16. EYE WASH STATION LOCATION (S)
17. FALL PROTECTION
18. FIRE SAFETY/BONDING-GROUNDING TECHNIQUES
19. FIRST AID/CPR
20. FUGITIVE DUST CONTROL
21. GENERAL SITE SAFETY RULES
22. HAND TOOL HAZARDS
23. HAZARD COMMUNICATION/LOCATION OF MSDS/REVIEW OF HAZMAT PROPERTIES
24. HEALTH AND SAFETY PLAN
25. HEARING PROTECTION
26. HEAT STRESS
27. HEAVY MACHINERY
28. HOSPITAL DIRECTIONS
29. HOUSEKEEPING
30. MATERIAL HANDLING
31. MECHANICAL HAZARDS/GUARDING/LOTO
32. OVERHEAD HAZARDS
33. PERSONAL PROTECTIVE EQUIPMENT
34. RESPIRATORY PROTECTION AND FILTER CHANGE-OUT SCHEDULE
35. ROLES AND RESPONSIBILITIES
36. SITE SECURITY
37. SMOKING AND BREAK AREAS
38. TANK REMOVAL SAFETY
39. UNDERGROUND UTILITIES
40. USE OF “BUDDY SYSTEM”
41. VAPOR CONTROL
42. WATER HAZARDS
43. WORK STOPPAGE

APPENDIX G

EXCAVATION AND TRENCHING

EXCAVATION AND TRENCHING -- SOP-02

1.0 INTRODUCTION

Excavation and trenching is one of the major hazards of construction activities; therefore a number of precautions must be taken to prevent cave-ins or other accidents. OSHA defines an excavation as any man-made cut, cavity, trench, or depression in the earth's surface as formed by earth removal. A trench refers to a narrow excavation made below the surface of the ground in which the depth is greater than the width- and the width does not exceed 15 feet. The following site conditions must be taken into account when planning excavation work:

- Traffic;
- Proximity and physical conditions of nearby structures;
- Soil type;
- Surface and ground water;
- Depth to water table;
- Overhead and underground utilities; and
- Weather.

2.0 SUMMARY OF REQUIREMENTS

All excavations must be dug according to OSHA 29 CFR 1926.650-652, "Excavation, Trenching, and Shoring." These requirements include the following:

- The sides of trenches more than five (5) feet deep must be shored, unless they are sloped to the angle of repose or unless the trench is in solid rock. Shoring must be adequate to prevent trench wall collapse in whatever soil condition is encountered. See Appendices A through E of 29 CFR 1926.652.

- Trenches or excavations 4 feet or deeper must be provided with means of access/ egress (i.e., ramps or ladders). A worker must never be more than 25 feet away from a means of egress. Ladders must extend from the bottom of the trench to at least 3 feet above the surface of the ground.

- The atmosphere of the excavation must be tested for flammable gas concentration, oxygen deficiency, and other hazardous substances which may be present before employees enter a trench or excavation greater than 4 feet deep. Employees shall not be permitted to work in hazardous or toxic atmospheres with a combustible gas concentration greater than 20% of the lower flammable limit; and oxygen less than 19.5% or more than 23.5 %.

- Daily inspections of the excavation; adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could result in possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. Inspections are required prior to the start of work and as

needed throughout the shift, also after every rainstorm or other hazard increasing occurrence. Inspections are only required when employee exposure can be reasonably anticipated.

If the competent person finds evidence of a dangerous situation, employees must be removed from the hazardous area until precautions are taken to protect employees.

- Determine the exact location of underground utilities before excavating. While the excavation is open, the underground installations must be protected, supported, or removed as necessary to safeguard excavation personnel.

- All surface encumbrances (e.g., trees and boulders) must be removed or supported if they present a hazard to employees. Surface encumbrances can collapse on employees when undermined by excavation activities and also interfere with site traffic.

- If the stability of an adjacent structure is endangered by excavation operations, support systems must be used to ensure the stability of the structure.

- Water must not be allowed to accumulate in an excavation. Water accumulation leads to cave-ins.

- Employees must not work on faces of sloped or benched excavations at levels above other employees unless the employees at the lower level are protected from the hazard of falling, rolling, or sliding material or equipment.

- Personnel are not permitted on the downgradient side of heavy equipment when operating on a grade. A safe pathway must be determined before equipment is moved from one location to another.

- Employees are not permitted under loads handled by lifting or excavation equipment. To avoid being struck with debris, employees must also stand clear of trucks being loaded or unloaded.

- If a machine operator does not have a clear and direct view of an excavation's edge, a warning system (i.e., hand signals or barricades) must be used to ensure that equipment does not fall into the excavation.

- Personnel working along roadways must use highly visible safety vests. Signs, traffic cones, barricades and a flagman, if necessary, must be used to slow down and direct traffic away from the area.

- Emergency response equipment, including PPE and retrieval harnesses with lifelines, must be available when employees may enter an excavation deeper than 5 feet.

Employees entering deep and confined footing excavations must wear harnesses and lifelines.

- During excavation or trenching activities, the excavation must be barricaded to prevent employees and others from falling into them. When an excavation must remain open for the duration of the construction work, barricades, fences, horses, and warning signs are needed. If necessary, one or more employees will direct traffic away from the excavation.

- Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails must be provided.

Employees must be protected from loose rock or soil that could fall or slide into an excavation, either from the face of the excavation or from above the excavation. Materials and equipment must be kept at least 2 feet from the edge of the excavation, or a retaining device must be used to keep materials and equipment controlled.

The next three pages provide flow diagrams for selecting proper shoring and sloping systems. These diagrams were taken Appendix F of the OSHA excavation/trenching standard.

Additional information on soil classification, slope configuration, timber shoring, aluminum hydraulic shoring, and other alternatives are found in Appendices A through E at the end of 29 CFR 1926.652.

APPENDIX H

DRILLING

DRILLING

The following work practices should be used to minimize the risk of exposure and injury to employees during drilling and soil boring activities:

- Clear away all debris from the immediate area
- Be sure that the area to be drilled is free of underground power lines, gas lines, water mains, sewers, or other utilities.
- Before erecting the derrick, be sure that there are no overhead power lines, tree branches, or other obstructions in the way.
- Because the driller is expected to have the necessary experience, it is his responsibility to take charge of the drilling operation. He should be in control of the rig at all times so that the danger of someone accidentally engaging the drive during the operation is reduced.
- When extracting cores lay the core barrel on a platform clear of the drill hole. Allow enough slack in the hoisting cable to prevent the hoisting plug from unscrewing when lifting the core barrel from the hole.
- Never hold your hand over the end of the core barrel when extracting a core, the core may drop suddenly and cut your hand.
- Stay a safe distance from the lines being used for hoisting and pulling drill rods or sheet piling. Never straddle or reach across them. Serious injuries from whiplash can occur if the cable breaks or loosens suddenly.
- Always stand clear of the cable, hoisting plug, and rods while the operator releases the tension on the cable, the bail or hoisting plug may spin rapidly when the tension is released.
- **Never** place a hand on the guide or drive head when the drive hammer is suspended or in use. Most hand injuries around drill rigs occur in this fashion.

APPENDIX I

SAMPLING ACTIVITIES

SAMPLING ACTIVITIES

Well Testing, Ground Water Monitoring

These sampling activities involve possible contact with contaminated ground water. The most common route of exposure is skin/eye contact with splashed liquid, although there is also a potential for eye irritation and inhalation of volatile organic vapors if the water is heavily contaminated. Employees involved in handling samples and sampling equipment must wear gloves, safety glasses/goggles and other PPE as necessary.

Surface Water and Waste Sampling

Personnel sampling ponds, lagoons or other surface waters must wear appropriate PPE to protect themselves from over-exposure to hazardous substances. The most common danger associated with surface water sampling is skin and/or eye exposure due to splashing. Inhalation of volatile compounds is also a potential danger when sampling surface waters that may be heavily contaminated. If necessary to characterize hazards associated with sampling at specific sites, air monitoring will be conducted with instruments such as organic vapor monitors. PPE required may include coveralls, disposable gloves, boots, chemical splash goggles or safety glasses or full-face shield, and organic respirator or SCBA.

Drowning is a real danger for personnel suited in protective equipment that may impair swimming ability. Where there is danger of drowning, necessary safety gear such as lifeboats, safety lines and flotation gear will be provided. Whenever possible, stay on shore; be aware that some solid wastes may float and give the appearance of cracked mud. Caution should be exercised when working along shorelines.

Soil Sampling, Drilling

Contact with hazardous substances may include skin exposure from handling a sample, skin and/or eye exposure from flying debris while drilling, as well as from dusts, aerosols, vapors generated in drilling or while hand auguring. When necessary due to actual or expected site conditions, monitoring shall be performed with an organic vapor meter, combustible gas meter, and/or radiation detection device.

Employees involved in soil sampling by hand auguring or split-spoon sampling must wear gloves while handling samples and sampling equipment, and goggles/safety glasses to prevent eye damage or exposure while drilling, and other PPE such as coveralls, boots, safety shoes, and respirators, if necessary.

Drum Sampling

Drum sampling can be a hazardous activity because it often involves direct contact with unidentified wastes. To minimize hazards associated with drum sampling the following procedures will be performed as appropriate to the sampling situation:

- Obtain background information about the waste.
- Determine which drums should be sampled.
- Select the appropriate sampling device and containers.
- Develop a sampling plan, which includes the number, volume, and locations of samples to be taken.
- Follow the Standard Operating Procedures below for opening drums, sampling and sample packaging and transportation.
- Sample through a free opening or bung when possible.
- Do not move drum unless necessary.
- Mark sampling areas if necessary, and keep non-essential personnel at a safe distance.

- Do not lean over other drums to reach the drum being sampled unless absolutely necessary.

- Cover drum tops with plastic sheeting, if necessary, to avoid excessive contact with the drum tops.

- Never stand on drums. Use mobile steps or platforms to achieve the height. necessary to safely sample from the drums

- Select and use the appropriate PPE when sampling drums.

The appropriate procedures for sampling and handling drums depend on the drum contents. Prior to any handling or sampling, drums will be visually inspected to gain as much information as possible about their contents. The inspection should determine:

- Any symbols, words, or other marks indicating that its contents are hazardous (e.g., toxic, corrosive, flammable, etc.)

- Any symbols, words, or other marks indicating that it contains potentially dangerous materials in small volume individual containers

- Signs of deterioration such as corrosion, rust, and leaks

- Signs that the drum is under pressure such as swelling and bulging

- Drum type and configuration of drum head.

If there are no clues as to the contents of a drum, or if it is deemed necessary by the SHSO or his designee, monitoring will be conducted around the drums using appropriate instruments, such as an organic vapor monitor, a combustible gas meter, or a radiation survey instrument. Information about drum contents may also be obtained from the site history. The results of the initial survey and drum content determination will be recorded on the sampling sheet.

The following procedures are recommended when opening drums:

- Select and use appropriate PPE when opening and sampling drums (e.g., coveralls, disposable gloves compatible with the waste, rubber boots and safety shoes, chemical splash goggles or full face shield, organic respirator, or SCBA).

If necessary, monitor continuously during drum opening to characterize potential hazards.

- Do not use picks, chisels, etc. to open drums, sample through free openings or bungs.
- If drums must be pierced to open, use remote-controlled devices for opening drums and shields as necessary.
- Keep non-essential personnel at a safe distance from the drums being opened.
- If the drum shows signs of swelling or bulging, perform all opening steps slowly. Relieve excess pressure prior to opening, use shielding if possible.
- Drums with drum covers should be opened carefully.

Drums containing individually packaged wastes such as discarded lab packs should be handled carefully as such containers may contain shock-sensitive materials, exotic toxic substances, etc. Lab packs may be opened to inspect and classify wastes but individual bottles should not be opened if they are unlabeled. To characterize unlabeled materials in individual packs, return the entire pack to the laboratory for analysis if possible.

APPENDIX J

AIR MONITORING FORM

AIR MONITORING FORM

Congaree River Sediments Site
Columbia, South Carolina

Date: _____

Grid Location(s) Excavated This Date: _____

Wind Direction: _____ Shift Start: _____ Shift End: _____

Air Monitoring:

Location / Excavation Depth	Time	PID BG / BZ	LEL BG / BZ	O_2 BG / BZ	H2S BG / BZ	Wind Direction

Safety observations for this date (Draeger Tube results):

_____

_____

_____

_____

_____

Signature of APEX Representative: _____

APPENDIX K

HEAT AND COLD STRESS PROCEDURES

HEAT/COLD STRESS PROCEDURES

1.0 HEAT STRESS

Heat stress is a significant potential hazard associated with the work task performed and the type and degree of protective equipment used in hot weather environments. Local weather conditions may produce conditions, which will require restricted work schedules in order to protect employees. Monitoring for heat stress will follow one of two protocols depending on whether impermeable clothing (tyvek, saranex. rain gear, etc.) or permeable clothing (cotton coveralls) is worm. This section will apply to both hazardous and non-hazardous waste workers at the site. The SHSO with direction from HSR will detemtine the environmental wet bulb globe temperature (WBGT) and physiological (heart rate (HRI and oral temperature [OR]) monitoring to be conducted for both of workers.

1.1 Workers Wearing Permeable Clothing

The ACGIH have set TLVs for worker exposure to heat stress in which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs assume that workers are acclirnatized, fully clothed in permeable clothing with adequate water and salt intake, and capable of functioning effectively under the given working conditions without exceeding a deep body temperature (BT) of 100.4°Fahrenheit (F). Measurement of the WBGT has been found to be the most adequately measurable environmental factor in which to correlate with the deep BT and other physiological responses to heat. The following table the work/rest regimen to be followed by all permeably clothed workers based upon routinely measured WBGT.

Permissible Heat Exposure TLVs Applicable to Workers Wearing Permeable Clothing

Work /Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86 (76)	80 (70)	77 (67)
75% work – 25% rest, each hour	87 (77)	82 (72)	78 (68)
50% work – 50% rest, each hour	89 (79)	85 (75)	82 (72)
25% work – 75% rest, each hour	90 (80)	88 (78)	86 (76)

Values are given in °F WBGT.

Rest means minimal physical activity. Rest should be accomplished in the shade. Any activity requiring only minimal activity can be performed during rest period.

() Parentheses indicate the 10 degree adjustment for working in impermeable protective clothing.

1.2 Workers Wearing Impermeable Clothing

Workers who must wear impermeable clothing are held at a higher risk of suffering heat stress. Impermeable clothing impedes sweat evaporation, one of the body's major cooling mechanisms. It is the duty of each employer to alert or notify the SHSO if symptoms of heat stress occur to their respective site

personnel. Physiological and environmental monitoring of personnel wearing an impermeable protective equipment ensemble will commence when the ambient temperature rises above 70°F. Environmental monitoring will be conducted continuously for as long as the ambient temperature stays above 70°F and physiological monitoring will be conducted immediately before and after each work period. Frequency of physiological monitoring will increase as the ambient temperature increases or if slow recovery rates are indicated. The break time must be sufficient to allow workers to recover from the effects of heat stress. This will be accomplished by measuring the recovery HR and OT. The break time duration will be determined using the following methodology and criteria:

- Seat person being monitored;
- Take OT; and
- Measure pulse in the following sequence:
    - Pulse #1: 30 seconds to 1 minute after sitting
    - Pulse #2: 2½ to 3 minutes after sitting

An excessive heat stress condition exists when any of the following conditions exist:

1. Oral or ear temperature exceeds 99.5°F
2. If pulse #2 is greater than 90 beats/minute
3. Pulse #1 is greater than I 00 beats/minute

Worker cannot return to work until:

- Oral or ear temperature is below 99.5°F
- Pulse rate is below 90 beats/minute
- Recovery HR for workers with HRs over 9Obeats per minute is less than 10 beats per minute less than the original HR

Adhering to the guidelines for heat stress prevention and monitoring will greatly minimize the possibility of the occurrence of heat stress. Site personnel must also be aware of the symptoms of heat-related disorders and be prepared to administer the appropriate treatments.

1.2.1 Prevention

A. Provide plenty of fluids. A 50 percent solution of fruit juice or similar solution in water, or plain water will be available. For workers performing work inside an EZ, fluid intake may occur in the CRZ. Workers must first perform a partial decontamination process, which will include removal of gloves and washing of hands and face prior to consumption of fluids. The SHSO will monitor the partial decontamination and fluid consumption process to ensure that ingestion of site contaminants does not occur.

B. Work in pairs whenever conducting Level B activity or permit required CSE activity.

C. Provide cooling devices. Ice vests or on-site showers can be provided to reduce BT and/or cool protective clothing.

   The amount and type of undergarments worn will be left to the preference of each individual unless prone to heat stress, especially heat rash. In this case, the worker can wear “long john” cotton type underwear to keep skin off chemical resistant clothing.

D. Adjustment of the work schedule. When practicable the most labor-intensive tasks should be carried out during the coolest part of the day.

E. Shaded or cooled rest areas. Shaded or cooled rest areas will be provided when site environmental and/or workers physiological responses warrant.

1.1.3 Heat Stress Monitoring

Physiological monitoring of personnel wearing an impermeable protective ensemble will be conducted at regular intervals at the beginning and conclusion of the work period. HR must be periodically measured for all site personnel when heat stress conditions (climate or wearing impermeable clothing) Additional physiological monitoring such as BT and body water temperature (BWT) monitoring can be measured for extreme temperatures and when impermeable clothing is worn.

A. HR must be measured by the radial pulse for 30 seconds as early as possible in the resting period and repeated approximately 3 minutes into rest period.

   The HR at the beginning of the rest period should not exceed 110 beats per minute. The HR also should not exceed 90 beats per minute after approximate 3 minutes of rest. If the HR does exceed the criteria, the next work period will be shortened by 33 percent, while the length of the rest period will remain the same. If the HR still exceeds the criteria at the beginning of the next rest period, the following work period will be shortened by 33 percent.

B. BT can be measured orally with a clinical or disposable thermometer in accordance with manufacturer's instructions, as early as possible in the rest period (before drinking liquid). Oral or ear temperature at the beginning of the rest period should not exceed 99.5°F. If it does, the next work period will be shortened by 33 percent while the length of the rest period will remain the same. However, if the OT exceeds 99.5°F at the beginning of the next rest period, the following work period will be shortened by another 33 percent. A worker will not be permitted to wear a semi-permeable or impermeable protective ensemble when his or her BT exceeds 99.5°F.

C. Body water loss (B.L.) due to perspiration can be measured by having the worker weigh him or her self at the beginning and end of each workday. Similar clothing should be worn at both weighing. B.L. should not exceed 1.5 percent total body weights in a workday.

Suggested Frequency of Physiological Monitoring for Fit and Acclimated Workers [1]

Adjusted Temperature [2]	Normal Work Ensemble [3]	Impermeable Ensemble [4]
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° -90°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

1 For work levels of 250 kilocalories per hour.

2 Calculate the adjusted air temperature (T_{adj}) using the following equation:

$$T_{adj}\ (°F) = Tadj\ (°F) + (13 \times \text{percent sunshine})$$

Measure the air temperature (Tadj) using a standard mercury-in-glass thermometer with the bulb shielded from radiant heat.

3 A normal work ensemble consists of cotton overalls with long sleeves and pants.

4 An impermeable work ensemble consists of impermeable coveralls with long sleeves and pants.

1.1.4 Recognition and Treatment

Any personnel who observes any of the following forms of heat stress either in themselves or In another worker, will report this information to his or her immediate supervisor or the SSHO.

A. Heat Rash (or prickly heat)

Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.

Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.

Treatment: Remove sources of irritation and cool the skin with water or wet cloths.

B. Heat Cramps or Heat Prostration

Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

Symptoms: Sudden development of pain and/or muscle spasms in the abdominal region.

Treatment: Remove the worker to the CRZ. Remove protective clothing. Decrease BT and allow a period of rest in a cool location.

C. Heat Exhaustion - SERIOUS

Cause: Over exertion in a hot environment and profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

Symptoms: Muscular weakness, staggering gait, nausea, dizziness, shallow breathing.

Treatment: Perform the following while simultaneously making arrangements for transport to a medical facility.

Remove the worker to the CRZ. Remove protective clothing. Lie the worker down on his or her back in a cool place, and raise the feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of a salt water solution consistency of one teaspoon salt in 12 ounces water. Transport the worker to a medical facility.

D. Heat Stroke - EXTREMELY SERIOUS

Cause: Same as heat exhaustion.

Symptoms: No perspiration, dry mouth, pain in the head, dizziness, nausea.

Treatment: Perform the following while making arrangements for transport to a medical facility.

Remove the worker to the CRZ. Remove protective clothing. Lie the worker down in a cool place and raise the head and shoulders slightly. Cool without chilling. Apply ice bags or cold wet cloth to the head. Sponge bare skin with cool water or rubbing alcohol. If possible, place the worker in a tub of cool water. Do not give stimulants. Transport to a medical facility.

HEAT STRESS MONITORING FORM

Project Name: _____

Project Number: _____

SHSO: _____

Date	Title	Ambient Temp.	WBGT	Work/ Rest Regimen	Employee/ Location	Pulse Rate	Body Temp.	Body Water Loss	Comments

2.0 COLD STRESS

If work on this project begins in the winter months thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Localized cold exposure is generally labeled frostbite.

A. Hypothermia: hypothermia is defined as a decrease in the patient core temperature below 96°F. The BT is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

B. Frostbite: frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 2°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of cold related illness can be aided by educating workers on recognizing the symptoms of frostbite and hypothermia and by identifying and limiting known risk factors. The workers should be provided with enclosed, heated invironments on or adjacent to the site, dry changes of clothing, and warm drinks.

To monitor the worker for cold related illnesses, start (oral) temperature recording at the job site:

- At the field team leader's discretion when suspicion is based on changes in a worker's performance or mental status.
- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
- As a screening measure whenever any one worker on the site develops hypothermia.

Workers developing moderate hypothermia (a core temperature of 92°F) should not return to work for at least 48 hours.

Progressive Clinical Symptoms of Hypothermia

Core Temperature (°F)	Symptoms
99.6	Normal core body temperature
96.8	Metabolic rate increases
95.0	Maximum shivering
93.2	Victim conscious and responsive
91.4	Severe hypothermia
89.6 - 87.8	Consciousness clouded, blood pressure difficult to obtain, pupils dilated but react to light, shivering ceases
86.0 - 84.2	Progressive loss of consciousness, muscular rigidity increases, pulse and blood pressure difficult to get, respiratory rate decreases
78.8	Victim seldom conscious
64.4	Lowest accidental hypothermia victim to recover

In order to minimize the risk of the hazards of working in cold environments, workers will be trained and periodically reinforced in the recognition of the physiologic responses of the body to cold stress. In addition, the use of insulated work clothing, warm shelters and work/warming regimens may be used to minimize the potential hazards of cold stress. Also, special attention will be paid to equipment warm-up time and freeze protection for vessels, piping, equipment, tools, and walking/working surfaces. The current ACGIH TLVs for cold stress found in this appendix will be used as a guideline.

APPENDIX L

COMMUNITY AIR MONITORING AND DUST/ODOR CONTROL PLAN

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

December 2016

Prepared for:

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COMMUNITY AIR MONITORING AND
ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach.

To ensure the safety of on-site workers and the local community, a comprehensive environmental site air-monitoring and odor/dust control program will be implemented during the project. SCE&G has successfully completed numerous former MGP remediation projects and has developed and refined a reliable and effective system for eliminating the potential for remediation worker or community exposure to the chemicals of concern originating from the coal tar impacted material. It should be noted that dust presents a typical concern with former MGP site remediation projects. For the Congaree River Sediment Project, dust from excavations will be a minimal since excavation operations are not planned except for the removal of the sand bar and construction of the anchor trench along the shoreline.

The primary components of the air monitoring program include real-time excavation area and perimeter air monitoring (during intrusive activities), dust and odor control measures, controlled and methodical excavation and contained material handling work areas. It should also be noted that since this is a sediment capping project, disturbance of the TLM is expected to be minimal, which limits the need for air monitoring. As currently planned, removal of the sand bar and excavation of the anchor trench along the shoreline are the only activities where potential disturbance of TLM are expected. Air monitoring will be conducted during these activities and during any other intrusive activities that may have the potential to disturb the TLM. Placement of the engineered capping material or other related site activities are not considered intrusive activities and air monitoring at in the work area or at the site perimeter is no anticipated during completion of these activities.

There are two basic objectives of the air monitoring program:

- Protection of the on-site remediation worker; and
- Protection of the surrounding community.

A brief overview of the safety program developed for the on-site worker is provided in the next section as it provides the basis for the community air-monitoring program.

ON-SITE REMEDIATION WORKER HASP

Based on regulatory requirements and SCE&G's commitment to health and safety, a Health and Safety Plan (HASP) was prepared and will be implemented to protect the health and well-being of the on-site remediation workers. In summary, the HASP specifically addresses:

- The potential hazards associated with completing the work;
- The primary chemicals of concern that site workers may be exposed to; and
- The safety measures, precautions and personal protective equipment (PPE) to be used by the on-site workers.

A major concern addressed by the HASP is the air-monitoring activities that will be completed during active excavation and material handling activities. Numerous procedures and techniques have been developed and will be implemented to minimize exposure to the on-site workers at the point of excavation and subsequently while handling and screening the TLM-impacted sediment. If the exposure concentrations exceed certain standards as specified in the HASP, then on-site personnel must upgrade their PPE accordingly. It is important to note that air monitoring within the active work zones at other previously completed MGP projects has not identified sustained elevated air monitoring readings within the work areas and SCE&G does not anticipate that this project will produce sustained elevated readings in the work zone. Furthermore, in the areas where intrusive activities are expected to occur during completion of this project (sand bar and anchor trench) little to no impacts were observed. This will lessen the potential for elevated air monitoring readings at the point of excavation.

Work Area Air Monitoring

The work area air monitoring will be conducted to ensure that remediation workers are safely able to complete their duties. If elevated readings are identified, then the appropriate engineering controls will be implemented to quickly reduce any air impacts. Impacted material excavation and handling activities will be conducted only in the river within the capping area footprint located well away from potential residential areas.

Figure 3 provides the currently planned site operations scenario, which includes the planned sand bar removal area. This will be the primary location for the work area air monitoring activities. During intrusive activities, periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation

worker likely to have the highest exposure. These readings will be compared to the established action levels located in the HASP. Guidelines for specific project related activities that require air monitoring and the subsequent frequency of air monitoring are also presented in the HASP.

Volatile organic compounds (VOCs) associated with the constituents found in the TLM and dust/particulates will be the primary focus of the air monitoring program for this project. A photo-ionization detector (PID) and a particulate (dust) meter will be the instruments used to collect the periodic real-time measurements in the breathing zone in locations where impacted material is being handled. Examples of the instruments typically utilized for similar projects are provided in Attachment A. If sustained VOC readings are identified using a PID, additional air monitoring using constituent-specific detector tubes, as specified in he HASP will be conducted. Engineering controls such as the use of tarps or other such means to encapsulate the impacted material and limit the potential for volatilization will be implemented should conditions warrant. Visual indications of dusty conditions will necessitate dust mitigation measures and water sprays will be utilized to control dust.

The remainder of this Plan describes the community air-monitoring program.

COMMUNITY AIR MONITORING & ODOR/DUST CONTROL PLAN

This Community Air Monitoring and Odor/Dust Control Plan (CAMP) was developed to specifically identify measures that will be implemented to assure minimal impacts to the local residents and the surrounding community while completing the Congaree River Sediment Project. There are two primary elements of this plan that consist of:

- Conducting perimeter air-monitoring activities in the vicinity of Senate and Gist Streets during intrusive activities; and
- Implementing counter measures should the air monitoring activities warrant such mitigation activities.

SCE&G's objective for this plan is to measure air quality concentrations at the perimeter of the project area during intrusive activities to be protective of human health and confirm that there are no exceedances of any applicable air quality standards. The approach to achieving this objective is rather straight forward as described below.

Perimeter Air Monitoring

SCE&G plans to implement a perimeter air monitoring program during intrusive activities. SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at other SCE&G MGP remediation sites and it successfully confirmed the absence of elevated concentrations at these locations.

Attachment B provides information on the predominant wind direction and wind speed for the Columbia Owens, SC weather station located approximately 3.5 miles southeast of the site. This weather station documents a predominant northeast to southwest wind direction. This approximate wind direction is also shown on Figure 3. With the prevailing wind direction blowing across the site from the northeast to the

southwest, the downwind perimeter of the site would most often be the southeast corner, which is the Congaree River. Other than boaters utilizing this portion of the river on an infrequent basis, this perimeter location does not contain potential sensitive receptors. The primary location of potential sensitive receptors is the Senate and Gist Streets area and the Gervais Street Bridge. As a result, SCE&G has developed this perimeter air monitoring program to be protective of both the sensitive receptor areas and the downwind perimeter of the site at all times, regardless of wind direction.

SCE&G will establish a number of air monitoring stations along the northern and eastern landside perimeter, as shown on Figure 3. These stations will house VOC and particulate air monitors whenever impacted material handling operations are being conducted regardless of the predominant wind direction. A windsock or another device on-site will be used to determine the direction of the wind. Wind direction, weather conditions and perimeter monitoring locations will be noted in the field logbook. Two stations in the Gist, Senate and Gervais Street areas will be supplemented with one downwind station and one upwind (background station) that will be established on a daily basis. Implementation of this scenario will provide background data, downwind data and data directly adjacent to the Gervais Street Bridge and Senate and Gist Streets area.

During intrusive activities, the perimeter meters will conduct continuous real-time measurements of dust and organic compounds and will be set to log data at 15-minute intervals and to alarm at conservative action levels. The monitoring stations will be periodically inspected by site personnel and the data collected will be downloaded to the site computer and provided in the final report for the project. The data will also be available for review at any time.

For volatile organic vapors the PIDs will have an audible alarm set at a 15-minute average concentration of 1 ppm. This conservative action level has been successfully utilized at other SCE&G sites. If the ambient air concentration of total organic vapors at the northern and eastern landside perimeter or the downwind perimeter of the work area exceeds 1 part per million (ppm) above background for a 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level decreases (per instantaneous readings) below 1 ppm over background, work activities will resume with continued monitoring. If total organic vapor levels at the perimeter monitoring stations persist at levels in excess of 1 ppm over background work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions and monitoring continued until levels are reduced below 1 ppm and work activities can resume.

Similar to the VOC monitoring, the particulate monitoring will be performed at the perimeter locations during intrusive activities using real-time monitoring equipment (e.g., DataRam) capable of integrating readings over a period of 15 minutes (or less) and data logging the results. The monitors will be set to alarm at the conservative action level and will be periodically inspected by oversight personnel. In addition, fugitive dust migration will be visually assessed during work activities. If the perimeter particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be immediately employed. Work may continue with dust suppression techniques provided that downwind particulate level does not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 µg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 µg/m^3 of the background level and in preventing visible dust migration.

It is important to note that visual indications of dusty conditions will prompt dust control measures whether or not air monitoring is being conducted (i.e. non-intrusive activities are occurring) and/or no action levels are being exceeded. All loading and off-loading activities will be conducted with care to minimize the occurrence of particulate emissions. Also, water-resistant tarps will be used on all vehicles loaded at the site to minimize the production of particulates during transportation off-site. Site personnel will visually monitor for dust during equipment movement and windy conditions. Nuisance dust from truck movements (haul roads) may require management through the application of a water spray via a water truck. A source of clean potable water will be obtained (most likely from a fire hydrant tap permit) and a water truck will be operated on-site to periodically dampen haul roads and other site areas exhibiting visible dust.

Air Monitor Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. A written record of all air monitoring equipment calibration and adjustment information will be maintained. Initially, the PID and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday when intrusive activities are scheduled to occur. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the field work. Calibration and/or zeroing will also be conducted during work hours if a potential malfunction in the instrument is detected.

Odor Control

Odor control measures will be implemented, as needed to ensure that site activities do not produce unsatisfactory odors at the site perimeter. Exposed impacted material, if encountered, will only be handled within the river excavation areas. Plastic sheeting or tarps may be applied to cover impacted material and prevent or minimize fugitive odors. Additional control measures will be available on-site as a contingency measure during intrusive activities. These include the following two commercially available odor suppressant technologies, or equivalent:

- **Bio Solve® –** Bio Solve® is a biodegradable, water-based product that has the ability to encapsulate hydrocarbon VOC vapors. The product is mixed with water at a 3 to 5 percent concentration and can be applied with a variety of water application spray methods. Bio Solve® is not subject to breaches or drawdown (like some foam applications) that allow for re-volatilization, making it a preferred option in windy conditions or on sloped surfaces.
- **Odor Suppressant Foam –** Odor suppressant foam can provide immediate, localized control of odor emissions. The foam is produced by injection of air into a foam concentrate/water mixture using a pneumatic foam unit. The foam is applied via a hose to cover source areas, generally to a depth of 3 to 6 inches. Short-term foam (such as Rusmar AC-645) is recommended to control odors from active excavations and stockpiles. This foam may last between 12 to 16 hours but because it can degrade quickly in direct sunlight, frequent and liberal applications may be

necessary. For longer-term odor suppression, such as over weekends, a long-term foam (such as Rusmar AC-904) should be used.

BROAD RIVER

Timmerman Bridge

Randolph Cem

St Peters Cem

Sch

ELMWOOD

INTERSTATE I-126

Governors Mansion

232

HUGER

LAUREL

250

CONGAREE RIVER

BDY

Howard Sch

Reservoirs

WT

Irwin Park

TAYLOR

150

Correctional Institution

HUGER ST. FORMER MGP SITE LOCATION

SALUDA RIVER

12

GIST STREET

1
378

N & S

SENATE STREET

Powerplant

4 LANE

LEAPHART

ST

LUCAS

GERVAIS STREET BRIDGE

Gaging Sta

RICHLAND-LEXINGTON CO

SEDIMENT CAPPING AREA

Brookland Sch

AVE

200

BLOSSOM STREET BRIDGE

2

PO

6TH

DRIVE

Brookland-Cayce

0 537 1,074 1,611 2,148

SCALE (APPROXIMATE)

FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 09/13/16 FILE NAME: CONG402

APEX COMPANIES, LLC

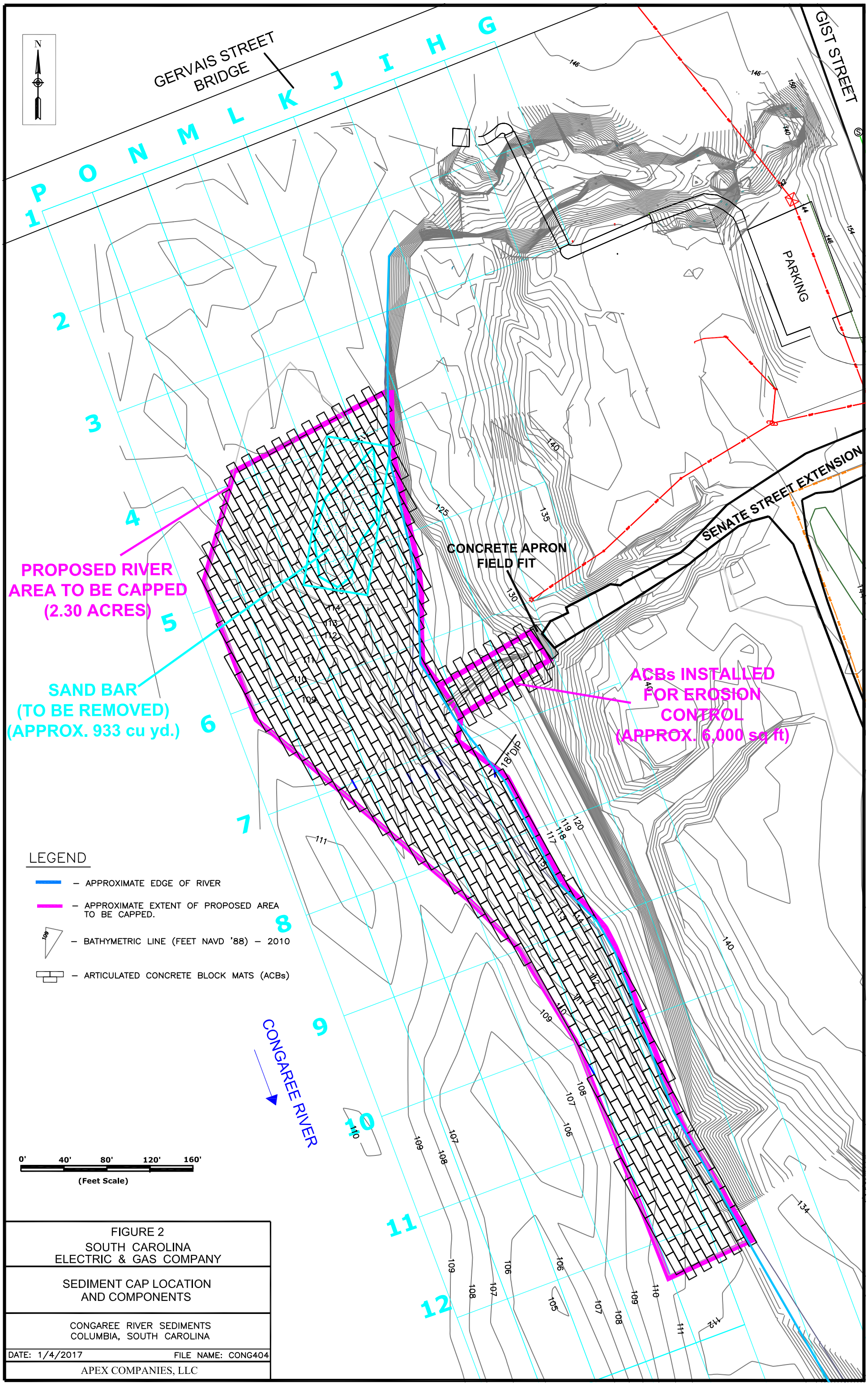


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION AND COMPONENTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 1/4/2017 FILE NAME: CONG404

APEX COMPANIES, LLC

GERVAIS STREET BRIDGE

CONGAREE RIVER

PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)

SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)

AREA TO BE CAPPED

WORK AREA

WORK PLATFORM

SILT CURTAIN

18"DIP

JOB TRAILERS

CONCRETE MAT STORAGE

GATE

GATE

GATE

GATE

GATE

PARKING

GIST STREET

SENATE STREET

ACCESS ROAD

TREE LINE

N

LEGEND

- APPROXIMATE EDGE OF RIVER
- OVERHEAD POWER
- GAS
- FIBER OPTIC
- SANITARY SEWER
- GRAVEL AREAS
- APPROXIMATE LOCATION OF CHAIN LINK FENCE
- PREDOMINANT WIND DIRECTION
- AIR MONITORING STATION LOCATION

0' 100' 200'

(Feet Scale)

FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN SCENARIO
WITH AIR MONITORING STATION LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 12/22/16 FILE NAME: CONG418

APEX COMPANIES, LLC

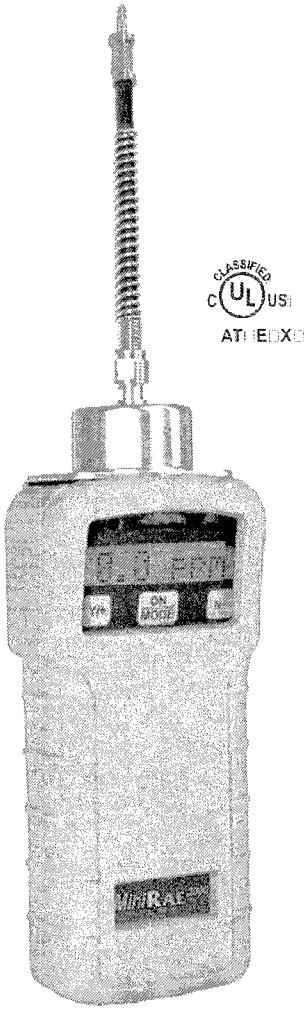
ATTACHMENT A

AIR MONITORING INSTRUMENT INFORMATION

MiniRAE 2000

Portable Handheld VOC Monitor

The rugged MiniRAE 2000 is the smallest pumped handheld Volatile Organic Compound (VOC) monitor on the market. Its Photoionization Detector's (PID) extended range of 0-10,000 ppm makes it an ideal instrument for applications from environmental site surveying to HazMat/Homeland Security.



Key Features

Proven PID technology
The patented 3D sensor provides a 3-second response up to 10,000 ppm and sets a new standard for resistance to moisture and dirt.

Self-cleaning lamp and sensor
Our patented self-cleaning lamp and sensor minimize the need for maintenance and calibration.

The MiniRAE 2000 lamp and sensor can be taken apart in seconds for easy maintenance without any tools!

Measure more chemicals than with any other PID With over 100 Correction Factors built into the MiniRAE 2000 memory and the largest printed list of Correction Factors in the world (300+), RAE Systems offers the ability to accurately measure more ionizable chemicals than any other PID. When a gas is selected from the MiniRAE 2000's library, the alarm points are automatically loaded into the meter.

User friendly screens make it easy to use for simple applications and flexible enough for sophisticated operations.

Drop-in battery When work schedules require putting in more hours than the 10 hours supplied by the standard NiMH battery, the drop-in alkaline pack supplied with every MiniRAE 2000 lets you finish the job.

Rugged Rubber Boot The standard rubber boot helps assure that the MiniRAE 2000 survives the bumps and knocks of tough field use.

Strong, built-in sample pump draws up to 100 feet (30m) horizontally or vertically.

Tough flexible inlet probe

Large keys operable with 3 layers of gloves.

Easy-to-read display with backlight.

Stores up to 267 hours of data at one minute intervals for down-loading to PC (with the datalogging option).

3-year 10.6 eV lamp warranty

Applications

HazMat/Homeland Security
- Initial PPE (personal protective equipment) assessment
- Leak detection
- Perimeter establishment and maintenance
- Spill delineation
- Decontamination
- Remediation

Industrial Hygiene/Safety
- Confined Space Entry (CSE)
- Indoor Air Quality (IAQ)
- Worker exposure studies

Environmental
- Soil and water headspace analysis
- Leaking underground storage tanks
- Perimeter fence line monitoring
- Fugitive emissions (EPA Method 21)
- Vapor recovery breakthrough
- Landfill monitoring

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rev10_ 04.04

ISO 9001 CERTIFIED

RAE SYSTEMS

Specifications*

Default Sensor Settings**

Gas Monitor	Range (ppm)	Resolution (ppm)	Response Time (T90)
VOCs	0 - 999 ppm	0.1 ppm	< 3 sec
	100 - 10,000 ppm	1 ppm	< 3 sec

Detector Specifications

Size	8.2"L x 3.0"W x 2.0"H (21.8 x 7.62 x 5.0 cm)
Weight	20 oz with battery pack (553g) w/o rubber boot
Sensor	Photoionization sensor with standard 10.6 eV or optional 9.8eV or 11.7 eV UV lamp
Battery	• Rechargeable, external, field replaceable Nickel-Metal-Hydride (NiMH) battery pack • Alkaline battery holder (for 4 AA batteries)
Operating Period	10 hours continuous operation
Display	Large LCD, backlight activated manually, with alarms or darkness
Keypad	1 operation and 2 programming keys
Direct Readout	• VOCs as ppm by volume • High and low values • STEL and TWA (in hygiene mode) • Battery and shut down voltage
Alarms	90 dB buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms automatic reset or latching with manual override • Optional plug-in pen size vibration alarm • User adjustable alarm limits
Calibration	Two point field calibration of zero and standard reference gas. Calibration memory of 8 calibration gases, alarm limits, span values and calibration date
Datalogging	Optional 267 hours (at one minute intervals) with date/time. Header information includes monitor serial number, user ID, site ID, date and time
Sampling Pump	• Internal, integrated flow rate 400 cc/min • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto shut-off pump at low flow condition
Communication	Download data and upload instrument set-up from PC through RS-232 link to serial port
Temperature	14° to 104°F (-10° to 40°C)
Humidity	0% to 95% relative humidity (non-condensing)
EM/RFI	Highly resistant to EMI /RFI. Compliant with EMC Directive 89/336/EEC
IP-rating	IP-55: protected against dust, protected against low pressure jets of water from all directions
Hazardous Area Approval	• US and Canada: UL and cUL, Classified for use in Class I, Division 1, Groups A, B, C and D hazardous locations • Europe: ATEX II IG EEx ia IIC T4
Attachment	Durable bright yellow rubber boot w/belt clip & wrist strap
Warranty	Lifetime on non-consumable components (per RAE Systems Standard Warranty), 1 year for 10.6.V PID lamp, 1 year for pump and battery

MiniRAE 2000 and Accessories

Monitor only includes:

- 10.6eV, 9.8eV or 11.7eV as specified
- RAE Systems UV lamp: 10.6eV, 9.8eV or 11.7eV as specified
- 5-inch Flex-I-Probe
- External filter
- Rubber boot with belt clip
- Alkaline battery adapter
- Tool kit
- Lamp cleaning kit
- Nickel-Metal-Hydride battery
- 120/230 V AC/DC wall adapter (if specified)
- Operation and maintenance manual

Monitor with accessories kit adds:

- Hard transport case with pre-cut foam
- 5 porous metal filters and O-rings
- Organic vapor zeroing adapter
- Gas outlet port and tubing

Optional calibration kit adds:

- 10 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

Datalogging monitor adds:

- ProRAE Suite software package for Windows 98, NT, 2000 and XP
- Computer interface cable

Optional Guaranteed Cost of Ownership Program:

- 4-year repair and replacement guarantee
- Annual maintenance service

* On going projects to enhance our products means that these specifications are subject to change

** Performance based on isobutylene calibration

MiniRAE 2000

ATEX

ISO 9001 CERTIFIED

DISTRIBUTED BY:

RAE Systems Inc.
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Tel: 408.752.0723 • Fax: 408.752.0724
Email: raesales@raesystems.com • www.raesystems.com

rev10_ 04.04

Product Overview

All these applications in one small unit

- Indoor air quality monitoring
- Walk-through surveys
- Personal exposure monitoring
- Time & motion studies
- Workplace & plant monitoring
- Fixed-point continuous monitoring
- Remediation personal surveillance
- Remote alarming
- Mobile monitoring in vehicles & aircraft
- Toxicology & epidemiology studies
- Emergency response
- Testing air filtration efficiency

*personal*DataRAM™ Series

Measures airborne particulate concentration in real time

- *p*DR-1000AN
  For passive air sampling applications
- *p*DR-1200
  For active air sampling applications

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

*p*DR-1000AN
Hand-held and fixed-point, real-time aerosol monitor/datalogger

Measure airborne particulate concentration in real-time

The *personal*DataRAM (*p*DR-1000AN) measures mass concentrations of dust, smoke, mists, and fumes in real time, and sounds an audible alarm whenever the user-defined level is exceeded. Conventional filter-based monitoring methods cannot indicate dangerous, real-time dust levels. In contrast, the *p*DR-1000AN alerts you to a problem within seconds, allowing you to take immediate action. With the datalogging enabled, the instrument automatically tags and time stamps the data collected, and stores it for subsequent retrieval, printing, or graphing through a computer.

Highest performance of any real-time personal particulate monitor

With a measurement range from 0.001 to 400 mg/m^3 (auto-ranging), and an optical feedback stabilized sensing system, the *p*DR-1000AN sets the standard for sensitivity, long-term stability and reliability.

The palm-sized *p*DR-1000AN weighs only 18 oz (0.5 kg) for easy portability and attachment to a belt or a shoulder strap. The absence of any moving parts, such as pumps, motors and valves, and the use of low-power semiconductors housed in a ruggedized case ensures long life and dependable operation.

High correlation with gravimetric measurement

The *p*DR-1000AN is a light-scattering photometer (i.e., nephelometer) incorporating a pulsed, high output, near-infrared light emitting diode source, a silicon detector/hybrid preamplifier, and collimating optics and a source reference feedback PIN silicon detector. The intensity of the light scattered over the forward angle of 50^0 to 90^0 by airborne particles passing through the sensing chamber is linearly proportional to their concentration. This optical configuration produces optimal response to particles in the size range of 0.1-10 µm, achieving high correlation with standard gravimetric measurements of the respirable and thoracic fractions.

Simple zeroing and calibration

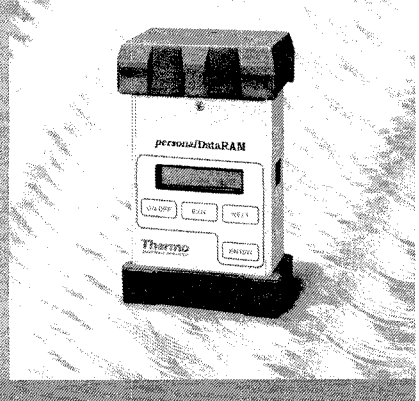
The *p*DR-1000AN arrives practically ready to use after the easy zeroing step. The unit comes gravimetrically calibrated in mg/m^3 (NIST traceable) using standard SAE Fine test dust (ISO Fine). Zeroing with particle-free air is accomplished quickly and effectively under field conditions using the zeroing kit included with the instrument. Internal firmware controls an automatic calibration check. To maximize efficiency in the field, gravimetric calibration can be performed by comparison with a filter sampler and programming of the calibration constant.

Standard Accessories

- Universal voltage power supply
- PC communications software
- Zeroing kit
- Belt clip kit
- Instruction manual
- Carrying case
- Signal output cables

Optional Accessories

- Rechargeable battery pack (NiMH)
- Active sampling kit (converts *p*DR-1000AN to *p*DR-1200)
- Portable pump unit
- Shoulder strap
- Remote alarm interface
- Wall mounting bracket



*p*DR-1200
Active aerosol monitor/datalogger, plus aerodynamic sizing

Designed for active particulate monitoring applications

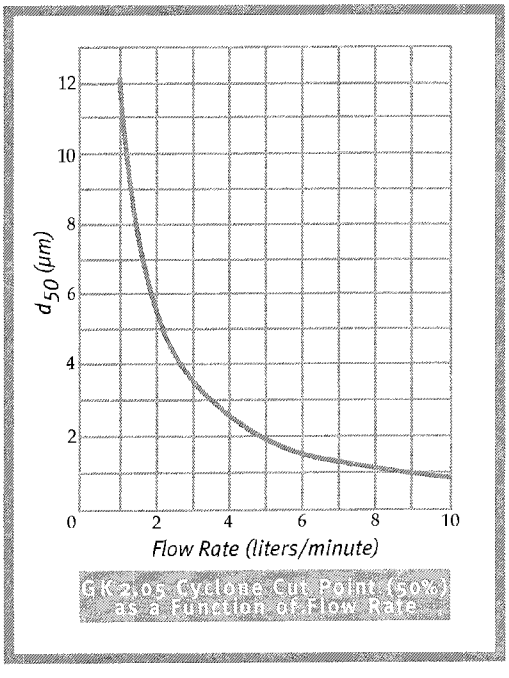
The *personal*DataRam™ (model *p*DR-1200) performs active sampling applications and aerosol sizing. The *p*DR-1200 requires a vacuum pump module to perform particle size selective measurements under field conditions. The separate pump (not included) is required for active sampling and aerosol sizing. With optional inlet accessories, the *p*DR-1200 is excellent for ambient air measurements under variable wind and high humidity conditions. It is ideal for respirable, thoracic, and PM2.5 monitoring, as well as continuous emission and test chamber monitoring. With an isokinetic sampling set, the pDR-1200 can be used for stack and duct extractive sampling monitoring. Membrane filters can be used to capture particles for particles for subsequent laboratory analysis.

Aerodynamic particle sizing

The *p*DR-1200 incorporates an optimally designed metal cyclone (BGI Model GK 2.05) or the optional low flow cyclone (BGI Model Triplex SCC1.062-CUST) especially selected for PM2.5 collection at 1.5 LPM. By operating the pump at specific sampling flow rates, the *p*DR-1200 cyclone preseparator provides precisely defined particle size cuts.

Primary calibration and particle samples by filter collection

An integral filter holder directly downstream of the photometric sensing stage accepts 37 mm filters. The calibration constant of the *p*DR-1200 is simply adjusted to coincide with the filter-determined concentration. Primary gravimetric calibration of the instrument concentration readout is easily accomplished under actual field conditions by means of this integral filter. Use membrane filters for chemical analysis or concurrent gravimetric measurements.

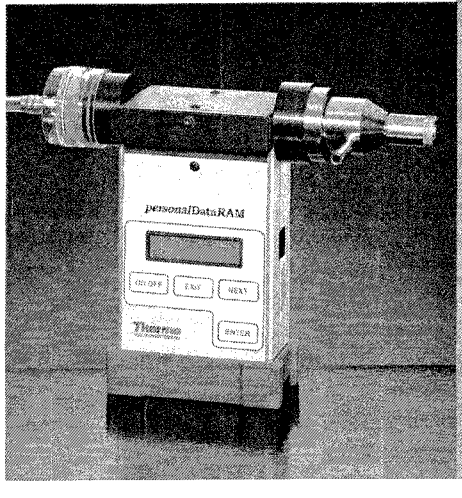


GK 2.05 Cyclone Cut Point (50%) as a Function of Flow Rate

*p*DR-PU Attachable Pump Module

This optional accessory is designed for use with the *personal*DataRAM Model *p*DR-1200. It incorporates a dual-chamber diaphragm pump, a volumetric flow sensing, and control unit. The pump module operates from either an optional, rechargeable NiMH battery pack or from AC line current using the power supply/charger supplied with the *personal*DataRAM. The *p*DR-PU is designed as a modular unit that can be used in various combinations.

- Flow rate (user adjustable): 1 to 4 liters/minute
- Maximum pressure drop: 10 in H2O (25 mbar)
- Precision of constant flow rate control: ±2%
- Power: 9 VDC, 200 mA at 4 liters/minute (approximate)
- Dimensions: 4 in (100 mm) H x 3.6 in (90 mm) W x 1.8 in (45 mm) D
- Weight: 1 lb (0.45 kg)



personalDataRAM™ ***Series***

At last,
a compact,
versatile,
real-time
aerosol monitor

Specifications

Concentration Measurement Range (auto-ranging)
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm sg = 2.5, as aerosolized)
0.001 to 400 mg/m^3

Scattering Coefficient Range
1.5 x 10^{-6} to 0.6 m^{-1}(approx) @ lambda = 880 nm

Precision/Repeatability Over 30 Days (2-sigma at constant temperature and full battery voltage)

- ±2% of reading or ±0.005 mg/m^3, whichever is larger, for 1 second averaging time
- ±0.5 of reading or ±0.0015 mg/m^3, whichever is larger, for 10 second averaging time
- ±0.2% of reading or ±0.0005 mg/m^3, whichever is larger, for 60 second averaging time

Accuracy
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm, sg = 2.5, as aerosolized)
±5% of reading ±precision

Resolution
0.1% of reading or 0.001 mg/m^3, whichever is larger

Particle Size Range of Maximum Response
0.1 to 10 µm

Flow Rate Range (model *p*DR-1200)
1-10 liters/min (external pump required)

Aerodynamic Particle Sizing Range
1.0 to 10 µm (*p*DR-1200 only)

Concentration Display Updating Interval
1 second

Concentration Display Averaging Time (user selectable)
1 to 60 seconds

Alarm Level Adjustment Range (user selectable)
Selectable over entire measurement range

Alarm Averaging Time (user selectable)
Real-time (1 to 60 seconds) or STEL (15 minutes)

Datalogging Averaging Periods (user selectable)
1 second to 4 hours

Total Number of Data Points That Can Be Logged in Memory
More than 13,300

Number of Data Tags (data sets)
99 (maximum)

Logged Data

- Each data point: average concentration, time/date, and data point number
- Run summary: overall average and maximum concentrations, time/data of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration, and time/date of occurrence, averaging (logging) period, calibration factor, and tag number

Analog Signal Output
0 to 5 V and 4 to 20 mA, with selectable full scale ranges between 0.1 and 400 mg/m^3

Power

- Internal battery 9 V alkaline, 20 hour run time (typical)
- Internal battery 9 V lithium, 40 hour run time (typical)
- AC source universal voltage adapter (included) 100-250 volts, 50-60 Hz (CE marked)
- Optional battery pack rechargeable NiMH, 72 hour run time typical (*p*DR-BP)

Readout Display
LCD 16 characters (4 mm height) x 2 lines

Serial Interface
RS232, 4800 baud

Computer Requirements
PC compatible, 486 or higher, Windows 95® or higher

Storage Environment
-20°C to 70°C (-4°F to 158°F)

Operating Environment
-10°C to 50°C (14°F to 122°F), 10 to 95% RH, non-condensing

Dimensions (max external)
153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D (*p*DR-1000AN)
160 mm (6.3 in) H x 205 mm (8.1 in) W x 60 mm (2.4in) D (*p*DR-1200 including cyclone and filter holder)

Weight
0.5 kg (18 oz) (*p*DR-1000AN)
0.68 kg (24 oz) (*p*DR-1200)

Approvals

- Intrinsic safety approval by US Mine Safety & Health Administration (MSHA) coal-mining environments containing methane gas (the *p*DR-PU pump is not approved by MSHA)
- US FCC Rules (Part 15)
- CE certified

Lit_PDREID_06/05

Thermo Electron Corporation
Environmental Instruments
27 Forge Parkway
Franklin MA USA 02038
www.thermo.com/eh
1.866.282.0430
+1.508.520.0430
+1.508.520.1460 fax

ATTACHMENT B

PREDOMINANT WIND DIRECTION INFORMATION

FIGURE 1

SOUTH CAROLINA ELECTRIC & GAS COMPANY

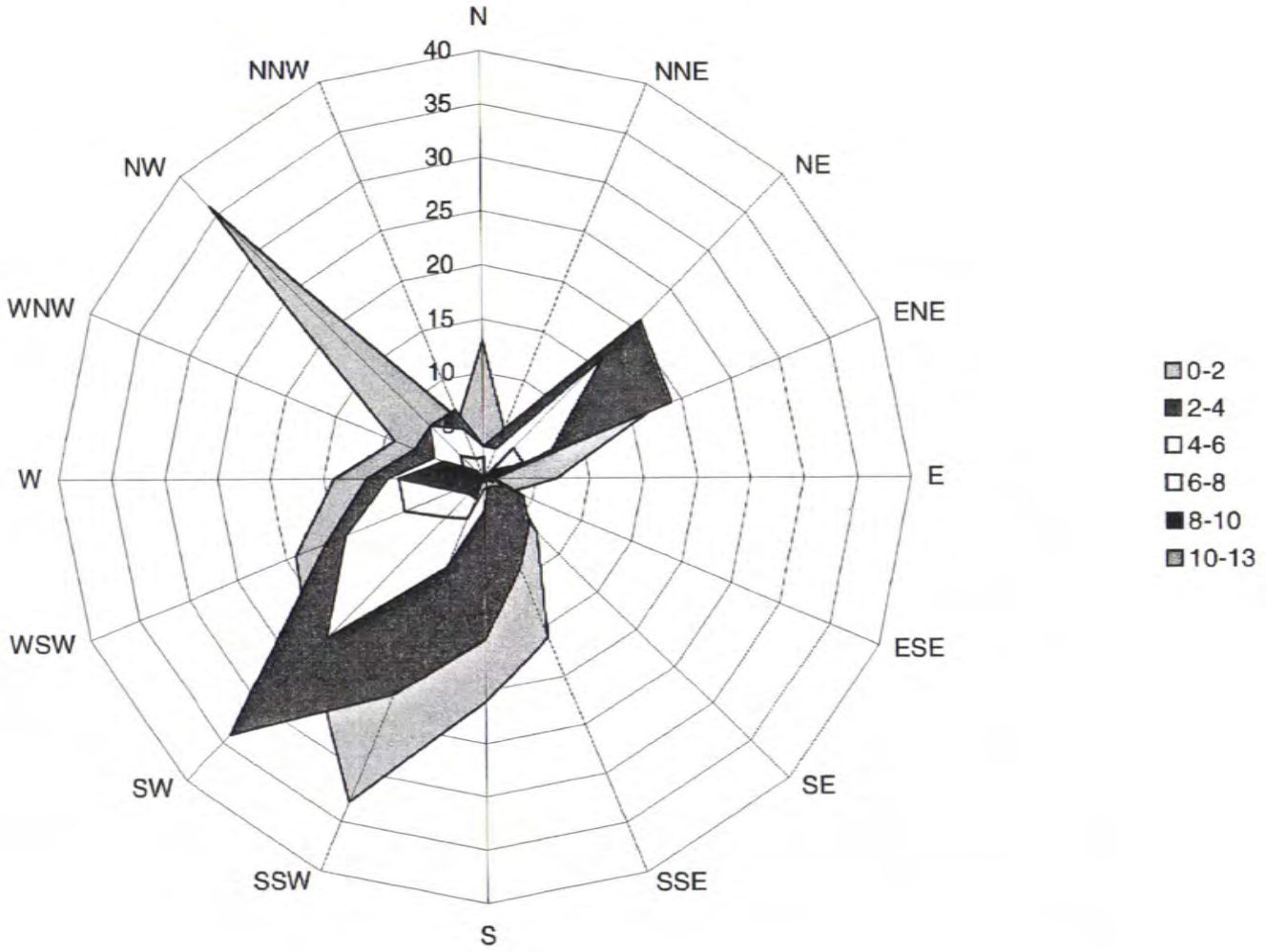
LOCATION OF THE PROJECT AREA WITH RESPECT TO THE WEATHER STATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

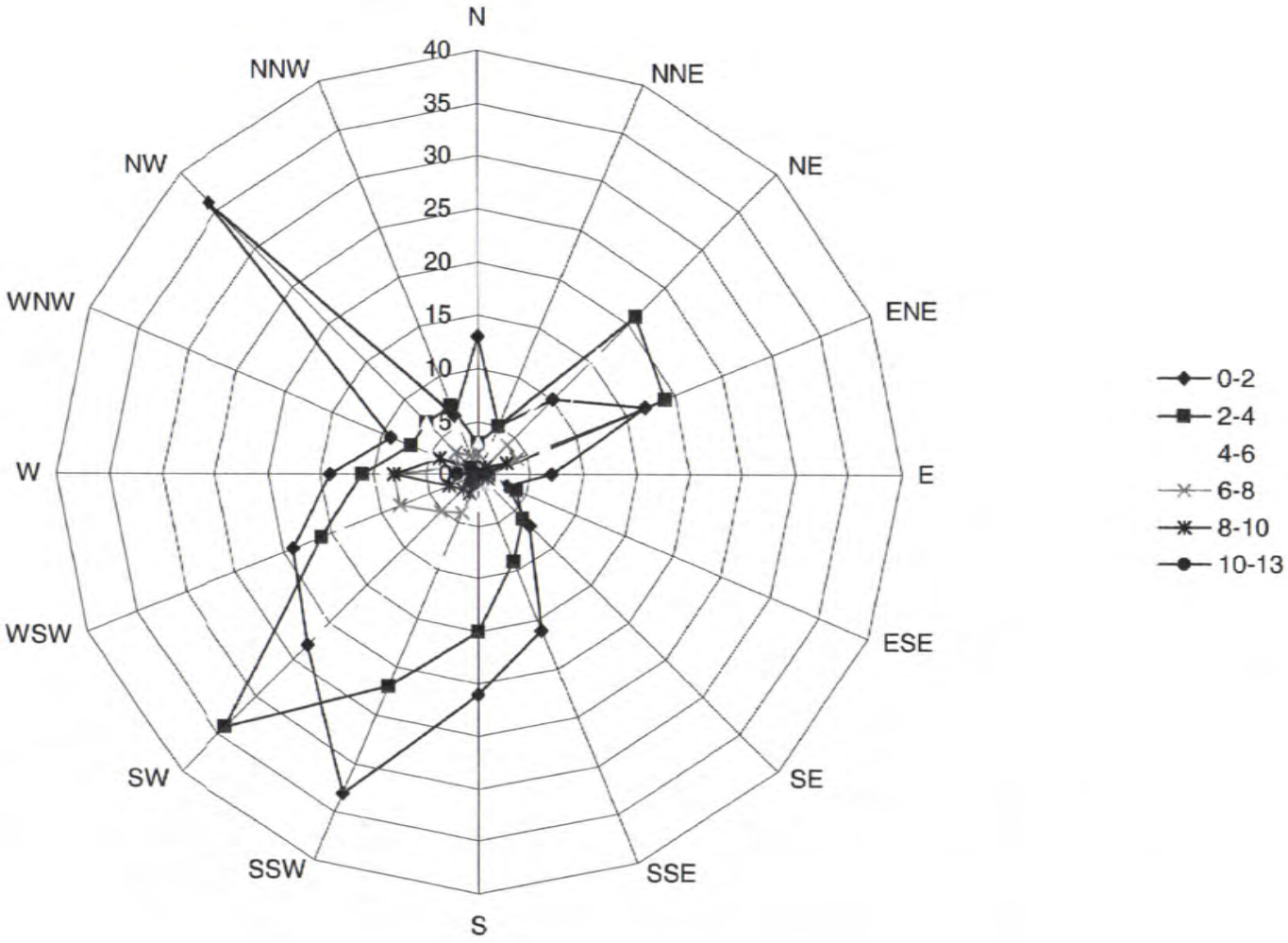
DATE: 05/05/2014 FILE NAME: WEATHER STATION

APEX COMPANIES, LLC

Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



Calculation of a Site-specific airborne dust action level for PAHs:

EQUATION USED IN THIS CALCULATION

$$\text{Dust action level} = \frac{(10^6)(\text{Exposure Limit mg/m}^3)}{(\text{Soil/Waste Concentration mg/kg})(\text{Safety Factor})}$$

Constituent	OSHA Permissible Exposure Limit[(1)] (mg/m^3)	Total PAH Max Soil Concentration[(2)] (mg/Kg)	Safety Factor	Site-specific Dust Exposure Limit (mg/m^3)
Total PAHs	0.2	9429	4	5.30

Conversion to ug/m^3 5.30 mg/m^3 x 1000 ug/m^3= 5300 ug/m3

Notes:

(1) OSHA Permissible Exposure Limit is for Coal Tar Pitch Volatiles which, by OSHA definition, include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter.

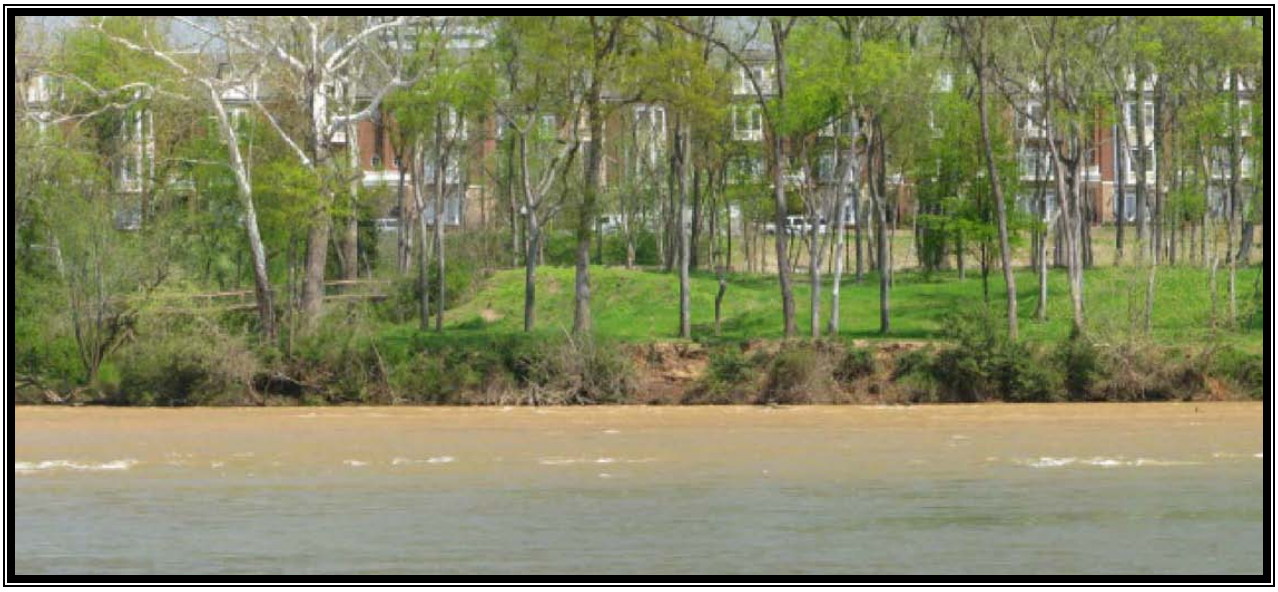
(2) The highest concentration of Total PAHs detected was collected from SCE&G S-1 on 6/28/2010.

APPENDIX K

RIVERBANK AND SHORELINE RESTORATION PLAN

RIVERBANK AND SHORELINE RESTORATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA



September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

RIVERBANK AND SHORELINE
RESTORATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach. It is SCE&G's intent to complete the cap installation with as little of an impact on the Congaree River shoreline and riverbank as possible. However, some impacts due to construction of access points, etc. will be required. Following completion of the cap installation the Riverbank and Shoreline Restoration Plan will be implemented to address any areas impacted by construction activities.

This Plan was developed to provide additional details regarding the planned riverbank and shoreline restoration activities that will be completed at the end of the project. This Plan includes the use of bio-restoration techniques for the riverbank and riparian areas disturbed by construction activities. The actual approach, locations and techniques for shoreline protection are assumed and may have to be modified slightly during construction. This Plan will serve as a guide for the planned restoration techniques and recognizes that actual site conditions will dictate the exact extent, location, and materials of construction for the shoreline restoration.

SEDIMENT CAPPING ACTIVITIES

The project basically entails the placement of a physical barrier in the form of an engineered capping system over the majority of impacted sediment within the project area. Figure 2 provides the limits of the planned Modified Removal Action (MRA) area and the currently anticipated cap placement scenario. Based on the design criteria, the cap will consist of a geotextile fabric material overlain by articulated concrete blocks (ACBs) connected together to form a mat. It is currently envisioned that the ACBs will be placed from approximately the 116-foot elevation line and they will extend westward, out into the river from approximately 50 to 200 feet, depending on the location. Landside support zone construction activities as well as improved access to the river project area will be required. SCE&G will strive to limit

impacts to the riverbank area, but some encroachment will be required in order to gain access to the work area. Figure 3 provides the currently anticipated scenario where several access points will be constructed in the riverbank to access the work area. Once the cap is installed, the landside support zone equipment and structures will be demobilized, and the upland footprint of the project area will be restored to pre-removal action conditions. The following sections describe the specific site restoration activities associated with the river, shoreline and riverbank areas.

Riverbank and Shoreline Restoration

Figure 3 provides the site operations plan scenario and highlights the approximate areas where the eastern shoreline of the riverbank will likely be disturbed as a result of construction activities. These locations are chosen for illustrative purposes and may be adjusted based on the final plan for accessing the work area and the need for creating additional access points other than the Senate Street alluvial fan. Areas not slated for disturbance are not shaded and will be demarcated with flagging or fencing to ensure that they are not damaged by capping operations or heavy equipment movement. Oversight personnel will monitor these areas regularly in order to prevent damage.

In areas where shoreline impacts are unavoidable, SCE&G will conduct restoration activities, which will include recreating the approximate shoreline slope, stabilization of the bank via riprap and/or bioengineered solutions and restoration of vegetative cover, where practical. SCE&G's goals are to:

- Minimize riverbank disturbance whenever possible;
- To restore disturbed areas to natural approximate pre-removal action conditions with characteristics that resist future erosion; and
- To utilize bioengineering techniques and structures to the extent practical when repairing impacted shoreline.

In areas where it is necessary, placement of geotextile and riprap along the streambed and up the bank to the approximate normal river flow level will be conducted to fortify the lower bank and resist future erosion and undercutting.

Figure 4 provides the currently envisioned restoration techniques for each general area of planned disturbance. Figures 5 through 8 show details and examples of these techniques. In general, different techniques will be utilized based on the potential for future erosion due to river characteristics and flow velocity in the vicinity of each portion of the riverbank. In high water velocity or turbulent areas, stabilization of the shoreline will take priority over re-establishing vegetative cover. As a result, in some areas it will be necessary to utilize restoration techniques and material that is more resistant to erosion (i.e., hardscape) in order to ensure that the bank is capable of withstanding high velocity and turbulent flows. Figure 5 provides examples of these types of restoration techniques. As currently envisioned, the area north of the Senate Street alluvial fan may be a location where these stabilization practices will likely be necessary.

In areas where river flow characteristics are more conducive, bioengineered solutions, such as those shown on Figures 6 through 8, will be employed. These alternatives primarily focus on incorporating vegetative restoration with stabilization. Shoreline cover re-creation such as staging partially submerged trees or other habitat enhancements will also be conducted, as feasible. In some areas, it may be

appropriate to utilize erosion control matting and plant native southeastern shrubs, grasses and forbs secured by a biodegradable mat. As currently envisioned, the remainder of the disturbed shoreline downstream of the Senate Street alluvial fan can be restored using these techniques (Figure 4).

This Plan was developed in order to convey the current river and shoreline restoration plans. As project plans are further developed prior to implementation through consultation with the chosen sediment cap construction contractor, certain details or specifications of this Plan may be modified in order to reflect minor changes in the project or input from applicable experts. The USACE, SCDHEC and other agencies, as may be appropriate, will be made aware of any major modifications to planned activities prior to implementation. Details pertaining to the completion of the restoration activities will be provided in the final report for the project. Monitoring of the shoreline and restored portions of the project area will be a component of the Post-Construction Monitoring/Mitigation Plan. If significant erosion or other issues are identified in the restored areas during the post construction monitoring, they will be addressed, as needed.

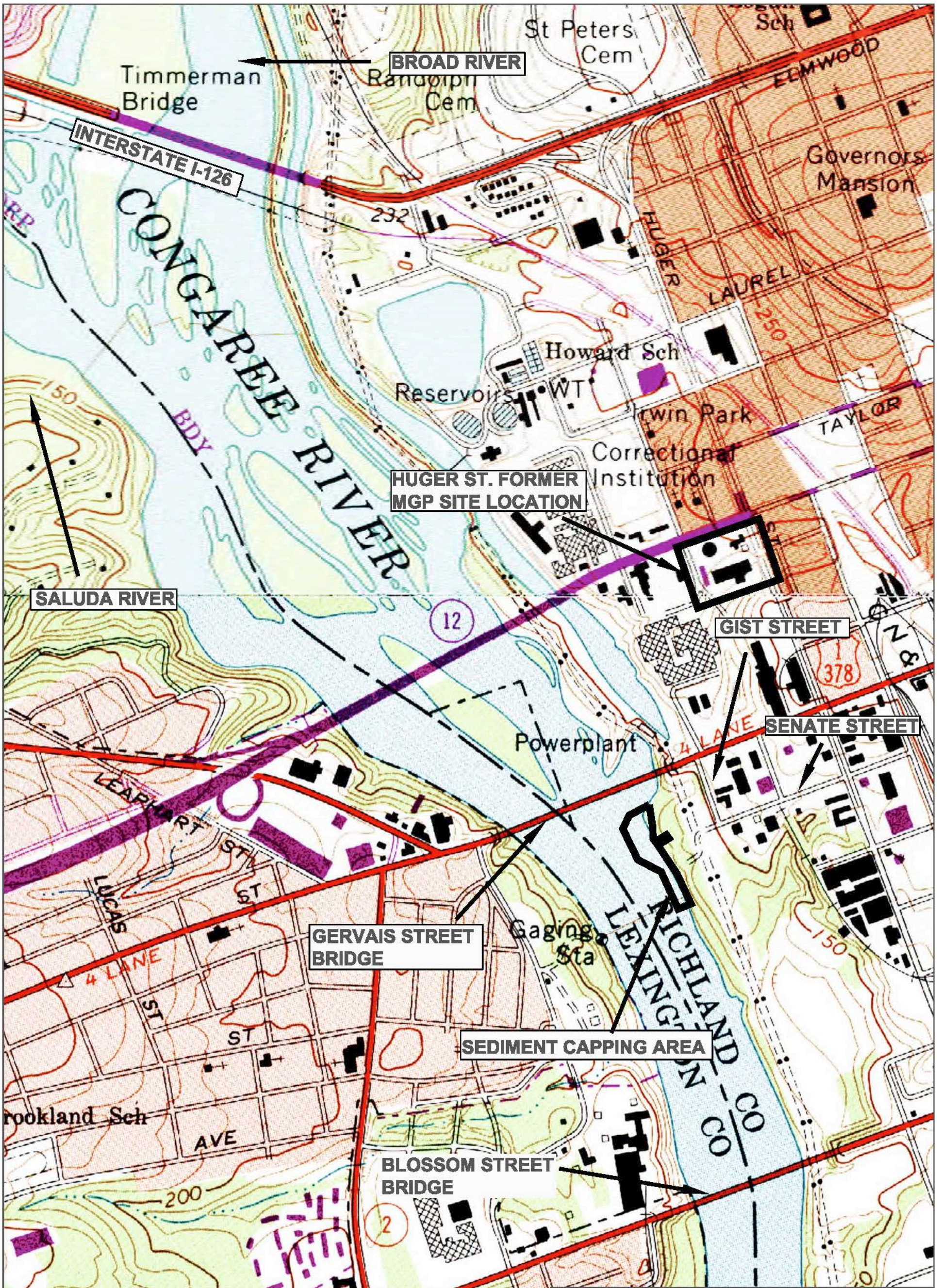


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

18"DIP

CONGAREE RIVER

LEGEND

- — APPROXIMATE EDGE OF RIVER
- — APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.
- — BATHYMETRIC LINE (FEET NAVD '88) – 2010
- — ARTICULATED CONCRETE BLOCK MATS (ACBs)

40' 80' 120'

(Feet Scale)

FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION
AND DESIGN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/2017 FILE NAME: CONG461

APEX COMPANIES, LLC

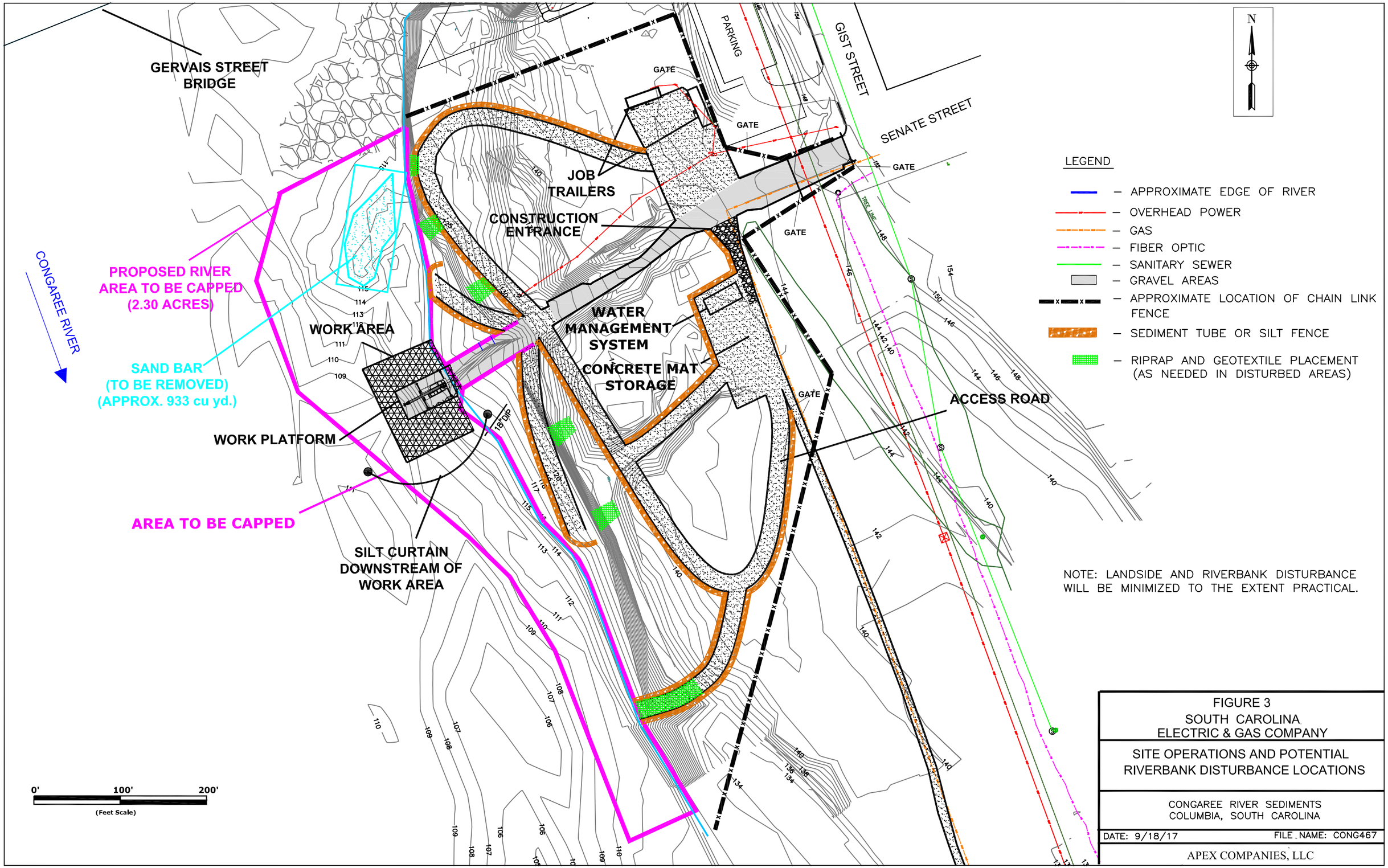


FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS AND POTENTIAL RIVERBANK DISTURBANCE LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/18/17 FILE NAME: CONG467

APEX COMPANIES, LLC

LEGEND

– APPROXIMATE EDGE OF RIVER

– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.

– BATHYMETRIC LINE (FEET NAVD '88) – 2010

– OVERHEAD POWER

– GAS

– FIBER OPTIC

– SANITARY SEWER

– APPROXIMATE LOCATION OF RIPRAP PLACEMENT

– APPROXIMATE LOCATION OF BIOENGINEERED SOLUTIONS

– TRANSITION FROM HARDSCAPE TO BIOENGINEERED SOLUTIONS

N

Culvert Outfall

Unnamed Tributary #1

Unnamed Tributary #1

Gervais Street Bridge

G H I J K L M

GIST STREET

Gist Street

PARKING

Northern Boulder Field

Sand Bar

Senate Street

SENATE STREET EXTENSION

TREE LINE

BOAT RAMP AREA

18"DIP

5 6 7 8 9 10 11 12 13 14

CONGAREE RIVER

0' 100' 200'

(Feet Scale)

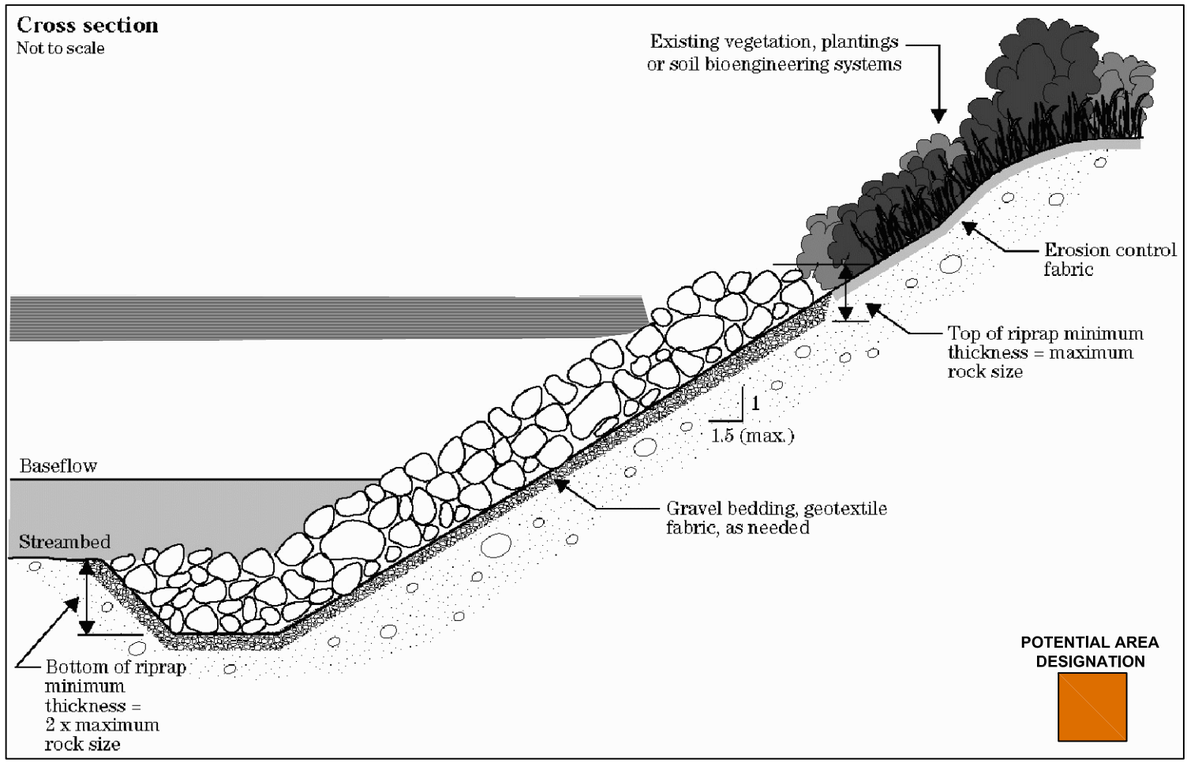
FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SHORELINE RESTORATION SCENARIO

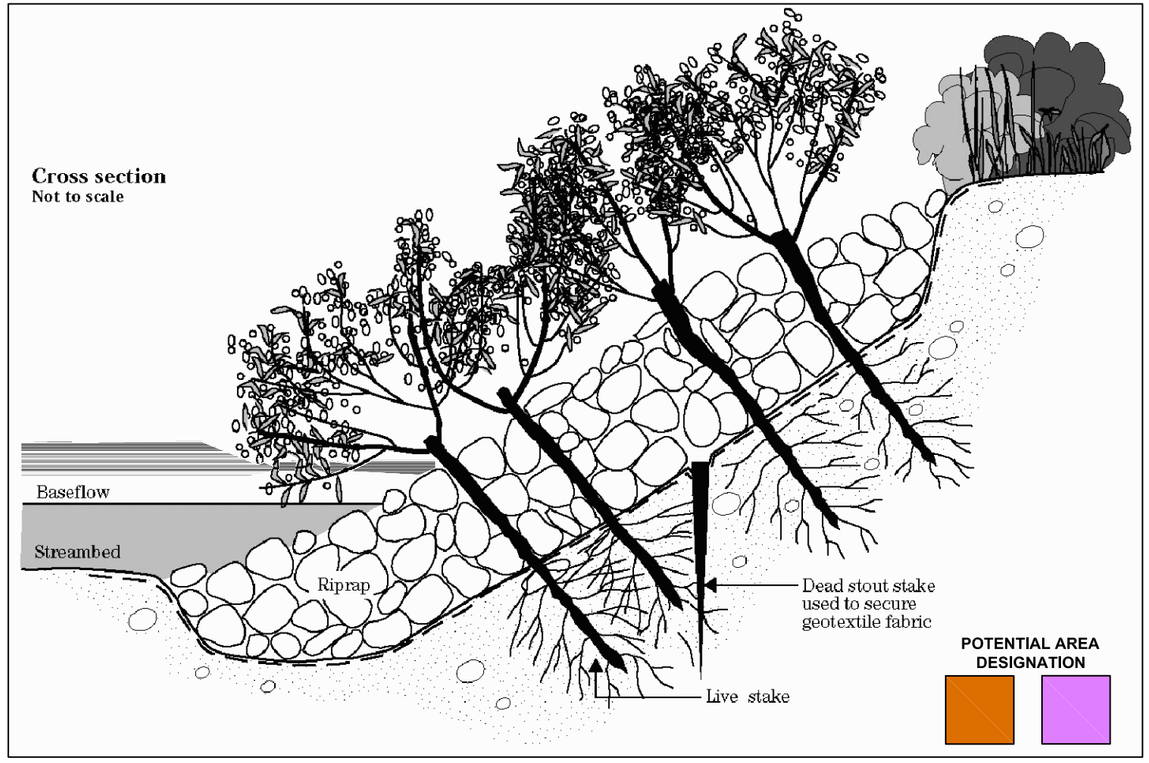
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/19/2017 FILE NAME: CONG468

APEX COMPANIES, LLC



TYPICAL RIPRAP RIVER BANK STABILIZATION
(OR OTHER HARDSCAPE MATERIAL)



TYPICAL RIPRAP RIVER BANK STABILIZATION WITH JOINT PLANTING
(OR OTHER HARDSCAPE MATERIAL)

NOTES:
1. RIPRAP BANK STABILIZATION WILL BE UTILIZED IN AREAS WITH HIGH VELOCITY AND OR TURBULENT RIVER FLOWS TO GUARD AGAINST FUTURE RIVERBANK EROSION.
2. JOINT PLANTING WILL BE CONDUCTED, IF FEASIBLE, TO PROVIDE VEGETATIVE COVER IN RIPRAP AREAS AND TO PROVIDE A TRANSITION TO OTHER BIOENGINEERED AREAS.
3. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
4. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
5. TABLES 1, 2 AND 3 ON FIGURE 7 PROVIDE PLANT SPECIFICATIONS.

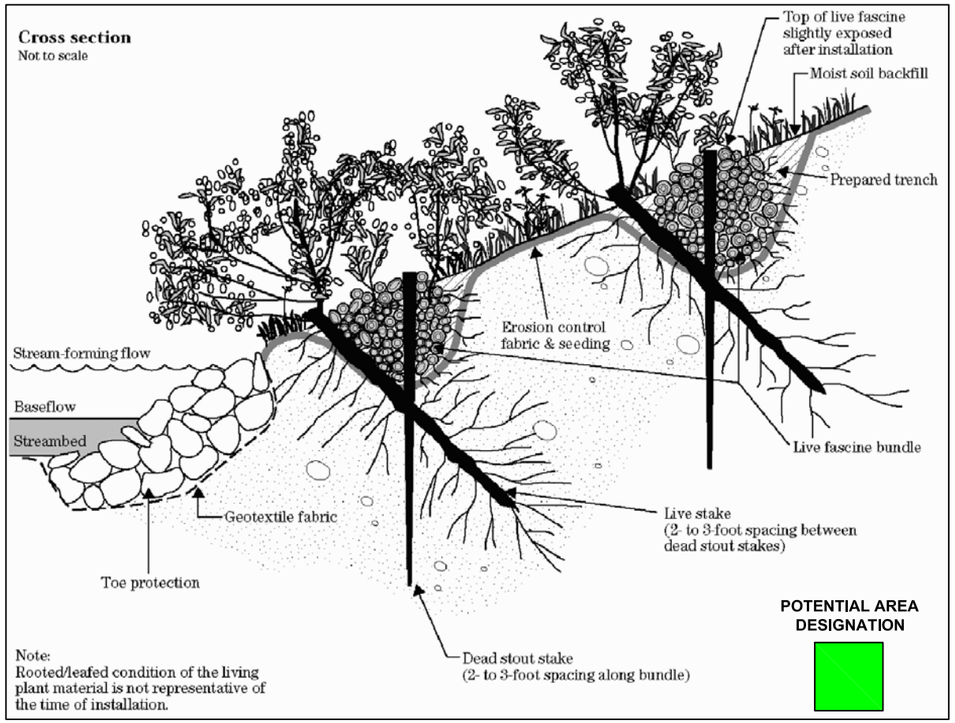
FIGURE 5
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

HARDSCAPE STABILIZATION
DETAILS

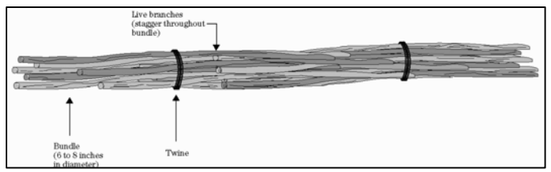
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/28/17 FILE NAME: CONG469

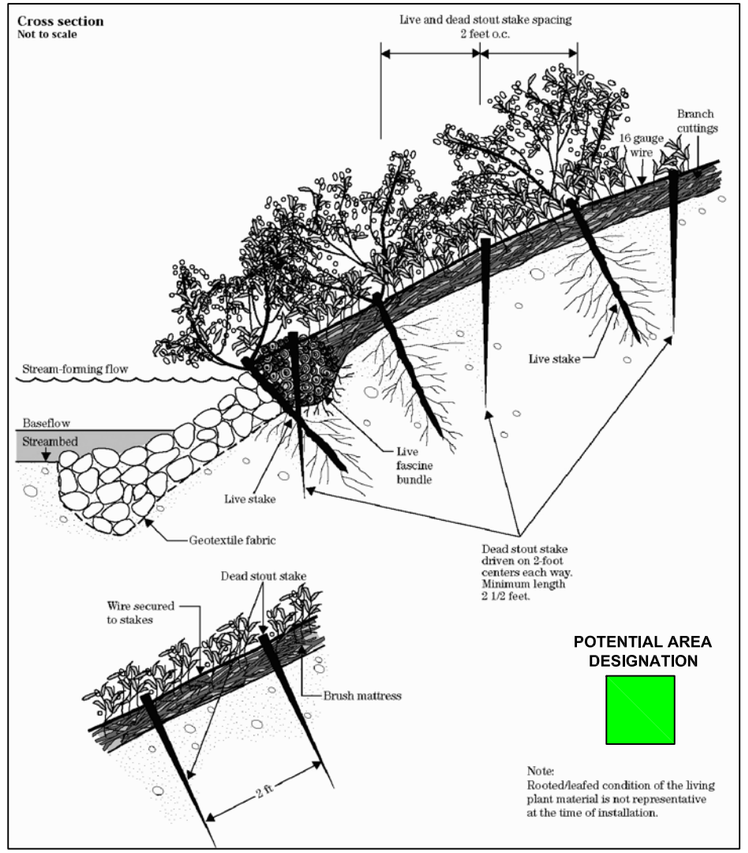
APEX COMPANIES, LLC



LIVE FASCINE STABILIZATION DETAIL



LIVE FASCINE DETAIL



BRUSHMATTRESS BANK STABILIZATION DETAIL

NOTES:

1. LIVE FASCINES ARE AN OPTION FOR FLATTER SLOPE (3:1 OR FLATTER) STABILIZATION IN AREAS WHERE RIVER VELOCITY AND TURBULENCE CONDITIONS DO NOT REQUIRE ADDITIONAL STABILIZATION MEASURES.
2. LIVE FASCINES ARE LONG BUNDLES OF BRANCH CUTTINGS THAT CONTAIN SOME LIVE BRANCHES.
3. BRUSHMATTRESS PROVIDE A COMBINATION OF LIVE STAKES, LIVE FASCINES AND BRANCH CUTTINGS AND PROVIDE MORE PROTECTION FROM EROSION OF STEEPER SLOPES OR AREAS OF HIGHER VELOCITY RIVER FLOW.
4. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
5. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
6. TABLES 1, 2 AND 3 ON FIGURE 7 PROVIDE PLANT SPECIFICATIONS.

FIGURE 6
SOUTH CAROLINA ELECTRIC & GAS COMPANY

BIOENGINEERED STABILIZATION OPTION DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/19/17 FILE NAME: CONG469

APEX COMPANIES, LLC

TABLE 1
GRASSES AND FORBES

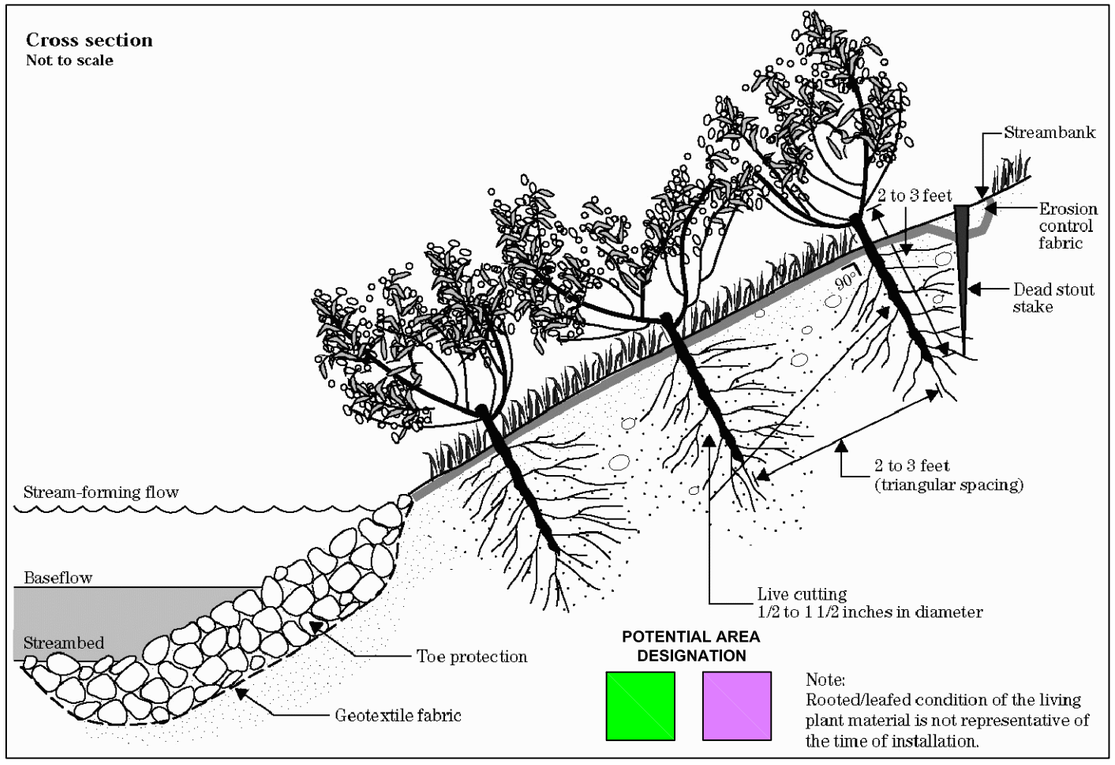
Schientific Name	Common Name	Soil Preference	Drought Tolerance	Shade Tolerance	Flood Tolerance
Ammophila breviligulata	American beachgrass	sands	fair	poor	
Andropogon gerardii	Big bluestem	loams	good	poor	fair
Arundo donax	Giant reed	sandy	good	poor	poor
Herarthria altissima	Limpograss	sandy	poor	poor	good
Panicum amarulum	Coastal panicgrass	sands to loams	good	poor	good
Panicum virgatum	Switchgrass	loams to sands	good	poor	good
Paspalum vaginatum	Seashore paspalum	sandy		poor	good
Pennisetum purpureum	Elephant grass			poor	
Spartina pectinata	Prairie cordgrass	sands to loams	good	fair	fair
Zizaniopsis miliacea	Giant cutgrass	loam	poor	poor	good

TABLE 2
PLANTS SUITABLE FOR ROOTING

Scientific Name	Common Name	Plant Type	Rooting Ability (from cutting)
Acer negundo	Boxelder		
Asimina triloba	Pawpaw	small tree	poor to fair
Baccharis balimifolia	Groundsel bush	medium shrub	good
Cephalanthus occidentalis	Buttonbush	large shrub	fair to good
Cornus amomum	Silky dogwood	small shrub	fair
Cornus sericia	Red osier dogwood		
Gleditsia triacanthos	Honeylocust	medium tree	poor to fair
Populus deltoides	Eastern cottonwood	tall tree	very good
Robinia sp.	Black locust		
Salix discolor	Pussy willow	large shrub	very good
Salix nigra	Black willow	small to large tree	good to excel
Salix purpurea	Purpleosier willow	medium tree	excel
Sambucus canadensis	American elder	medium shrub	good
Viburnum dentatum	Arrowwood	medium to tall shrub	good
Viburnum lentago	Nannyberry	large shrub	fair to good

TABLE 3
WOODY PLANTS

Scientific Name	Common Name	Plant Type	Establishment Speed
Acer negundo	Boxelder	small to medium tree	fast
Acer rubrum	Red maple	medium tree	fast
Alnus serrulata	Smooth alder	large shrub	medium
Amorpha fruitcosa	False indigo	shrub	fast
Aronia arbutifolia	Red Chokeberry	shrub	fast
Asimina triloba	Pawpaw	small tree	
Betula nigra	River birch	medium to large tree	fast
Carpinis caroliniana	American hornbeam	small tree	slow
Carya cordiformis	Bitternut hickory	tree	
Catalpa bignonioides	Southern catalpa	tree	fair
Celtis laevigata	Sugarberry	medium tree	slow
Celtis occidentalis	Hackberry	medium tree	slow
Cephalanthus occidentalis	Buttonbush	large shrub	medium
Chionanthus virginicus	Fringe tree	small tree	
Clethera ainifolia	Sweet Pepperbush	shrub	
Cornus amomum	Silky dogwood	small shrub	medium
Cornus florida	Flowering dogwood	small tree	fair
Diospyros virginiana	Persimmon	medium tree	fair
Fraxinus pennsylvanica	Green ash	medium tree	fast
Gleditsia triacanthos	Honeylocust	medium tree	fast
Ilex decidua	Possomhaw	large shrub to small tree	
Ilex opaca	American holly	small tree	medium
Ilex verticillata	Winterberry	small to large shrub	
Juglans nigra	Balck walnut	medium tree	fair
Juniperus virginiana	Eastern redcedar	large tree	medium
Liquidambar styraciflua	Sweetgum	large tree	
Liriodendron tulipifera	Tulip poplar	large tree	fast
Magnolia virginiana	Sweetbay	small tree	
Nyssa sylcatica	Blackgum	tall tree	slow
Ostrya virginiana	Hophornbean	small tree	slow
Platanus occidentalis	Sycamore	large tree	fast
Populus deltoides	Eastern cottonwood	tall tree	fast
Quercus alba	White oak	large tree	slow
Quercus lyrata	Overcup oak	medium tree	slow
Quercus michauxii	Swamp chestnut oak	medium tree	fair
Quercus nigra	Water oak	medium tree	slow
Quercus phellos	Willow oak	medium to large tree	medium
Quercus shumardii	Shumard oak	large tree	slow
Rhododenron atlanticum	Coast azalea	small shrub	
Rhododendron viscosum	Swamp azalea	shrub	
Salix nigra	Black willow	small to large tree	fast
Viburnum nudum	Swamp haw	large shrub	



4-2 JOINT PLANTING BIOENGINEERED BANK STABILIZATION OPTION DETAIL

NOTES:
1. LIVE STAKES WILL POTENTIALLY BE UTILIZED IN CONJUNCTION WITH OTHER BIOENGINEERED SOLUTIONS, AS NEEDED, IN AREAS WHERE RIVERBANK DISTURBANCE EXTENDS SIGNIFICANTLY ABOVE THE NORMAL WATERLINE AND RIVER FLOW VELOCITY AND TURBULENCE CONDITIONS DO NOT REQUIRE ADDITIONAL STABILIZATION MEASURES.
2. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
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6. TABLES 1, 2 AND 3 ON FIGURE 7 PROVIDE PLANT SPECIFICATIONS.

FIGURE 7
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

RIVERBANK TOE STABILIZATION
AND BIOENGINEERING OPTION DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/19/17 FILE NAME: CONG469

APEX COMPANIES, LLC

APPENDIX L

SITE OPERATIONS PLAN

SITE OPERATIONS PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

October 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

SITE OPERATIONS PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach.

The following details regarding the anticipated project site preparation and support activities were based primarily on the previously (and successfully) executed FDP work plan and involved using the adjacent property for site support activities. However, it should be noted that SCE&G may need to implement an alternate plan for project access and support, should this area not be available at the time of construction. In the event that the adjacent landside area is not available, SCE&G will submit an Alternate Site Operations Plan (Alternate SOP). The Alternate SOP will not affect any of the previously stated capping objectives.

This Site Operations Plan is intended to provide a description of the planned general procedures to safely and effectively implement the proposed sediment cap installation activities. Several site preparation activities will take place prior to initiating the cap construction work in order to assure the safe and effective implementation of the response action. Once the site preparation activities are completed, the river-based construction will be initiated, and it is anticipated that the work will be completed in one construction season. The conceptual approach to the Site Operations Plan is summarized on the attached Figure 3. Some variations to the plan and site layout may occur, depending on site conditions encountered at the time of implementation. The actual layout for site operations will be finalized in consultation with the construction contractor and provided to SCDHEC for review and concurrence.

PREPARATORY ACTIVITIES

Landside Site Setup

Site preparation and operations will involve the following activities:

- Landside support zone construction including installation of site security fencing and gates and capping material and equipment staging areas;
- Re-establishment of the office trailer area utilized during the Field Demonstration Project (FDP) including establishment of electrical power, sanitary facilities and internet connection;
- Installation of erosion and sedimentation controls;
- Work zones; and
- Utility clearance and management.

A gravel covered parking and office area was established prior to initiation of the FDP. It included office trailers and security fencing and gates. This area will be re-established for the sediment capping project. Utility and communication lines are already installed and will be reconnected to the office trailers once they are placed at the site. Figure 3 provides the fencing and office trailer locations. A vehicle gate will be installed at the site entrance on the access road that leads to the intersection of Gist and Senate Streets. This will be the sole entry and exit point for the project. The area to the south of the access road will be graded and geotextile and gravel will be placed, as needed, to provide adequate equipment and material storage and staging areas.

Access improvements will be a critical component of the overall project. The current asphalt access road that leads to the alluvial fan will require improvement, especially at the end near the alluvial fan. This area will be graded to reduce the slope and geotextile and gravel will be placed to provide a stable area for equipment to move out on to the alluvial fan. Also, an additional access road is currently envisioned that will run parallel to the work area and will provide lateral access to the work area. These improvements are shown on Figure 2. The access road locations are shown for illustrative purposes only and access will be improved only where needed to minimize disturbance of the riverbank and riparian corridor.

Site Security

An important component of the overall project will be site security. The primary method for securing the site will be the installation of a temporary chain link fence around the perimeter of the landside support zone. Temporary “Restricted Area” signs will be posted at regular intervals along the fence and also in the river directly west of the project area, as noted in the Navigation Plan included as part of the Sediment Capping Work Plan (SCWP). The approximate fence location is shown on Figure 3. This temporary fence will have man gates installed to allow project personnel access to the outside perimeter of the site. A locking gate at the corner of Senate and Gist Streets will restrict vehicular traffic into and away from the project area.

To prevent the unauthorized or unknowing entry of third parties onto the site, access gates will remain closed during site activities to the extent practical. Man gates will be locked when not in use.

Once site construction operations are initiated, SCE&G will also post security guards on-site during non-working hours. SCE&G has successfully utilized off-duty City of Columbia police officers as security guards previously at other local sites. The guards will conduct regular patrols of the property during non-working hours and at times of low site activity, when a minimal number of site personnel are present. The guards and fence will serve to keep unauthorized and untrained personnel out of the active project area.

Erosion and Sedimentation Controls

Erosion and sediment (E&S) control best management practices (BMPs) for the site are identified in the Comprehensive Site Stormwater Pollution Prevention Plan (C-SWPPP), which was developed as part of the National Pollutant Discharge Elimination System (NPDES) permit application. The NPDES permit application and the C-SWPPP will be reviewed and approved by the City of Columbia and SCDHEC prior to initiation of land disturbance activities. The C-SWPPP requirements will be maintained throughout completion of the project. The C-SWPPP and the NPDES permit, as well as other pertinent documentation, will be available for review on-site at all times.

Attention to overall site erosion and sedimentation controls (E&S controls) will be required. In general, the E&S BMPs specified in the C-SWPPP will be the first construction components installed and the last to be removed. The E&S controls will include the use of a silt fence, filter socks, improved construction entrance, dust control, street sweeper, sufficient access and roadway construction, and other measures as may be required. Temporary roadways will be constructed, as needed, to prevent the spread or release of sediments from the work area. No tracking of mud or soil will be permitted beyond the site access gates. Any such impacts will be addressed immediately through the use of street-sweepers or power brooms that will be stationed on-site at all times during completion of the project. The silt fence or filter socks will be deployed and maintained, as required, to prevent sediment run-off from all disturbed areas. Remediation personnel will install and periodically inspect and repair the E&S BMPs identified in the C-SWPP in accordance with the Plan's requirements. Deficiencies will be documented and corrected as soon as practical.

Work Zones

The exclusion zone will contain the specific areas where intrusive or construction work is being conducted or in the unlikely event when TLM is being handled. The majority of the construction work will be completed in the river or along the eastern riverbank. Access to the exclusion zones will be limited to trained environmental remediation and construction personnel. Decontamination procedures will be implemented whenever equipment or personnel leave the exclusion zones on an as-needed basis to control the potential migration of constituents of concern from the work area. Equipment decontamination facilities will be available in the general work area. As necessary, a boot wash area will also be maintained at the exclusion zone boundary to control tracking of potentially impacted material across the site.

Other work zones will be determined in the field, as necessary. These areas are expected to include:

- Traffic zones for loading of trucks, construction material drop-off/delivery, delivery/pickup of roll-off boxes, etc.;
- Staging areas for equipment and material;

- Water management area; and
- Support zones outside of the primary work areas.

Utility Clearance and Management

A number of utilities are present within the planned project area. These are shown on Figures 2 and 3. For the landside support zone, the overhead high voltage electrical transmission lines were recently relocated by SCE&G to provide more clearance for site operations. Underground utilities within the landside support zone footprint include buried fiber optic communication lines, sanitary sewer and a buried gas line. SCE&G believes that all buried utilities have been identified and located. However, in order to be consistent with the applicable regulations, a request for clearing and identifying potential underground utilities at the site will be submitted to the Palmetto Utility Protection Services, Inc. (PUPS) prior to initiating any intrusive activities, including temporary fence installation. In addition, a private utility location company will be utilized to pre-screen areas of expected intrusive activities for utilities and to more precisely identify known utility locations. All site personnel will be made aware of the buried utility locations.

A large sign indicating a “cable crossing” is located on the eastern shoreline of the river just south of the current access road. A group of metallic anomalies was detected extending out into the river from this point during completion of the investigative phase of this project. SCE&G has not been able to determine the owner, type and construction of the cable crossing, as of the publication date of this Plan. Specific information on this cable crossing will be obtained and appropriate safeguards put into place prior to initiation of site construction activities.

Traffic Control

Only authorized remediation personnel will be allowed access to the work areas during the construction activities. Since the capping project will be a relatively low impact activity, it is not expected to increase traffic significantly in the area surrounding the site. However, the Traffic Control Plan (SCWP) was developed to provide specific details pertaining to the planned safest routes into and away from the site. These routes were developed through consultation with local residents and local officials (police, fire department, public works, government personnel, etc.). Each truck driver will be informed of the prescribed routes for site entry and exit and an effort will be made to utilize regular drivers who are familiar with these routes. All site-related vehicles will follow the specific routes and oversight personnel will conduct periodic monitoring of truck movements to ensure compliance with the determined routes.

Trucks carrying material away from the site from activities such as the sand bar removal, will be inspected before they leave the site for loose debris and sediment that may become dislodged and dropped on the roadway. Clean, plastic lined loading areas will be utilized for truck loading operations. This will prevent potential migration of sediment from the excavation and handling areas.

Water Management System

The currently planned location for the water management system is shown on Figure 3. The specific details pertaining to the system, the types of water and the management methods are provided in the Water Management Plan (SCWP). The water management system’s primary role is to collect and

prepare for the disposal of any impacted water that is observed during completion of the project. Since the construction of the cap is not as intrusive as an excavation project, impacted water is not expected to be a major concern. As a result, impacted water management measures will be established as a contingency measure to be utilized in the unlikely event that they are needed.

This system will manage water that is visually impacted (i.e., contains large amounts of suspended solids, exhibits a sheen, tar-like odor, or has TLM particles suspended within the water column). The primary method for distinguishing between contact and non-contact water will be a visual evaluation by experienced site personnel. Also, the area of origin of the water will be utilized to aid in determining which mode of water management will be used.

The primary cap construction activities (i.e., placement of the geotextile and ACBs) is not expected to generate impacted water, but intrusive project activities that may result in disturbance of TLM will have the potential to generate water requiring management. These will include removal of the sandbar and construction of access roadways along the edge of the river.

The water management system will consist of appropriately sized pumps and hoses and two 20,000-gallon frac tanks. Other equipment and materials such as oil absorbent booms will be kept on-site to contain potentially impacted water where it is observed, until it can be collected in the tanks and properly disposed. SCE&G has obtained the appropriate approvals to dispose of water from site-related activities at the Vopak Logistic Services facility in Mauldin, SC. Once moved to the frac tanks, water will be transferred to tanker trucks for transportation to the disposal facility.

CAP CONSTRUCTION AND INTRUSIVE ACTIVITIES

Following completion of the preparatory activities described above, SCE&G will commence the intrusive activities within the river. These will include:

- Advance screening of the work area for potential unexploded ordnance (UXO);
- Mussel relocation;
- Access and work platform construction;
- Removal of the sandbar and water management;
- Cap construction; and
- Site reconstruction and demobilization.

UXO Screening and Management

With respect to the potential UXOs and/or historical items in the project area, SCE&G believes that any artifact and/or UXO that may have been present in the area to be capped is now covered by an additional layer of sediment (of varying thickness) deposited during the flood of 2015. Placement of the engineered capping materials on top of the project area is intended to NOT disturb any potential UXO or historical item and once installed, the engineered cap will provide an added layer of protection or isolation with respect to potential human contact.

The detailed plans developed to address potential UXO management issues have been updated and approved by the USACE following completion of the FDP and the decision to implement the capping alternative. They are included in the SCWP for review. Trained UXO management personnel will be on-site during all work that could potentially disturb UXOs and will pre-screen areas and direct field activities in accordance with the approved plans and procedures.

Mussel Relocation

A number of sensitive mussel species are likely to exist within the cap footprint. As a result, SCE&G has agreed to conduct freshwater mussel screening and relocation operations in order to preserve these indigenous freshwater mussels that may be present within the project area. The anticipated mussel relocation activities are explained in detail in the Mussel Relocation Plan (SCWP). In general, mussels located within the planned footprint of the cap will be collected and relocated by divers before the cap is constructed.

Access and Work Platform Construction

As currently envisioned, the ACB mat placement scenario will include a crane and/or excavator working from land and on secured barge platforms or "work pads". The temporary access roads constructed on top of the existing river bank will permit the equipment to access the work area and will be further augmented by access pathways constructed along the river's edge using timbers or swamp mats for stability. Small platform barges will be brought onto the site, assembled on dry land and fastened together, they will be pushed into position in the river with heavy machinery. Temporary timbers will likely be used to facilitate movement and leveling of the barges. Figure 3 shows the potential work platform scenario. These items are planned for use because they can be removed should excessive river flows be anticipated.

Removal of the Sandbar and Water Management

Some portions of the project area, such as the sand bar, may require limited grading of existing sediment to facilitate an even or smooth and continuous mat placement (e.g., the sandbar bar removal). Conversely, some small, irregularly shaped depressions in the river bottom may need to be filled to allow the mats to adequately cover the underlying sediment. To the extent practical, clean, imported backfill will be used to fill low areas to minimize disturbance to the existing bottom sediment. These types of filling operations are anticipated to be minimal but may be required because the ACB mats need to be in direct contact with the subgrade or destabilizing processes (i.e., erosion or channeling under the mats) may result.

The sand bar thickness ranges from approximately 1 to 2 feet above the bedrock with a top elevation of approximately 116 feet. Removal of the approximate 1 to 2 feet of material via excavation will allow for the sediment cap to be installed and for it to be below the normal water level (116.5 feet) during typical flow periods.

Previous sediment sampling conducted during the investigation phase of the project characterized the sand bar material as being unimpacted by TLM. However, TLM may be encountered and require management. In addition, entrained water from the sandbar may have come into contact with TLM and

exhibit a sheen or odor. As a result, the following measures will be in place prior to commencement of intrusive activities and the general sequence of activities will be followed:

- Removal of the sand bar will be completed during low river levels to limit the amount of river water that comes into contact with the sediment.
- A silt curtain and absorbent boom will be installed directly downstream of the work area to contain sediment within the work area. The silt curtain may be augmented by the placement of large 1-ton sandbags downstream of the work area to further contain the sediment.
- The Total Suspended Solids (TSS) Monitoring Plan will be implemented to measure TSS levels downstream of the work area in real-time to ensure the project does not contribute to elevated TSS concentrations.
- Remediation personnel will be present in the excavation area to observe the sediment as it is removed, to determine if TLM is encountered and to check for the presence of sheens or odors emanating from the disturbed sandbar material.
- The wet sandbar material will be stacked on the alluvial fan and the entrained water allowed to drain out and collect in a contained low area where it will be observed for evidence of TLM contact. If sheens or other indications are observed, the contact water will be pumped to the water management system.
- A lined and bermed sand storage area will be constructed in the landside support zone. The sand bar material will be transported to the lined area and stacked in this area to allow for further release of entrained water. The liner will consist of poly sheeting placed on the ground surface and a berm will be constructed around the extent of the sand pile to contain the released water. Accumulated water will be examined for evidence of a sheen or odor. If evidence of impacts is noted, the water will be pumped to the water management system.
- Once the sand bar material is dry enough for off-site transport, it will be loaded into trucks and transported to the proper disposal facility. Material used to construct the lined area will also be disposed.

The water management system and other contingency measures will remain on-site for the duration of river based construction activities and if contact water is encountered during non-intrusive activities, it will be managed accordingly. If the system is utilized to store water, it will be properly decontaminated prior to demobilization.

Cap Construction Activities

As stated above, following construction of the access improvements, mat placement will likely entail a crane and/or excavator working from land and the secured barge platforms or “work pads” and the capping material will likely be staged on flat bed trailers and transferred down the ramp for deployment by the crane or excavator, as needed. For portions of the project area located near the shoreline (southern project area), the ACB mats will likely be placed with the equipment based on the shoreline. The boat ramp area will likely be the primary access point during construction. Disturbing the actual riverbank will be minimized.

For the ACB mats that are deployed on the eastern, or landside edge of the cap, it is anticipated that a small anchor trench approximately three feet deep will be excavated, and the edge of the mats will be laid into the anchor trench. The anchor trench will help secure the mats on the slope and serve to prevent erosion under the mats from upslope run-off areas. The geotextile material will likely be pre-cut and

affixed to the bottom of the concrete mats (with some additional material left on the edges for overlap) in the landside support zone, to facilitate placement. This method of deployment will allow for the mat and geotextile to be lifted and placed as a unit in one motion and was successfully utilized by SCE&G at another river capping project in South Carolina. In areas where large boulders or severely uneven river bottom sections prevent the effective use of the mats, pieces of geotextile and singular concrete blocks (i.e., singular ACBs or "blocks") will be hand placed.

Placement of the geotextile and ACB mats will continue up the bank to the east, as seen on Figure 2, until tie in with the existing asphalt roadway (Senate Street Extension) is complete. Grading of the mat extension area will likely be required to create a smooth transition area from the end of the asphalt roadway to the main mat placement area.

Site Reconstruction and Demobilization

Once cap placement activities are completed, equipment and access improvements in the river work area will be removed and the disturbed portions of the riverbank will be reconstructed. The Riverbank and Shoreline Reconstruction Plan in the SCWP provides specific details pertaining to these activities.

All landside disturbed areas will be restored by removing equipment, materials, structures, etc., and final grading and re-establishment of vegetative cover will be completed. In general, the gravel and geotextile material utilized to construct the roads and laydown/storage areas will be removed and transported off-site for disposal. Final grading will be conducted, and vegetative cover re-established utilizing an approved seed mixture. Erosion and sedimentation control measures will be left in place until stabilization of disturbed areas is deemed complete. A scenario showing complete restoration is provided in the SCWP and the details associated with final reconstruction of the landside support zone are also included in the C-SWPPP and will be subsequently approved by the City of Columbia and SCDHEC.

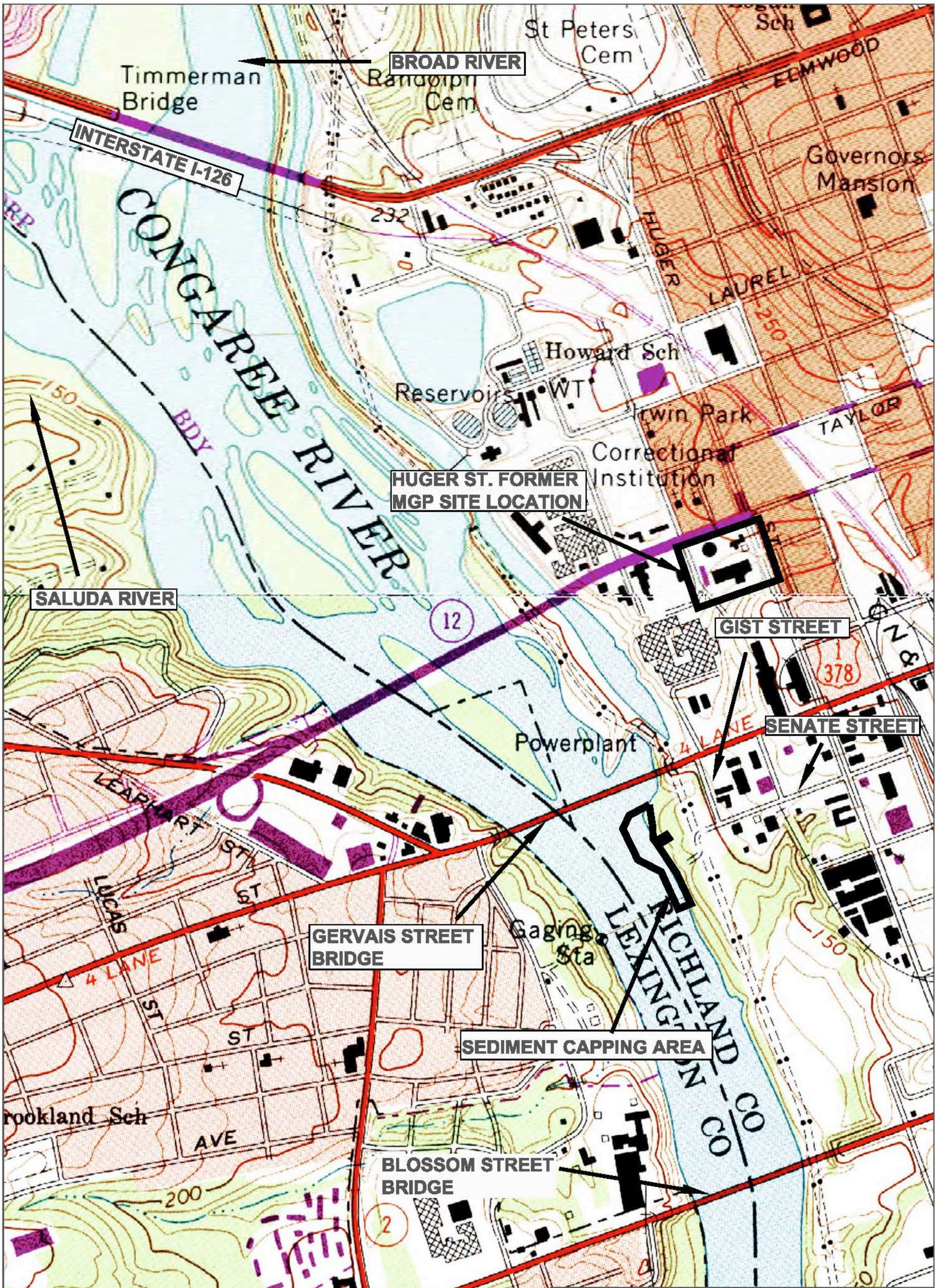

FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

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N

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)

SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)

ACBs INSTALLED FOR EROSION CONTROL (APPROX. 6,000 sq ft)

18"DIP

CONGAREE RIVER

LEGEND

– APPROXIMATE EDGE OF RIVER

– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.

– BATHYMETRIC LINE (FEET NAVD '88) – 2010

– ARTICULATED CONCRETE BLOCK MATS (ACBs)

0' 40' 80' 120' 160'

(Feet Scale)

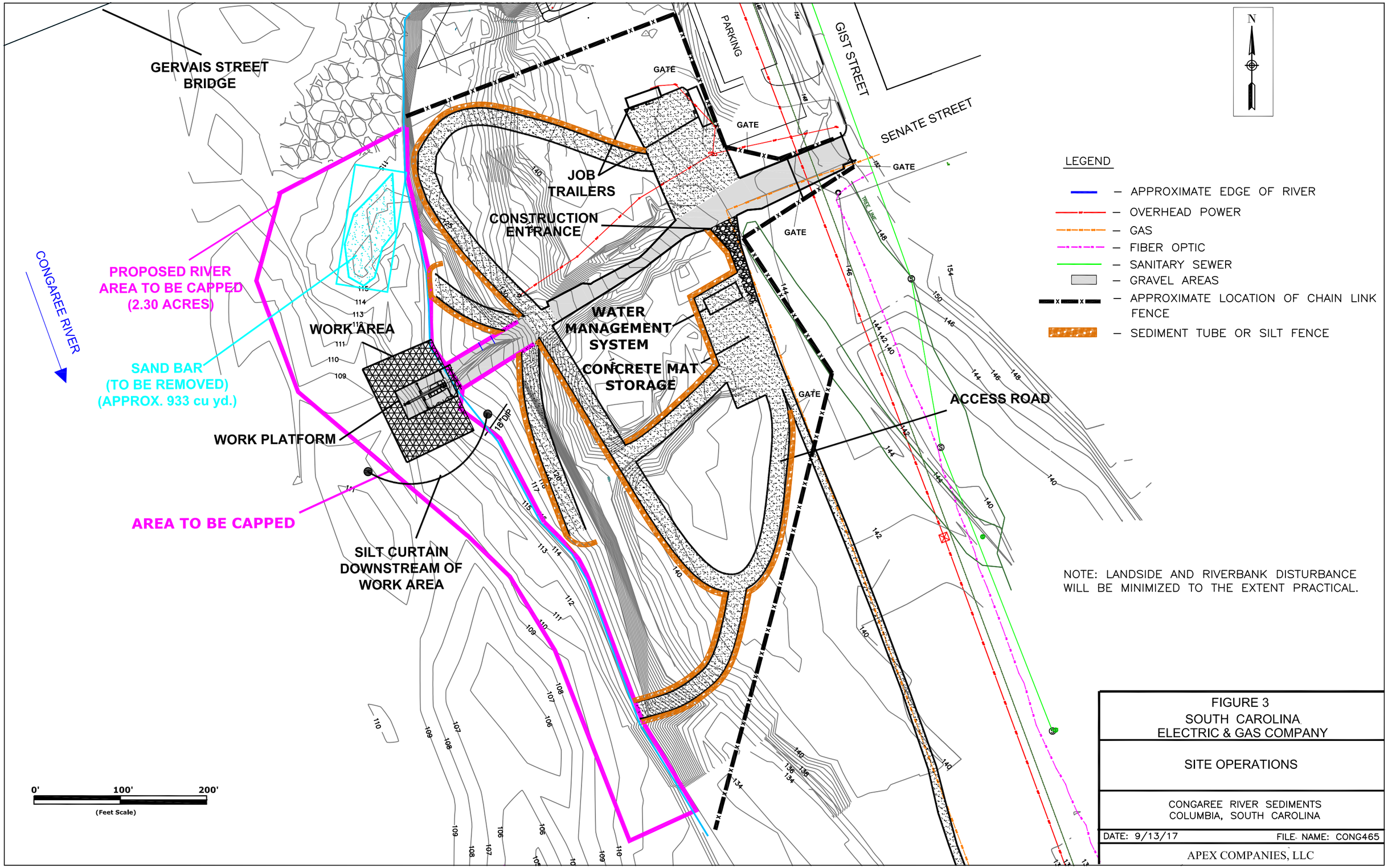
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION
AND COMPONENTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 1/4/2017 FILE NAME: CONG404

APEX COMPANIES, LLC



NOTE: LANDSIDE AND RIVERBANK DISTURBANCE WILL BE MINIMIZED TO THE EXTENT PRACTICAL.

FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/13/17 FILE NAME: CONG465

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APPENDIX M

PROJECT NOTIFICATION PLAN, MAILING LIST AND FACT SHEET

PROJECT NOTIFICATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

PROJECT NOTIFICATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Numerous project plans exist that describe the operational activities that will be utilized to remove the TLM from the river.

This plan is intended to identify and provide contact information for key third party stakeholders, local governmental officials, and State and Federal Agencies that would be notified in the event of project conditions that result in significant interruptions or disturbances while the project is underway.

Conditions that require notification of key third party stakeholders, adjacent property owners, local governmental officials and State and Federal Regulatory Agencies include:

- **Type A** - Unpermitted discharges into the Congaree River, land or air;
- **Type B** - Any violation of project permits and approvals;
- **Type C** - Catastrophic failure of critical operational assets;
- **Type D** - Reportable injuries to project personnel;
- **Type E** - Significant traffic incidents;
- **Type F** - Security breach (beyond that managed by on-site security); and
- **Type G** - Any other activities that result in a suspension of site-related activities (for periods exceeding two operational months).

The following notification list is provided by category type:

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
Congaree Riverkeeper Bill Stangler PO Box 5294 Columbia, SC 29250	Ph: 803-760-3357 crk@congareeriverkeeper.org	A, G
River Alliance Michael Dawson, Executive Dir. 420-C Rivermont Drive Columbia, SC 29210	Ph: 803-446-1300 info@riveralliance.com	A, G
Granby Crossing (apartment complex located near the river) 100 Granby Crossing Cayce, SC 29033	Ph: 803-739-4857	G
City Club and Congaree Park residential communities (located along both sides of the river) Congaree Park Development Co. 831 Meeting Street West Columbia, SC 29169	Ph: 803-451-5234	G
Congaree Vista Guild Meredith Atkinson, Executive Dir. 701 Gervais Street Suite 150-118 Columbia, SC 29201	Ph: 803-269-5946	G
Keep the Midlands Beautiful Jacqueline Buck, Executive Dir. 1307 Augusta Rd. West Columbia, SC 29169	Ph: 803-733-1139 info@keepthemidlandsbeautiful.org	G
Greater Columbia Chamber of Commerce Carl Blackstone, President & CEO 930 Richland Street Columbia, SC 29201	Ph: 803-733-1110 info@columbiachamber.com	G
Friends of the Congaree Swamp John Grego PO Box 7746 Columbia, SC 29202	Ph: 803-331-3366	G
Adventure Carolina Jane Scott 1107 State Street Cayce, SC 29033	Ph: 803-447-3327	G
Adjacent Property Owners:		
Guignard and Associates Charlie Thompson	Ph: 803-254-2125	C, G
Dupre Catering and Events Bobby Percival	Ph: 803-748-4144	C, G
City Club Condos Homeowners Association C. Dixon Lee (contact)	Ph: 803-343-3300	C, G

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
Adjacent Property Owners (continued):		
MJS Inc. Property Management City Club Condominiums 4910 Trenholm Rd. Columbia, SC 29206 Contact: Patricia Dawkins	Ph: 803-743-0600 ext 114	G
City of Columbia:		
City Manager Teresa Wilson	Ph: 803-545-3026 tbwilson@columbiasc.net	C, E, G
Columbia Police Department	Ph: 803-545-3500	E, F
Columbia Fire Department	Ph: 803-545-3700	(as appropriate)
Columbia Traffic Engineering David Brewer	Ph: 803-545-3850 ddbrewer@columbiasc.net	E, G
Columbia Waste Water Dept.	Ph: 803-545-3400 CustomerCare@ColumbiaSC.Net	B, C, G
The Development Center (Land Disturbance Permit) -or- Tracy Mitchell, Stormwater Engineer	Ph: 803-545-3483 Stormwater@ColumbiaSC.Net Ph: 803-545-3304	B
City of Cayce:		
Cayce City Manager Rebecca Vance	Ph: 803-550-9557 rvance@cityofcayce-sc.gov	E, G
Cayce Traffic Engineering	Ph: 803-794-0456	E, G
Cayce Fire Department	Ph: 803-794-0456	E
Cayce Police Department	Ph: 803-794-0456	E
City of West Columbia:		
West Columbia City Administrator Brian E. Carter	Ph: 803-791-1880 ext. 600 bcarter@westcolumbiasc.gov	G
Richland County:		
Richland County EMS	Ph: 803-576-3400	D (as appropriate)
Region IV FEMA	Ph: 770-220-5200	G (flood related issues)
SC Regulatory Agencies:		
SCDHEC Bureau of Land Management Lucas Berresford	Ph: 803-231-9031	A, B, C
SCDHEC Bureau of Water Mark Giffin	Ph: 803-898-4179	A, B, C (applicable to water related issues)

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
SC Regulatory Agencies (continued):		
SCDHEC Bureau of Water Water Quality Certification and Wetlands Section Chuck Hightower, Manager	Ph: 803-898-0369	A, B, C (applicable to water related issues)
SCDNR Wildlife and Freshwater Fisheries Vivianne Vejandi	Ph: 803-734-4199	A, B, C (applicable to water related issues)
SCDHEC Air Quality	Ph: 803-898-4123	A, B, C (applicable to air quality issues)
South Carolina State Historic Preservation Office Emily K. Dale	Ph: 803-896-6181	B (applicable to historical preservation issues)
South Carolina Institute of Archeology and Anthropology Jim Spirek	Ph: 803-576-6566	B, C (applicable to historical preservation issues)
South Carolina DOT	Ph: 855-467-2368 Toll Free or- 803-737-2314	B (applicable to DOT related incidents)
Federal Regulatory Agencies:		
USACE Columbia Office Chip Ridgeway Brice McKoy	 Ph: 803-253-3906 Ph: 803-253-3994	A, B, C, G
USACE Huntsville Office Chris Cochrane Project Manager	Ph: 256-895-1696	B, C, G
US National Marine Fisheries NOAA Charleston Jaclyn Daly-Fuchs Pace Wilber Virginia M. Fay	 Ph: 301-427-8438 Ph: 843-762-8601 Ph: 727-551-5739	A, C, G
US National Marine Fisheries Southeast Regional Office St. Petersburg, FL Kelly Shotts	Ph: 727-824-5312	A, C, G
US Fish and Wildlife Mark Caldwell Jay Herrington Dr. Thomas Rainwater (ext. 218)	 Ph: 803-727-4707 ext. 215 Ph: 843-727-4707 ext. 212 Ph: 843-727-4707 ext. 218	A, C, G

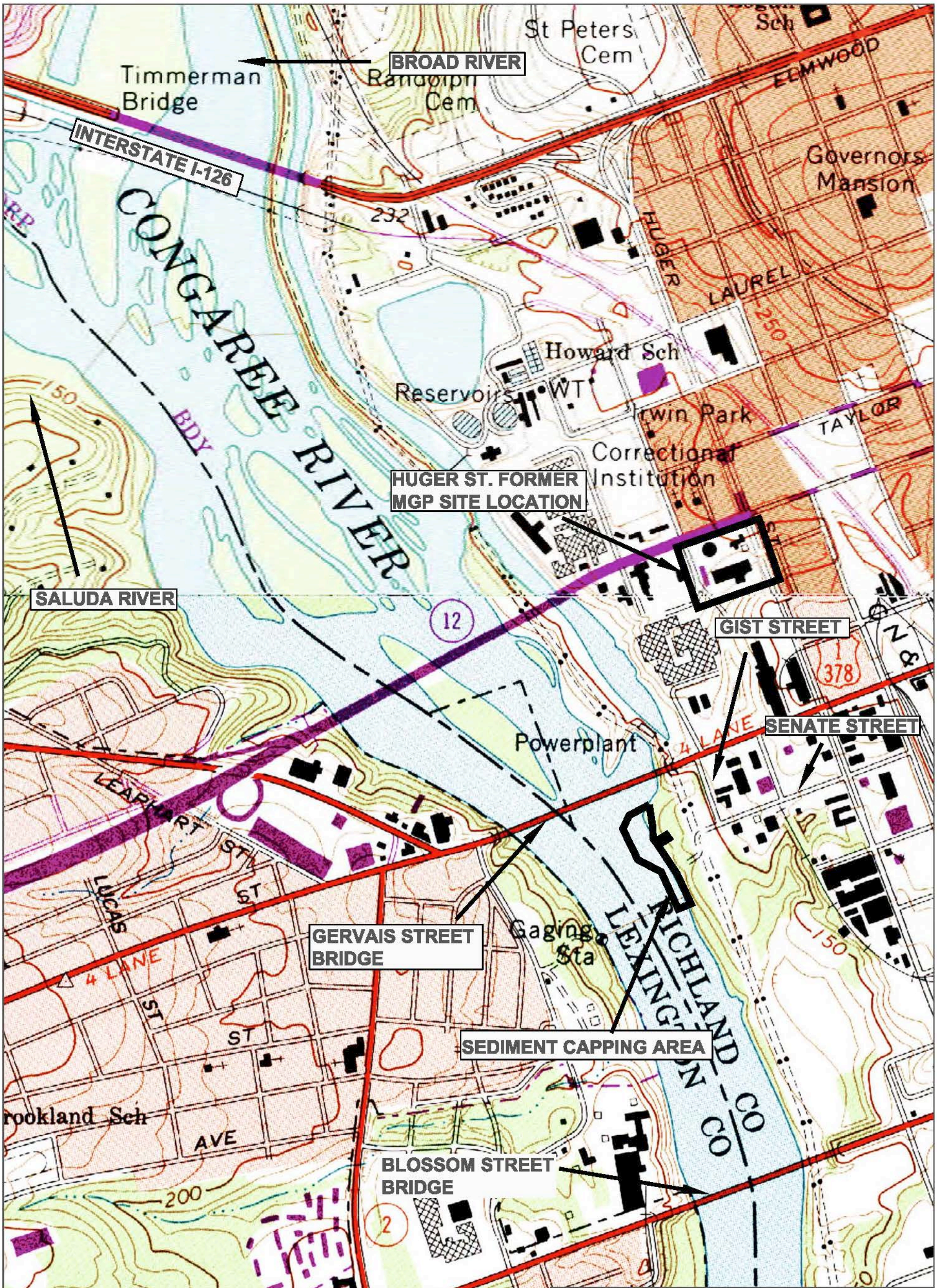


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

BUSINESS AND RESIDENTIAL ADDRESSES

NAME			TITLE	COMPANY NAME	ADDRESS	CITY	STATE	ZIP	ZIP4
				LTC BENEFITS INC	326 ALEXANDER RD	WEST COLUMBIA	SC	29169	7605
				BEN STERN CONST	121 ALEXANDER RD	WEST COLUMBIA	SC	29169	7601
MS NIKKI		SETZLER	PARTNER	SETZLER NIKKI G RES	249 CONGAREE PARK DR	WEST COLUMBIA	SC	29169	7647
				NOVINGER QTR CONSULTING	351 MEETING ST	WEST COLUMBIA	SC	29169	7530
				BRIDGEPOINTE CONDOMINIUMS	100 SUNSET BLVD APT 601	WEST COLUMBIA	SC	29169	7566
MR AL		LOFTIS	OWNER	AL'S UPSTAIRS ITALIAN RESTAURANT	300 MEETING ST	WEST COLUMBIA	SC	29169	7531
MS CHELSEA		SCOGGINS	MANAGER	STERLING UNIV	500 ALEXANDER RD OFC	WEST COLUMBIA	SC	29169	7653
MR MATT		FULMER	OWNER	PERSONALLY FIT	1315A GADSDEN ST	COLUMBIA	SC	29201	3001
MR JOHN		WILLIAMSON	OWNER	WILLIAMSON & ASSOCIATES INC	500 TAYLOR ST STE 402	COLUMBIA	SC	29201	3000
MR TIMOTHY	B	TUTEN	PRESIDENT	MUFFLER SHOP OF COLUMBIA	918 HUGER ST	COLUMBIA	SC	29201	3622
MR TED		JENKINS	MANAGER	A F L NETWORK SERVICES INC	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
MS PAULA		WESSINGER	OWNER	CRUISE AND TRAVEL VIP	506 GERVAIS ST	COLUMBIA	SC	29201	3046
				JIMMY JOHN'S GOURMET SANDWICH SHOP	715 GERVAIS ST STE A	COLUMBIA	SC	29201	6007
MR CURT		DAVIS	PRESIDENT	CURT DAVIS AND ASSOCIATES	1523 HUGER ST	COLUMBIA	SC	29201	2223
				MUSEUM COMMISSION SC STATE	301 GERVAIS ST	COLUMBIA	SC	29201	3073
MR DAVID		HUNT	PRESIDENT	HUNT DAVID CREATIVE	807 GERVAIS ST STE 302	COLUMBIA	SC	29201	3163
MS PEGGY		PARKINSON	MANAGER	PRESTIGE MARBLE	919 HUGER ST	COLUMBIA	SC	29201	3621
MR SEAN		CELIA	OWNER	SOUTHERN VALET	710 LADY ST STE 102	COLUMBIA	SC	29201	6008
				ACADEMY MORTGAGE	700 GERVAIS ST STE 250	COLUMBIA	SC	29201	3061
MS SHARON		TURNER	MANAGER	TRAFFIC COURT	1400 HUGER ST	COLUMBIA	SC	29201	3012
				MEZZA LEBANESE BISTRO & HOOKAH LOUNGE	701 GERVAIS ST	COLUMBIA	SC	29201	3066
MR BERT T		MARTIN		BERT T MARTIN	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
				MULKEY INC	701 GERVAIS ST STE 120	COLUMBIA	SC	29201	3065
				TERRI VELETTO	611 LADY ST UNIT 100	COLUMBIA	SC	29201	3092
MS MICHELLE		LEITNER		MOJO CITY SALON	601 LADY ST UNIT B	COLUMBIA	SC	29201	3087
				WOODY THE	808 LADY ST	COLUMBIA	SC	29201	3104
MS DIANE		SPRADLEY	MANAGER	CAROLINA TELCO COLUMBIA SC	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
MR BEN		REX	OWNER	CYBERWOVEN	1523 HUGER ST STE B	COLUMBIA	SC	29201	2223
MR THOMAS		SAVORY	ASSISTANT	LSEP ASSOCIATES LTD	701 LADY ST	COLUMBIA	SC	29201	3076
				NEEL-SCHAFFER	1324 GADSDEN ST	COLUMBIA	SC	29201	6006
				NOVA BELLA SALON & SPA	801 GERVAIS ST	COLUMBIA	SC	29201	3125
TERRY		WADE	CEO	EAGLE EYE ANALYTICS	500 TAYLOR ST STE 200	COLUMBIA	SC	29201	3000
MS ELIZABETH		WESSLES	OWNER	AT HOME	705 GERVAIS ST	COLUMBIA	SC	29201	3049
				CAROLINA CARE	601 GERVAIS ST	COLUMBIA	SC	29201	3022
MR JIM		MC GEHEE	OWNER	COLUMBIA FLAG & BANNER LLC	790 HUGER ST	COLUMBIA	SC	29201	3618
MR DOUGLAS		ROSINSKI	OWNER	DJF & F LLC	701 GERVAIS ST STE 150	COLUMBIA	SC	29201	3065
MR RICHARD		MOLTEN JR	PRESIDENT	MOLTEN-LAMAR ARCHITECTS	808 LADY ST	COLUMBIA	SC	29201	3104
MR BILL		DANIELSON	OWNER	DANVILLE BUSINESS ADVISORS	500 TAYLOR ST STE 401	COLUMBIA	SC	29201	3000
				KIDNEY FOUNDATION OF SC	500 TAYLOR ST STE 101	COLUMBIA	SC	29201	3000
MS PATTI		WALTERS	OWNER	COLUMBIAS THE SALON	620 GERVAIS ST STE D	COLUMBIA	SC	29201	3075
MS BONNIE		ADAMS	EXECUTIVE DIRECTOR	NEW MORNING FOUNDATION	807 GERVAIS ST STE 102	COLUMBIA	SC	29201	3163
				FRANKS JUMPS 4 VETTER LEARNING LLP	500 TAYLOR ST	COLUMBIA	SC	29201	3000
MS BETH		IRICK	CEO	KIDNEY FOUNDATION OF SOUTH CAROLINA	508 HAMPTON ST STE 200	COLUMBIA	SC	29201	2765
MR HARRY		LIGHTSEY	PRESIDENT	BELL SOUTH	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
TERRY		SULLIVAN	MANAGER	TOMPKINS THOMPSON SULLIVAN LLC	807 GERVAIS ST STE 202	COLUMBIA	SC	29201	3163
MR HARRY	R	MARSH		HARRY R MARSH	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
MR STEPHEN		SMITH	MANAGER	CAROLINA ALE HOUSE	708 LADY ST	COLUMBIA	SC	29201	3020
MS GRETCHEN		LAMBERT	OWNER	STUDIO 2LR	801 GERVAIS ST STE 201	COLUMBIA	SC	29201	3155
MS ROSE MARIE		CRAIG	OWNER	M CRAIG FURNITURE	807 GERVAIS ST STE 102	COLUMBIA	SC	29201	3163
MS SUSAN		BLACK	PUBLISHER	APPAREL MAGAZINE	801 GERVAIS ST STE 101	COLUMBIA	SC	29201	3155
MS MISSY		CARNAGGIO	VP	SUNVEST PROPERTIES INC	400 GERVAIS ST	COLUMBIA	SC	29201	3086
MR RON		SIMPSON	MANAGER	PIONEER CREDIT CO	717 LADY ST STE B	COLUMBIA	SC	29201	3063
MR BIN		WISNESKI	OWNER	HOME BUILDERS ASSOCIATION OF GREATER COLUMBIA	625 TAYLOR ST STE A	COLUMBIA	SC	29201	2764
				HOLIDAY INN EXPRESS	501 TAYLOR ST	COLUMBIA	SC	29201	2738
				B AND A TRAVEL SERVICE	717 LADY ST STE C	COLUMBIA	SC	29201	3063
MR MARK		WOODHAM	PRESIDENT	ONE EARED COW GLASS	1001 HUGER ST	COLUMBIA	SC	29201	3623
				TSUNAMI JAPANESE RESTAURANT	700 GERVAIS ST	COLUMBIA	SC	29201	3047
				FOR A REASON ENTERPRISES	805 GERVAIS ST	COLUMBIA	SC	29201	6106
MR DAVID		ANDERSON	OWNER	CONSTANT NOW LLC	1237 GADSDEN ST STE 105	COLUMBIA	SC	29201	3098
MR EUGENE		BROWN	OWNER	CRYSTAL LINEN SVC	531 LADY ST	COLUMBIA	SC	29201	3015
MR BILL		GATES	CEO	UTI	700 GERVAIS ST STE 100	COLUMBIA	SC	29201	3061
MR JOHN		EASTERBROOK	MANAGER	PUBLIX	501 GERVAIS ST	COLUMBIA	SC	29201	3045
				AFLAC GROUP	500 TAYLOR ST	COLUMBIA	SC	29201	3000
MR JAMES		BARNETT	EXECUTIVE	COURSON JOHN E	700 HUGER ST	COLUMBIA	SC	29201	3618
MR LARRY		RAIFORD	RELIGIOUS LEADER	APOSTLE F B H CHURCH	412 TAYLOR ST	COLUMBIA	SC	29201	2238
				CSX	500 TAYLOR ST	COLUMBIA	SC	29201	3000
MR HARRISON		JAMES	PARTNER	HARRISON JAMES H	500 TAYLOR ST STE 400	COLUMBIA	SC	29201	3000
MS VICKY		BOYLSTON	CEO	SC TELCO FEDERAL CREDIT UNION	1025 PULASKI ST	COLUMBIA	SC	29201	3629
MR HANK		FISHER	EXECUTIVE DIRECTOR	AT & T	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
LINDSEY		OSEN	OWNER	GRAHAM US SENATOR LINDSEY	508 HAMPTON ST STE 202	COLUMBIA	SC	29201	2765
				CANAL SIDE	383 TAYLOR ST	COLUMBIA	SC	29201	2263
				AMOS TRACY D C P A	718 LADY ST	COLUMBIA	SC	29201	3020
MR BEVAN		WEYBURN	MANAGER	EDWARD JONES-FINANCIAL ADVISOR BEVAN C WEYBURN	620 GERVAIS ST STE C	COLUMBIA	SC	29201	3075
				VISTA COMMONS	1100 PULASKI ST	COLUMBIA	SC	29201	3644
				FARRELL AGENCY THE	611 LADY ST	COLUMBIA	SC	29201	3092
				BEACH CANAL SIDE LOFTS LLC	535 DEPOT ST	COLUMBIA	SC	29201	2274
MS CATHY		LANIER	PRESIDENT	TECHNOLOGY SERVICE SOLUTIONS	917 HUGER ST	COLUMBIA	SC	29201	3621
MS CLARE		MORRIS	PRESIDENT	CLARE MORRIS AGENCY	1237 GADSDEN ST STE 200G	COLUMBIA	SC	29201	3098
MR JEFF Z		BROOKER III	OWNER	BROOKER LAW FIRM PA	717 LADY ST STE G	COLUMBIA	SC	29201	3063
				WALLACE RICHARD H ATTY	500 TAYLOR ST	COLUMBIA	SC	29201	3000
MR WILLIE		CALLOWAY	CEO	SOUTH CAROLINA STATE MUSEUM	301 GERVAIS ST STE 2	COLUMBIA	SC	29201	3073
MR BROOKS		CHARLES	PARTNER	CHARLES J BROOKS II	504 GERVAIS ST	COLUMBIA	SC	29201	3046
MR DON		MOUZON	CEO	AMTRAK	850 PULASKI ST	COLUMBIA	SC	29201	3635
MS TAMMY		WATSON	OWNER	CLINE'S SALON VISTA	1237 GADSDEN ST STE 104	COLUMBIA	SC	29201	3098
MR KENNETH		ORMAND	OWNER	KENNETH E ORMAND JR LLC	625 TAYLOR ST STE B	COLUMBIA	SC	29201	2764
MR PERCIVAL		DEPRIE	OWNER	300 SENATE	300 SENATE ST	COLUMBIA	SC	29201	3032
				JASON'S DELI	823 GERVAIS ST	COLUMBIA	SC	29201	3167
				XS OF COLUMBIA	700 GERVAIS ST	COLUMBIA	SC	29201	3047
				GENTLEMEN CORNER	829 GERVAIS ST	COLUMBIA	SC	29201	3125
				THE COMMONWEALTH	508 HAMPTON ST	COLUMBIA	SC	29201	2759
MR KENNETH		SUGGS	PARTNER	SUGGS TRIAL LAWYERS	500 TAYLOR ST STE 400	COLUMBIA	SC	29201	3000
				MICHAEL BAKER JR INC	700 HUGER ST	COLUMBIA	SC	29201	3618
MS ADELE		HROVAT	SALES EXECUTIVE	THE BUYERS REALTY	800 LADY ST	COLUMBIA	SC	29201	3104
MS JERI		BROOKS	EXECUTIVE	SOUTH CAROLINA BANK AND TRUST	520 GERVAIS ST STE 310	COLUMBIA	SC	29201	3071
				HALEY FOR GOVERNOR INC	717 LADY ST	COLUMBIA	SC	29201	3062
MR TAJ		GHOSHEH	OWNER	SUBWAY SANDWICHES	701 GERVAIS ST STE 140	COLUMBIA	SC	29201	3065
FULVIL		VALSECCHI	OWNER	RISTORANTE DIVINO	803 GERVAIS ST	COLUMBIA	SC	29201	3125
MS SADIE		HARTMAN	EXECUTIVE DIRECTOR	HARTMAN HALL CHILD DEVELOPMENT CENTER	1130 GIST ST	COLUMBIA	SC	29201	3038
COYT		PARKER	MANAGER	HUGHES SUPPLY INC	801 PULASKI ST	COLUMBIA	SC	29201	3634
				LOCKHART POWER COMPANY	301 GERVAIS ST	COLUMBIA	SC	29201	3073
MR WALTER		CAUDLE	OWNER	CONGAREE HOLDINGS DEVELOPMENT GROUP	320 SENATE ST	COLUMBIA	SC	29201	3032

				MCKAY AND AMOS LLC	718 LADY ST	COLUMBIA	SC	29201 3020
				STARBUCKS COFFEE	831 GERVAIS ST	COLUMBIA	SC	29201 3125
MR	BILL	OWINGS	OWNER	BILL OWINGS CUSTOM CLOTHING	500 TAYLOR ST STE 302	COLUMBIA	SC	29201 3000
	CUNDARI	CUNDARI	EXECUTIVE	BEARD GRADY L	1310 GADSDEN ST	COLUMBIA	SC	29201 3002
				SC JOBS-ECONOMIC DEVELOPMENT AUTHORITY	1523 HUGER ST	COLUMBIA	SC	29201 2223
MR	JACK	WALKER	OWNER	COLUMBIA SELF DEFENSE	1315 GADSDEN ST # A	COLUMBIA	SC	29201 3001
MR	BEN	ARNOLD	OWNER	ARNOLD BEN D RL EST	720 LADY ST	COLUMBIA	SC	29201 3020
MR	KEVIN	BLOCKER	MANAGER	HAMPTON INN	822 GERVAIS ST	COLUMBIA	SC	29201 3126
				PRO VEST INC	701 GERVAIS ST	COLUMBIA	SC	29201 3066
MR	KURT	EYRING	VP	MILLER-VALENTINE GROUP	823 GERVAIS ST STE 200	COLUMBIA	SC	29201 3167
				ALACRI-TECH SOLUTIONS INC	807 GERVAIS ST STE 303	COLUMBIA	SC	29201 3163
				FULTON GEORGE PHOTO IMAGERY INC	1224 HUGER ST	COLUMBIA	SC	29201 3085
MR	LEWIS	GRAHAM	RELIGIOUS LEADER	ZION BAPTIST CHURCH	801 WASHINGTON ST	COLUMBIA	SC	29201 3115
MS	CATHERINE	HORNE	OWNER	EDCETERA THE EDVENTURE STORE	211 GERVAIS ST	COLUMBIA	SC	29201 3067
				SPRINGHILL SUITES	511 LADY ST	COLUMBIA	SC	29201 3015
MR	EWART	EDGERTON	PRESIDENT	ALLEN BROTHERS MILLING CO	804 GERVAIS ST	COLUMBIA	SC	29201 3126
				RICHLAND COUNTY PUBLIC LIBRARY	301 GERVAIS ST	COLUMBIA	SC	29201 3073
	XIAOLAN	WANG	OWNER	M VISTA	701 LADY ST STE C	COLUMBIA	SC	29201 3077
MR	ALAN	GRIMSLEY	IT	COUNTS H WARREN CPA	508 HAMPTON ST STE 100	COLUMBIA	SC	29201 2765
MR	RALPH	MAYER		RALPH H MAYER	1600 WILLIAMS ST	COLUMBIA	SC	29201 2220
MR	RICHARD	MOCK	PRESIDENT	RICHARD MOCK DESIGNS	1237 GADSDEN ST STE 200H	COLUMBIA	SC	29201 3098
MR	MARIO	CAMMALETTI	OWNER	GERVAIS & VINE	620 GERVAIS ST STE A	COLUMBIA	SC	29201 3075
				EXPECTING WELL LLC	514 GERVAIS ST	COLUMBIA	SC	29201 3057
				CAPELLI SALON	701 GERVAIS ST	COLUMBIA	SC	29201 3066
MR	TODD	STUART	OWNER	MAD MONKEY INC	808 LADY ST	COLUMBIA	SC	29201 3104
MR	SCOTT	RAYFIELD	OWNER	SIGNATURE TRANSPORTATION	701 GERVAIS ST STE 150	COLUMBIA	SC	29201 3065
MR	LAMAR	DICK	OWNER	VISTA STUDIOS-GALLERY 80808	808 LADY ST	COLUMBIA	SC	29201 3104
MR	TERRENCE	SPEAKS	EXECUTIVE	SAVOY	721 LADY ST	COLUMBIA	SC	29201 3019
				PNC BANK	701 GERVAIS ST STE 160	COLUMBIA	SC	29201 3026
				TABU NIGHTLIFE	700 GERVAIS ST	COLUMBIA	SC	29201 3047
MR	BENNY	CLARK	OWNER	MCDONALD'S	438 GERVAIS ST	COLUMBIA	SC	29201 3044
MR	WES	LYLES		LYLES WES	801 GERVAIS ST STE 201	COLUMBIA	SC	29201 3155
MR	BILL	RICHARDSON	MANAGER	WILD WING CAFE	729 LADY ST	COLUMBIA	SC	29201 3019
				OCCO SKIN STUDIO	1218 PULASKI ST	COLUMBIA	SC	29201 3052
MS	MITZI	JAVERS	EXECUTIVE DIRECTOR	COLUMBIA TROLLEY	1409 HUGER ST	COLUMBIA	SC	29201 3011
MR	STEVE	BRINCHI	OWNER	PIA'S & STEVE'S	717 LADY ST STE A	COLUMBIA	SC	29201 3063
MR	TOM	COX	OWNER	CARL THOMAS LAMPS INC	724 LADY ST	COLUMBIA	SC	29201 3020
MR	MICHAEL	SANDUSKY	CEO	BUSINESS CAROLINA	1523 HUGER ST STE A	COLUMBIA	SC	29201 2223
MR	DUANE	FULLER	OWNER	MAINSPRING INTERACTIVE	701 GERVAIS ST STE 150	COLUMBIA	SC	29201 3065
MS	ELLEN	TAYLOR	MANAGER	DOMICILE GROUP THE	807 GERVAIS ST	COLUMBIA	SC	29201 3162
MR	MARK	STUCKEY	PRESIDENT	INTERMARK MANAGEMENT CORPORATION	807 GERVAIS ST STE 301	COLUMBIA	SC	29201 3163
MR	WALTER	BULL	OWNER	STERLING GARDEN CTR	320 SENATE ST	COLUMBIA	SC	29201 3032
				BEACH CANAL SIDE LOFTS LLC	384 TAYLOR ST	COLUMBIA	SC	29201 2279
MR	ALAN	BERRY	MANAGER	S C STATE CREDIT	800 HUGER ST	COLUMBIA	SC	29201 3620
MR	THOMAS	MILLS	OWNER	LUNA INC	721 LADY ST	COLUMBIA	SC	29201 3019
MR	CHARLES	ROBERTSON	OWNER	STRONGHOLD GYM	925 HUGER ST	COLUMBIA	SC	29201 3621
	CHRIS	EIDSON	OWNER	CHRIS SPIVEY-STATE FARM INSURANCE AGENT	514 GERVAIS ST STE B	COLUMBIA	SC	29201 3057
MR	JOHN	MOYLAN	MANAGER	WYCHE PA	801 GERVAIS ST STE B	COLUMBIA	SC	29201 3155
MR	DREW	MCKISSICK	MANAGER	CAPITAL STRATEGIES PUB RELS COUNSLR	1237 GADSDEN ST STE 200K	COLUMBIA	SC	29201 3098
MR	JAY	WINGARD	OWNER	18TH STREET DESIGN LLC	1237 GADSDEN ST STE 200J	COLUMBIA	SC	29201 3098
				JILLIAN'S	800 GERVAIS ST	COLUMBIA	SC	29201 3126
				COMPLETE SECURITY SVCS	1237 GADSDEN ST	COLUMBIA	SC	29201 3098
MR	NATHAN	BALLENTINE	VP	WELLS FARGO	508 HAMPTON ST STE 202	COLUMBIA	SC	29201 2765
MS	DOTTIE	JORDAN	OWNER	CITY MARKET ANTIQUES MALL	705 GERVAIS ST	COLUMBIA	SC	29201 3049
				YOUNGINER LLC ENGINEERED	1237 GADSDEN ST	COLUMBIA	SC	29201 3098
MR	LARRY	NASSIVERA	MANAGER	FIRST SUN CONSULTING LLC	500 TAYLOR ST	COLUMBIA	SC	29201 3000
MR	BILL	BROOKS	MANAGER	CONSUMER SERVICES DIV	1101 WILLIAMS ST	COLUMBIA	SC	29201 3035
				L2 TECHNOLIGIES	1219 WAYNE ST	COLUMBIA	SC	29201 3055
				WELLS FARGO	717 LADY ST	COLUMBIA	SC	29201 3062
MS	KATHLEEN	CANNON	OWNER	DRS EYECARE & CONTACT LENS CLINIC	620 GERVAIS ST STE B	COLUMBIA	SC	29201 3075
MR	SCOTT	BILLS		PAUL MITCHELL THE SCHOOL	700 GERVAIS ST # D	COLUMBIA	SC	29201 3047
MR	JAY	EPTING	MANAGER	EPTING DISTRIBUTORS INC	1006 HUGER ST	COLUMBIA	SC	29201 3624
				0 0 24 HOUR LOCKSMITH SERVICE	701 GERVAIS ST STE 150	COLUMBIA	SC	29201 3065
MR	RICK	CUNNINGHAM	MANAGER	THE UPS STORE	701 GERVAIS ST STE 150	COLUMBIA	SC	29201 3065
				MIKKI HALEY FOR GOVERNER	717 LADY ST	COLUMBIA	SC	29201 3062
				WET WILLIE'S INC	800 GERVAIS ST	COLUMBIA	SC	29201 3126
MR	JOHN	STREVENS	MANAGER	CELTIC WORKS BUILDERS	1310 PULASKI ST UNIT A	COLUMBIA	SC	29201 6001
				WRIGHT-JOHNSON	601 TAYLOR ST	COLUMBIA	SC	29201 2740
MS	GLADIS	BROWN	MANAGER	COLUMBIA COURT CLERK	811 WASHINGTON ST	COLUMBIA	SC	29201 3115
				ORANGEED LLC	1237 GADSDEN ST	COLUMBIA	SC	29201 3098
MR	MALCOLM	JONES	OWNER	BACKPACKER THE	1215 WAYNE ST	COLUMBIA	SC	29201 3055
MR	ROBERT	WILLIAMS	MANAGER	UPS	917 HUGER ST	COLUMBIA	SC	29201 3621
MR	BARRY	CLARK	OWNER	CLARK BW INC	1209 GADSDEN ST	COLUMBIA	SC	29201 3039
				CITY CLUB HOA	1120 GIST ST	COLUMBIA	SC	29201 3038
MR	BILL	CORLESS	MANAGER	BLUE	721 LADY ST	COLUMBIA	SC	29201 3019
				NEW SAMARITAN BAPTIST CHURCH	930 HUGER ST	COLUMBIA	SC	29201 3622
MR	AARON	HARDWICK	OWNER	BRICK ASSOCIATION OF CAROLINAS	625 TAYLOR ST STE C	COLUMBIA	SC	29201 2764
MR	MARVIN	CHURNOFF	OWNER	RIVERS	600 GERVAIS ST	COLUMBIA	SC	29201 3048
	W	BECKHAM	PARTNER	SHERER BECKHAM ARCHITECTURE	718 LADY ST	COLUMBIA	SC	29201 3020
MR	BRENT	WHITENER	MANAGER	HD SUPPLY ELECTRICAL	801 PULASKI ST	COLUMBIA	SC	29201 3634
MR	GARY	WILLIAMS	OWNER	CATAGENA TRADING CO LLC	1025 PULASKI ST	COLUMBIA	SC	29201 3629
MR	CLARENCE	RUSSELL	MANAGER	WILLIAMS-RUSSELL & JOHNSON INC	807 GERVAIS ST STE 102	COLUMBIA	SC	29201 3163
MR	STEPHEN	LENKER	OWNER	COMMUNICATIONS VENTURES LLC	700 GERVAIS ST STE 300	COLUMBIA	SC	29201 3061
				CAROLINA IMPORTS	705 GERVAIS ST	COLUMBIA	SC	29201 3049
MR	AARON	JOHNSON	PRESIDENT	PRETTY PENNY PRODUCTIONS LLC	1224 HUGER ST STE 2	COLUMBIA	SC	29201 3085
MR	PERCIVAL	DUPRE	OWNER	DUPRE CATERING AND EVENTS	316 SENATE ST	COLUMBIA	SC	29201 3032
MR	DAVID	LEWIS	PRESIDENT	SLEEP MED INC	700 GERVAIS ST STE 200	COLUMBIA	SC	29201 3061
	ISHMAL	KIRBIE	MANAGER	COLUMBIA VIOLATIONS BUREAU	811 WASHINGTON ST	COLUMBIA	SC	29201 3115
				GLEISNER LAWFIRM LLC	1237 GADSDEN ST STE 200A	COLUMBIA	SC	29201 3098
MS	SUSAN	WORTHY	EXECUTIVE	REVENUE DEPARTMENT	301 GERVAIS ST STE 2	COLUMBIA	SC	29201 3073
MS	KATHLEEN	PALINSKI		PALINSKI KATHLEEN JD MBA	700 GERVAIS ST STE 300	COLUMBIA	SC	29201 3061
MR	JOHN	CLINGER	MANAGER	CAROLINA WINGS & RIB HOUSE	600 GERVAIS ST	COLUMBIA	SC	29201 3048
				BBR HOLDING CO INC	404 PENDLETON ST	COLUMBIA	SC	29201 3626
MR	WADE	DOUROUX	PRESIDENT	COMMUNITY RESOURCE MORTGAGE INC	508 HAMPTON ST STE 201	COLUMBIA	SC	29201 2765
MS	PATRICIA	WALKER	PRESIDENT	FRENZY INC	1102 HUGER ST	COLUMBIA	SC	29201 3030
	LINDE	DOWNS	OPERATOR	M PAK INC	1312 PULASKI ST UNIT A	COLUMBIA	SC	29201 6002
MR	MIKE	KELLY	CEO	KELLY MIKE ATTY	500 TAYLOR ST STE 400	COLUMBIA	SC	29201 3000
MS	ANGELA	FRANKS	OWNER	FRANKS AND ASSOCIATES INC	500 TAYLOR ST STE 403	COLUMBIA	SC	29201 3000
MR	ALLEN	ROBERSON	MANAGER	CONFEDERATE RELIC ROOM	301 GERVAIS ST STE 1	COLUMBIA	SC	29201 3073
MR	ERIC	SPOTTS	PHYSICIAN	VISTA WOMEN'S CARE	700 GERVAIS ST	COLUMBIA	SC	29201 3047
MR	KEN	SUGGS	PARTNER	SUGGS & KELLY PA	500 TAYLOR ST STE 400	COLUMBIA	SC	29201 3000
MR	RICHARD	DAVIS	OWNER	SOUTH CAROLINA PHILHARMONIC	721 LADY ST	COLUMBIA	SC	29201 3019
MR	GREG	HARRIS	OWNER	LIBERTY TAPROOM & GRILL	828 GERVAIS ST	COLUMBIA	SC	29201 3126
MS	KARA	SPROLES	OWNER	KARA SPROLES MOCK APR	1237 GADSDEN ST STE 200H	COLUMBIA	SC	29201 3098

MR	PHIL		REYNOLDS	OWNER	A CITY LOCK SERVICE	516 SENATE ST	COLUMBIA	SC	29201	3646
MR	DAVID		STUCK	VP	MATTRESS DIRECT	1219 WAYNE ST	COLUMBIA	SC	29201	3055
MR	DARIAN		GRAHAM	OWNER	DPK ENTERPRISES	808 LADY ST	COLUMBIA	SC	29201	3104
					ALL ABOUT WIRELESS	615 LADY ST	COLUMBIA	SC	29201	3094
					RENAISSANCE PLAZA	1324 PULASKI ST	COLUMBIA	SC	29201	3082
					SOUTH CAROLINA AUTOMOBILE DEALERS ASSOCIATION	526 HAMPTON ST	COLUMBIA	SC	29201	2718
	BURNADENE		PAYTON	MANAGER	REVELATIONS	1530 WILLIAMS ST	COLUMBIA	SC	29201	2239
MS	BRITTNEY		MARTIN	MANAGER	RBC BANK	701 GERVAIS ST STE 160	COLUMBIA	SC	29201	3026
MS	MIMI		WORRELL-MORGAN	OWNER	CENTER FOR DANCE EDUCATION	914 PULASKI ST	COLUMBIA	SC	29201	3637
	CECYLE		SMITH	SUPERVISOR	SMITH RUBBER STAMPS & SEALS INC	602 LADY ST	COLUMBIA	SC	29201	3018
MS	DEBI		WINDSOR	PARTNER	AUSTIN & ROGERS PA	508 HAMPTON ST STE 300	COLUMBIA	SC	29201	2765
					S C STATE MUSEUM	301 GERVAIS ST	COLUMBIA	SC	29201	3073
					YOUR AMERICAN BACKYARD	514 GERVAIS ST	COLUMBIA	SC	29201	3057
					S C DEVELOPMENT	514 GERVAIS ST	COLUMBIA	SC	29201	3057
MR	STEVE		BASTON		STEVE BASTON	1600 WILLIAMS ST	COLUMBIA	SC	29201	2220
MR	JOEL		CAMPBELL	OWNER	SAKITUMI	807 GERVAIS ST STE 103	COLUMBIA	SC	29201	3163
					SEVEN HUNDRED LADY STREET ASSOCIATION	701 LADY ST	COLUMBIA	SC	29201	3076
MR	JIM		THIGPEN	MANAGER	TRUSTUS THEATER	520 LADY ST	COLUMBIA	SC	29201	3016
					COLUMBIA FLORIST CONCIERGE BY WIRE	GERVAIS ST	COLUMBIA	SC	29214	2
MS	BRENDA	R	SLICE		304 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MS	CHRISTA		MCGREGOR		100 SUNSET BLVD	APT 702	WEST COLUMBIA	SC	29169	7566
MR	TIMOTHY		MINA		213 HUDSON ST		WEST COLUMBIA	SC	29169	7623
	WENDYTH	T	WELLS		100 SUNSET BLVD	APT 501	WEST COLUMBIA	SC	29169	7565
MS	MARGARET	E	GROFF		100 SUNSET BLVD	APT 502	WEST COLUMBIA	SC	29169	7565
MS	PRISCILLA	B	BRAZELL		317 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MS	LUANE		BRICKHOUSE		327 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MR	MICHAEL		LYNN		207 OLIVER ST		WEST COLUMBIA	SC	29169	7629
MS	ROSE	L	ADKINS		326 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MR	BARBARA	J	TURNER JR		119 AUGUSTA ST		WEST COLUMBIA	SC	29169	7613
MS	MAXINE		PERRY		317 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MS	SANDRA	L	SIMS		215 HUDSON ST		WEST COLUMBIA	SC	29169	7623
	A		THORNLEY		301 COURT AVE		WEST COLUMBIA	SC	29169	7621
MR	DANIEL	M	RICE		120 AUGUSTA ST		WEST COLUMBIA	SC	29169	7614
	ZAKIAH		NELSON		318 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MS	FLORENCE		KLEMICK		100 SUNSET BLVD	APT 404	WEST COLUMBIA	SC	29169	7565
MS	ANGELA		BRICKHOUSE		329 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MR	SCOTT	K	DAVIS		100 SUNSET BLVD	APT 604	WEST COLUMBIA	SC	29169	7566
	NIC		MALLORY		305 COURT AVE		WEST COLUMBIA	SC	29169	7621
	ARLIENE	B	SHELLEY		100 SUNSET BLVD	APT 304	WEST COLUMBIA	SC	29169	7565
MS	VICKI	L	SEWELL		100 SUNSET BLVD	APT 203	WEST COLUMBIA	SC	29169	7561
MR	WILLIAM		BARNWELL		206 HUDSON ST		WEST COLUMBIA	SC	29169	7624
MR	RUDY		FLEISCHHACKER		100 SUNSET BLVD	APT 401	WEST COLUMBIA	SC	29169	7565
MS	CLARA	P	ANDERS		100 SUNSET BLVD	APT 1003	WEST COLUMBIA	SC	29169	7567
MR	PHILLIP		BYRD		302 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MS	MARGRET		NADLER		308 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MS	JUDY	K	WHITE		100 SUNSET BLVD	APT 703	WEST COLUMBIA	SC	29169	7566
MS	LISA		BARNES		121 AUGUSTA ST		WEST COLUMBIA	SC	29169	7613
	PEPPER		ELKINS		100 SUNSET BLVD	APT 601	WEST COLUMBIA	SC	29169	7566
MS	BRENDA		HAUCK		100 SUNSET BLVD	APT 402	WEST COLUMBIA	SC	29169	7565
MR	JONATHAN	F	PIERCE		100 SUNSET BLVD	APT 302	WEST COLUMBIA	SC	29169	7561
	SIOUX		TAYLOR		100 SUNSET BLVD	APT 803	WEST COLUMBIA	SC	29169	7566
MS	MARILYN		BLACK		100 SUNSET BLVD	APT 902	WEST COLUMBIA	SC	29169	7567
MR	WILLIAM	L	KERNAN		320 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MS	CASSIE		POCIASK		203 OLIVER ST		WEST COLUMBIA	SC	29169	7629
	VIRGINA		DAVIS		219 HUDSON ST		WEST COLUMBIA	SC	29169	7623
	VIVAN	L	EDWARDS		307 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MR	HAROLD		HIRSCH		220 HUDSON ST		WEST COLUMBIA	SC	29169	7624
MR	GERALD		CRONIN		100 SUNSET BLVD	APT 903	WEST COLUMBIA	SC	29169	7567
MR	HARRY		LESTER		221 HUDSON ST		WEST COLUMBIA	SC	29169	7623
MR	WALKER		GARRISON		101 OLIVER ST		WEST COLUMBIA	SC	29169	7627
MS	NORMA	B	POPE		100 SUNSET BLVD	APT 202	WEST COLUMBIA	SC	29169	7561
MR	ABBOTT	L	BRAY JR		101 AUGUSTA ST		WEST COLUMBIA	SC	29169	7613
MS	MELISSA		ALLGRIM		324 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MR	WILLIAM	A	BECKHAM JR		100 SUNSET BLVD	APT 504	WEST COLUMBIA	SC	29169	7565
MR	MERRICK		ESTES		100 SUNSET BLVD	APT 602	WEST COLUMBIA	SC	29169	7566
MR	DANIEL	B	SMIGAY		100 SUNSET BLVD	APT 104	WEST COLUMBIA	SC	29169	7561
MR	JOSHUA		RENNER		103 OLIVER ST		WEST COLUMBIA	SC	29169	7627
MS	MARVA	J	LARRABEE		100 SUNSET BLVD	APT 201	WEST COLUMBIA	SC	29169	7561
MR	MARK	L	HARRINGTON		311 HUDSON ST		WEST COLUMBIA	SC	29169	7625
	SHAYLIN		STREETMAN		310 HUDSON ST		WEST COLUMBIA	SC	29169	7626
	BURDETTE		BURR		204 HUDSON ST		WEST COLUMBIA	SC	29169	7624
MS	JANIE		RICHARDSON		100 SUNSET BLVD	APT 804	WEST COLUMBIA	SC	29169	7567
MS	ELIZABETH	A	WARREN		304 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MS	BARBARA		WATSON		100 SUNSET BLVD	APT 801	WEST COLUMBIA	SC	29169	7566
MR	BARTON		DUMAS		100 SUNSET BLVD	APT 303	WEST COLUMBIA	SC	29169	7561
MS	CHERI	B	SPETS		100 SUNSET BLVD	APT 102	WEST COLUMBIA	SC	29169	7561
	JERRY	T	WILLIAMS		206 OLIVER ST		WEST COLUMBIA	SC	29169	7630
MS	NELLIE	B	ADKINS		324 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MS	KAYLA		SOUTHWICK		325 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MS	MARY	C	MUNGO		100 SUNSET BLVD	APT 1002	WEST COLUMBIA	SC	29169	7567
	KATERINA		KERCHEVA		325 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MS	PAMELA	A	MILKEREIT		323 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MS	DEBORAH	C	WILLIAMS		100 SUNSET BLVD	APT 204	WEST COLUMBIA	SC	29169	7561
	MERCELIS		ODOM		314 HUDSON ST		WEST COLUMBIA	SC	29169	7626
MS	MARGARET		PERRY		301 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MR	JAMES		MOORE		327 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MS	ANNMARIE		CLARK		217 HUDSON ST		WEST COLUMBIA	SC	29169	7623
MS	MARTHA	D	INABINET		210 CARPENTER ST		WEST COLUMBIA	SC	29169	7619
MR	BENJAMIN	D	HARWELL		309 COURT AVE		WEST COLUMBIA	SC	29169	7674
MS	LILLIAN	D	JEFFCOAT		313 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MS	JANE	A	DORN		204 CARPENTER ST		WEST COLUMBIA	SC	29169	7619
MR	KENNETH	R	TAYLOR		209 OLIVER ST		WEST COLUMBIA	SC	29169	7629
MR	CHARLES		WESTBROOK		107 OLIVER ST		WEST COLUMBIA	SC	29169	7627
	CHRISTIN		BRADSHAW		206 CARPENTER ST		WEST COLUMBIA	SC	29169	7619
MS	DEBORAH		SLICE		305 HUDSON ST		WEST COLUMBIA	SC	29169	7625
	KIM		BENNETT		313 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MR	BRANDON	E	MILLARES		100 SUNSET BLVD	APT 901	WEST COLUMBIA	SC	29169	7567
MS	MELANIE	A	LOBEL		100 SUNSET BLVD	APT 403	WEST COLUMBIA	SC	29169	7565
MR	GEORGE		ADKINS		322 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MS	JOY		SHELLEY		100 SUNSET BLVD	APT 1001	WEST COLUMBIA	SC	29169	7567
MS	BETH		LESESNE		100 SUNSET BLVD	APT 904	WEST COLUMBIA	SC	29169	7567
MR	WALKER		SATTERFIELD		315 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MR	PHIL		BODIE		122 AUGUSTA ST		WEST COLUMBIA	SC	29169	7614
MS	GAYLE		BROOKS		310 CARPENTER ST		WEST COLUMBIA	SC	29169	7620

	JEAN		WINDHAM	100 SUNSET BLVD	APT 802	WEST COLUMBIA	SC	29169	7566
MS	MOIRA		CARR	210 OLIVER ST	APT A	WEST COLUMBIA	SC	29169	7649
MR	LARRY		MILLER	253 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MS	FELICIA	A	DUPREE	256 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MS	KAREN		BLACKMON	141 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
	LEE	F	WHITTLE	125 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MR	THORNTON		KIRBY	210 RIVERWALK CIR		WEST COLUMBIA	SC	29169	7645
MR	JAMES	E	ANDERSON	101 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MS	JANICE	M	DOWNING	309 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
MR	WAYNE		GOTTO	109 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MR	MADISON		MILLER	500 ALEXANDER RD	APT 523	WEST COLUMBIA	SC	29169	7658
MS	TIFFANY		HALL	500 ALEXANDER RD	APT 1018	WEST COLUMBIA	SC	29169	7665
MS	CHELSEA		SCOGGINS	500 ALEXANDER RD	APT 831	WEST COLUMBIA	SC	29169	7662
MR	JAMES	A	DEPAOLO	500 ALEXANDER RD	APT 1036	WEST COLUMBIA	SC	29169	7675
MS	MICHAELA		HELMS	500 ALEXANDER RD	APT 614	WEST COLUMBIA	SC	29169	7659
MR	JONATHAN		THOMAS	500 ALEXANDER RD	APT 433	WEST COLUMBIA	SC	29169	7657
	FEN		HUANG	500 ALEXANDER RD	APT 924	WEST COLUMBIA	SC	29169	7664
MR	LUCAS		NITSCHE	500 ALEXANDER RD	APT 717	WEST COLUMBIA	SC	29169	7660
MS	SWATI		YADAV	500 ALEXANDER RD	APT 711	WEST COLUMBIA	SC	29169	7660
MR	GRAHAM	C	DIXON	500 ALEXANDER RD	APT 513	WEST COLUMBIA	SC	29169	7658
	KYARA		MASSENBURG	500 ALEXANDER RD	APT 631	WEST COLUMBIA	SC	29169	7659
	LENZA		JOLLEY	500 ALEXANDER RD	APT 633	WEST COLUMBIA	SC	29169	7659
	SHURONE		BLACKWELL	500 ALEXANDER RD	APT 813	WEST COLUMBIA	SC	29169	7662
MR	BRUCE	H	BRUTSCHY	211 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
	LAUREN		TILL	500 ALEXANDER RD	APT 511	WEST COLUMBIA	SC	29169	7658
	DOMINIQUE		HUFF	500 ALEXANDER RD	APT 323	WEST COLUMBIA	SC	29169	7656
	BRITANY		SAWYER	500 ALEXANDER RD	APT 737	WEST COLUMBIA	SC	29169	7661
MR	MICHAEL		TURNER	500 ALEXANDER RD	APT 731	WEST COLUMBIA	SC	29169	7661
	JORDAN		TODARO	500 ALEXANDER RD	APT 233	WEST COLUMBIA	SC	29169	7655
MS	SARA	E	ROBERTS	500 ALEXANDER RD	APT 124	WEST COLUMBIA	SC	29169	7654
MS	AMANDA		COPLEY	500 ALEXANDER RD	APT 422	WEST COLUMBIA	SC	29169	7657
MS	HILLARY		MACARTHUR	500 ALEXANDER RD	APT 837	WEST COLUMBIA	SC	29169	7663
MR	DAVID		DINKINS	128 RIVERWALK CIR		WEST COLUMBIA	SC	29169	7644
MS	SARAH		CLEATON	500 ALEXANDER RD	APT 423	WEST COLUMBIA	SC	29169	7657
MR	MICHAEL		FAHY	500 ALEXANDER RD	APT 232	WEST COLUMBIA	SC	29169	7655
	LAUREN		HALL	500 ALEXANDER RD	APT 331	WEST COLUMBIA	SC	29169	7656
MS	JANE		ALLEN	105 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MS	ADELE		MECIONIS	104 RIVERWALK CIR		WEST COLUMBIA	SC	29169	7644
	SHAKEARA		JENNINGS	500 ALEXANDER RD	APT 1016	WEST COLUMBIA	SC	29169	7665
MS	CELESTE		HARMON	500 ALEXANDER RD	APT 223	WEST COLUMBIA	SC	29169	7655
	SHANDRILYA		LEWIS	500 ALEXANDER RD	APT 1026	WEST COLUMBIA	SC	29169	7665
	CHRIS		JONES	500 ALEXANDER RD	APT 732	WEST COLUMBIA	SC	29169	7661
	TRUNG		NGUYEN	500 ALEXANDER RD	APT 1027	WEST COLUMBIA	SC	29169	7665
	SHANNON		FULWOOD	264 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MR	BRYAN	B	BOLEN	133 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MR	JOSH		LATHAM	321 CARPENTER ST		WEST COLUMBIA	SC	29169	7671
	PRIMA		RAY	500 ALEXANDER RD	APT 123	WEST COLUMBIA	SC	29169	7654
MS	BRANDY	N	HENSLEY	500 ALEXANDER RD	APT 715	WEST COLUMBIA	SC	29169	7660
MR	ALLEN		YOUNG	500 ALEXANDER RD	APT 1028	WEST COLUMBIA	SC	29169	7665
	AUBREY		FOX	500 ALEXANDER RD	APT 333	WEST COLUMBIA	SC	29169	7657
	TRACEY		DANTONO	500 ALEXANDER RD	APT 321	WEST COLUMBIA	SC	29169	7656
MR	MICHAEL		COLOZZI	500 ALEXANDER RD	APT 214	WEST COLUMBIA	SC	29169	7655
	SHELBY		O'BRIEN	500 ALEXANDER RD	APT 411	WEST COLUMBIA	SC	29169	7657
MR	MICHAEL		CUBELLI	500 ALEXANDER RD	APT 1034	WEST COLUMBIA	SC	29169	7675
	WHITNEY		BOGART	500 ALEXANDER RD	APT 532	WEST COLUMBIA	SC	29169	7658
	FRANCIS	M	HINSON	126 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MS	AMBER		O'FAIR	500 ALEXANDER RD	APT 533	WEST COLUMBIA	SC	29169	7658
MR	MICHAEL	R	SANDUSKY	236 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MR	TRAVIS		JEFFERSON	500 ALEXANDER RD	APT 914	WEST COLUMBIA	SC	29169	7664
MR	OMAR		AL MASKARI	500 ALEXANDER RD	APT 1025	WEST COLUMBIA	SC	29169	7665
MS	SAMANTHA		JAROSZ	500 ALEXANDER RD	APT 816	WEST COLUMBIA	SC	29169	7662
MS	EMILY		TEMPLES	229 RIVERWALK CIR		WEST COLUMBIA	SC	29169	7645
MS	NIKKI		SETZLER	249 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MR	MICHAEL	W	CROWLEY	500 ALEXANDER RD	APT 922	WEST COLUMBIA	SC	29169	7664
MS	SARAH		RODRIGUEZ	500 ALEXANDER RD	APT 334	WEST COLUMBIA	SC	29169	7657
MS	CATHERINE		NORRIS	240 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7647
MS	BARBARA		FOX	500 ALEXANDER RD	APT 1111A	WEST COLUMBIA	SC	29169	7676
MS	SHEILA		METTETAL	500 ALEXANDER RD	APT 738	WEST COLUMBIA	SC	29169	7661
MR	BILLY		PUTNAM	149 CONGAREE PARK DR		WEST COLUMBIA	SC	29169	7639
MS	KIMBERLY		CALLE	500 ALEXANDER RD	APT 221	WEST COLUMBIA	SC	29169	7655
MS	CARLA		BAILEY	500 ALEXANDER RD	APT 233C	WEST COLUMBIA	SC	29169	7655
	KAITLYN		SHEALY	307 HUDSON ST		WEST COLUMBIA	SC	29169	7625
MS	KRISTI		GRISSOM	308 CARPENTER ST		WEST COLUMBIA	SC	29169	7620
MR	DANIEL		JOBES	209 HUDSON ST		WEST COLUMBIA	SC	29169	7623
MS	ANGELA		LEE	500 ALEXANDER RD	APT 134	WEST COLUMBIA	SC	29169	7654
	KELSEY		RUDZINSKY	500 ALEXANDER RD	APT 234	WEST COLUMBIA	SC	29169	7655
	TRANEISHA		MUMFORD	500 ALEXANDER RD	APT 113	WEST COLUMBIA	SC	29169	7654
MS	MARY		DEMENT	500 ALEXANDER RD	APT 921	WEST COLUMBIA	SC	29169	7664
MR	SAM		BENNETT	500 ALEXANDER RD	APT 132	WEST COLUMBIA	SC	29169	7654
MS	CHELSEA		STEVENS	500 ALEXANDER RD		WEST COLUMBIA	SC	29169	7652
MS	SARAH		NOYES	535 DEPOT ST		COLUMBIA	SC	29201	2274
	JI	E	SONG	535 DEPOT ST	APT 105	COLUMBIA	SC	29201	2274
MR	ROBERT		DEUEL	1320 PULASKI ST	UNIT 302	COLUMBIA	SC	29201	3081
	A		ALLEN	1100 PULASKI ST		COLUMBIA	SC	29201	3644
MR	GRADY		BROWN	1131 WILLIAMS ST		COLUMBIA	SC	29201	3035
MR	ZACHARY	M	HORAN	510 DEPOT ST	APT 111	COLUMBIA	SC	29201	2272
	JORDAN	C	REILLY	1100 PULASKI ST	APT 812	COLUMBIA	SC	29201	3658
MR	ADAM		SMOLKA	511 GERVAIS ST		COLUMBIA	SC	29201	3045
MR	WADE	T	CAUGHMAN	1133 WILLIAMS ST		COLUMBIA	SC	29201	3035
MS	ALLIE		SELMAN	1324 PULASKI ST	UNIT 112	COLUMBIA	SC	29201	3084
MS	KRISTEN	M	FRALA	510 DEPOT ST		COLUMBIA	SC	29201	2271
MR	KELVIN		BRITT	1100 PULASKI ST	APT 625	COLUMBIA	SC	29201	3655
MS	REBECCA		BOOKSTAVER	1100 PULASKI ST	APT 822	COLUMBIA	SC	29201	3658
MS	PAIGE		TYLER	1424 GADSDEN ST		COLUMBIA	SC	29201	3004
MR	LARRY	A	RIDEMAN	1129 WILLIAMS ST		COLUMBIA	SC	29201	3035
MS	MINA	F	HINSON	530 LADY ST	UNIT 303	COLUMBIA	SC	29201	6011
MS	LAURA		STRITZINGER	425 MACDOUGALL ST	APT 101	COLUMBIA	SC	29201	2278
MS	KATHERINE		STANTON	510 DEPOT ST	APT 102	COLUMBIA	SC	29201	2271
MS	KATIE		BROWN	1529 WILLIAMS ST	APT 107	COLUMBIA	SC	29201	2268
	TA-TANISHA		FAVOR	1120 GIST ST	# 14	COLUMBIA	SC	29201	3038
MR	STEVE		HINSON	530 LADY ST		COLUMBIA	SC	29201	6011
MS	TARA	A	NELSON	1100 PULASKI ST	APT 221	COLUMBIA	SC	29201	3648
MR	JACOB		PORTER	1529 WILLIAMS ST		COLUMBIA	SC	29201	2268
MS	MARGARET		LEHEUP	515 GERVAIS ST		COLUMBIA	SC	29201	3045

MS	THERESA	F	FOUDA	1529 WILLIAMS ST	APT 311	COLUMBIA	SC	29201	2270
MS	CHRISTINE	A	DUNCAN	530 LADY ST	UNIT 204	COLUMBIA	SC	29201	6011
MS	BEVERLY	H	CARRAWAY	302 CITY CLUB DR		COLUMBIA	SC	29201	6009
MS	MELISSA		BUTLER	530 LADY ST	UNIT 403	COLUMBIA	SC	29201	6011
MR	DICK		CLARKE	530 LADY ST	UNIT 401	COLUMBIA	SC	29201	6011
MR	PETER		CATHCART	535 DEPOT ST	APT 311	COLUMBIA	SC	29201	2276
MS	JANIS		CONKLIN	1125 WILLIAMS ST		COLUMBIA	SC	29201	3035
	COURTNEY		FILIPIAK	1625 WILLIAMS ST	APT 201	COLUMBIA	SC	29201	2266
MS	JULIA	G	LEE	317 SENATE ST		COLUMBIA	SC	29201	3031
MR	BENJAMIN		JOYE	1615 WILLIAMS ST	APT 101	COLUMBIA	SC	29201	2264
MR	DAVID	J	MEARS IV	535 DEPOT ST	APT 306	COLUMBIA	SC	29201	2276
MS	DONNA	C	HILL	519 GERVAIS ST		COLUMBIA	SC	29201	3045
MS	MARY	C	SNELL	1529 WILLIAMS ST	APT 206	COLUMBIA	SC	29201	2269
MR	JULIUS	W	MCKAY II	1123 WILLIAMS ST		COLUMBIA	SC	29201	3035
MR	DAVID	C	MCNAMARA	308 CITY CLUB DR		COLUMBIA	SC	29201	6009
MS	EVA		BERTHOLD	1324 PULASKI ST	UNIT 205	COLUMBIA	SC	29201	3084
MR	MARTIN	W	NYBERG	1324 PULASKI ST	UNIT 310	COLUMBIA	SC	29201	3084
MS	BETHANY		HECK	510 DEPOT ST	APT 108	COLUMBIA	SC	29201	2271
MR	DARRYL		ENNELS	1529 WILLIAMS ST	APT 303	COLUMBIA	SC	29201	2270
MS	ALLISON	B	BULLARD	510 DEPOT ST	APT 109	COLUMBIA	SC	29201	2271
MR	BRIAN	M	DELLI-GATTI	510 DEPOT ST	APT 107	COLUMBIA	SC	29201	2271
	DESHIA	A	LEONHIRTH	510 DEPOT ST	APT 202	COLUMBIA	SC	29201	2272
	ASHLEY		GOOLSBY	535 DEPOT ST	APT 302	COLUMBIA	SC	29201	2275
MR	STEPHEN		GEORGES	535 DEPOT ST	APT 206	COLUMBIA	SC	29201	2275
MR	JONATHAN		HARDIN	383 TAYLOR ST	APT 300	COLUMBIA	SC	29201	2263
MS	SUZANNE	L	SANDERS	510 DEPOT ST	APT 204	COLUMBIA	SC	29201	2272
MR	GIOVANNI		DUSTIN	510 DEPOT ST	APT 104	COLUMBIA	SC	29201	2271
	ALEX	C	BOOKERT	510 DEPOT ST	APT 110	COLUMBIA	SC	29201	2272
MR	DANIEL		BARRY	535 DEPOT ST	APT 303	COLUMBIA	SC	29201	2275
MS	KATIE	L	SMITH	535 DEPOT ST	APT 202	COLUMBIA	SC	29201	2275
MR	BRYCE	C	STALLINGS	535 DEPOT ST	APT 200	COLUMBIA	SC	29201	2275
MS	ROSEMARY		MONTGOMERY	1529 WILLIAMS ST	APT 211	COLUMBIA	SC	29201	2269
MR	CHRISTOPHER		COCKRELL	1639 WILLIAMS ST	APT 100	COLUMBIA	SC	29201	2267
MR	DOUG	E	THOMAS	1320 PULASKI ST	UNIT 201	COLUMBIA	SC	29201	3081
MS	RACHEL		COLGATE	510 DEPOT ST	APT 201	COLUMBIA	SC	29201	2272
MR	ETHAN		WALTER	1529 WILLIAMS ST	APT 110	COLUMBIA	SC	29201	2269
MS	NICOLE	M	BRUNETTI	535 DEPOT ST	APT 301	COLUMBIA	SC	29201	2275
MR	MICHAEL		WETZEL	1320 PULASKI ST	UNIT 204	COLUMBIA	SC	29201	3081
MS	AMY		LACLAIRE	535 DEPOT ST	APT 201	COLUMBIA	SC	29201	2275
	CARRIE	A	VAROUHAKIS	424 MACDOUGALL ST	APT 101	COLUMBIA	SC	29201	2277
MR	KEITH	S	SIMS	510 DEPOT ST	APT 200	COLUMBIA	SC	29201	2272
MS	ANGELA		ROSENBERG	510 DEPOT ST	APT 302	COLUMBIA	SC	29201	2272
MR	NICHOLAS		CALDWELL	510 DEPOT ST	APT 309	COLUMBIA	SC	29201	2273
MS	ELAINE	E	GREEN	1529 WILLIAMS ST	APT 213	COLUMBIA	SC	29201	2269
MS	JILL		JOHNSON	535 DEPOT ST	APT 310	COLUMBIA	SC	29201	2276
MR	AARON		RUTLEDGE	1625 WILLIAMS ST	APT 300	COLUMBIA	SC	29201	2266
MR	KENDALL		ULBRICH	1529 WILLIAMS ST	APT 210	COLUMBIA	SC	29201	2269
MS	SANDRA	L	BEICH	535 DEPOT ST	APT 103	COLUMBIA	SC	29201	2274
	J	M	BAILEY	535 DEPOT ST	APT 106	COLUMBIA	SC	29201	2274
MR	DENTON		KITCHELL	535 DEPOT ST	APT 107	COLUMBIA	SC	29201	2274
MR	JOSEPH	C	LOCKARD	1324 PULASKI ST	UNIT 204	COLUMBIA	SC	29201	3084
MR	PAUL		POTYLICKI	1120 GIST ST		COLUMBIA	SC	29201	3038
MS	JOANN	N	WALLACE	1320 PULASKI ST	UNIT 107	COLUMBIA	SC	29201	3081
MS	JENNIFER	E	NOEL	1529 WILLIAMS ST	APT 310	COLUMBIA	SC	29201	2270
MS	AMANDA		FAIRCHILD	1615 WILLIAMS ST	APT 301	COLUMBIA	SC	29201	2264
MS	VALERIE		LANGLEY	510 DEPOT ST	APT 210	COLUMBIA	SC	29201	2272
MS	LACEY	E	GOULDING	1529 WILLIAMS ST	APT 203	COLUMBIA	SC	29201	2269
MR	GOKUL		GONDI	1112 GIST ST		COLUMBIA	SC	29201	3038
MS	MEREDITH		VERONA	535 DEPOT ST	APT 113	COLUMBIA	SC	29201	2274
MR	DAVID	W	PETERSON	311 SENATE ST		COLUMBIA	SC	29201	3031
MR	MARCO		HABERMANN	1615 WILLIAMS ST	APT 300	COLUMBIA	SC	29201	2264
MR	NATHAN		ROSNER	425 MACDOUGALL ST	APT 300	COLUMBIA	SC	29201	2278
MR	JOSEPH		KIM	535 DEPOT ST	APT 112	COLUMBIA	SC	29201	2274
MS	AMY	D	TAYLOR	1127 WILLIAMS ST		COLUMBIA	SC	29201	3035
MR	JAKE		KRIEG	535 DEPOT ST	APT 109	COLUMBIA	SC	29201	2274
MS	KRISTINE		EVERETT	601 LADY ST	UNIT A	COLUMBIA	SC	29201	3087
MS	REBECCA	S	MCMILLAN	315 SENATE ST		COLUMBIA	SC	29201	3031
MS	KESHA		WATKINS	535 DEPOT ST	APT 307	COLUMBIA	SC	29201	2276
MR	JASON	P	WATKINS	1320 PULASKI ST	UNIT 307	COLUMBIA	SC	29201	3081
MR	GERALD		THARPE	1324 PULASKI ST	UNIT 309	COLUMBIA	SC	29201	3084
MS	SARA		CABRA	1625 WILLIAMS ST	APT 100	COLUMBIA	SC	29201	2265
MR	DAVID	C	WIESENDANGER	425 MACDOUGALL ST	APT 103	COLUMBIA	SC	29201	2278
MS	SUSAN	J	ROCAMORA	304 CITY CLUB DR		COLUMBIA	SC	29201	6009
	J	C	DARBY	1615 WILLIAMS ST	APT 100	COLUMBIA	SC	29201	2264
MR	ADAM		ANSARI	1126 GIST ST		COLUMBIA	SC	29201	3038
	TERA		CONSTANT	384 TAYLOR ST	APT 201	COLUMBIA	SC	29201	2279
MR	PATRICK		CASE	383 TAYLOR ST	APT 301	COLUMBIA	SC	29201	2263
MR	ROBERT		CARTER	383 TAYLOR ST	APT 302	COLUMBIA	SC	29201	2263
MR	ROBERT	J	SOX	300 GERVAIS ST	APT 102	COLUMBIA	SC	29201	3097
MR	JEREMY		WILLIAMS	1128 GIST ST		COLUMBIA	SC	29201	3038
MS	ANGELA		JOHNSON	613 LADY ST	UNIT B	COLUMBIA	SC	29201	3093
MR	ALLEN	N	BERGER	1122 GIST ST		COLUMBIA	SC	29201	3038
MS	SARA	L	COGSWELL	1320 PULASKI ST	UNIT 104	COLUMBIA	SC	29201	3081
MS	JENIFER	C	EDWARDS	306 CITY CLUB DR		COLUMBIA	SC	29201	6009
MS	LINDA		PERKINS	1320 PULASKI ST	UNIT 301	COLUMBIA	SC	29201	3081
MR	DOUGLAS		KENNEALLY	300 GERVAIS ST	APT 201	COLUMBIA	SC	29201	3097
	JEAN		DOZIER	716 WASHINGTON ST	APT 8	COLUMBIA	SC	29201	3060
MR	CRAIG	G	DAWSON	300 GERVAIS ST	APT 101	COLUMBIA	SC	29201	3097
MS	VIOLET	C	GABRIEL	300 GERVAIS ST	APT 104	COLUMBIA	SC	29201	3097
MR	VINCENT		JENKINS	716 WASHINGTON ST	APT 10	COLUMBIA	SC	29201	3060
MS	SADIE	H	HARTMAN	1130 GIST ST		COLUMBIA	SC	29201	3038
MR	CHARLES		PRESSIO	1100 GIST ST		COLUMBIA	SC	29201	3038
MR	BRUCE		SPROLES	1320 PULASKI ST	UNIT 207	COLUMBIA	SC	29201	3081
MR	JEREMY		WILSON	1102 GIST ST		COLUMBIA	SC	29201	3038
MR	ERIC		JEFFRIES	1320 PULASKI ST	UNIT 102	COLUMBIA	SC	29201	3081
MR	ROGER	L	WETNIGHT	1308 PULASKI ST	UNIT B	COLUMBIA	SC	29201	6000
MS	PEGGY		SPANN	1116 GIST ST		COLUMBIA	SC	29201	3038
MR	ERIC	D	BRIGHT	1100 PULASKI ST	APT 534	COLUMBIA	SC	29201	3655
MS	JULIE		REED	1106 GIST ST		COLUMBIA	SC	29201	3038
MR	PATRICK	J	CLEARY	1100 PULASKI ST	APT 735	COLUMBIA	SC	29201	3658
MR	SOL		BLATT JR	1320 PULASKI ST		COLUMBIA	SC	29201	3080
	JORDAN		HOPKINS	1100 PULASKI ST	APT 533	COLUMBIA	SC	29201	3655
	GRIFFIN		BURGESS	1100 PULASKI ST	APT 837	COLUMBIA	SC	29201	3659
MS	KATHLEEN		MOORE	1324 PULASKI ST	UNIT 104	COLUMBIA	SC	29201	3083

MR	JAMES	S	POPE	1324 PULASKI ST	UNIT 209	COLUMBIA	SC	29201	3084
MR	TERENCE		HARRIS	701 GERVAIS ST	APT 307	COLUMBIA	SC	29201	3064
MS	GAYLE		BURGESS	1320 PULASKI ST	UNIT 101	COLUMBIA	SC	29201	3081
MR	DEVIN	L	SHANKS	1324 PULASKI ST	UNIT 109	COLUMBIA	SC	29201	3084
MS	RACHEL		LALIBERTE	1114 GIST ST		COLUMBIA	SC	29201	3038
MR	MICHAEL		RICHARDSON	1100 PULASKI ST	APT 307	COLUMBIA	SC	29201	3648
MS	KRISTINE	L	CATO	1422 GADSDEN ST		COLUMBIA	SC	29201	3004
MS	MARY	A	LANGSTON	1110 GIST ST		COLUMBIA	SC	29201	3038
MS	KAY	B	FRAME	1108 GIST ST		COLUMBIA	SC	29201	3038
MR	RICHARD	K	ROWE	1324 PULASKI ST	UNIT 101	COLUMBIA	SC	29201	3083
MR	GEORGE		NOBLES	1324 PULASKI ST	UNIT 103	COLUMBIA	SC	29201	3083
MS	ANNETTE		SELLO	1124 GIST ST		COLUMBIA	SC	29201	3038
MS	ELLA		FIRTKO	1426 GADSDEN ST		COLUMBIA	SC	29201	3004
MS	CATHERINE	J	DICKSON	1428 GADSDEN ST		COLUMBIA	SC	29201	3004
MR	MICHAEL		UGINO	1104 GIST ST		COLUMBIA	SC	29201	3038
MS	BEVERLY	H	BERGERON	1324 PULASKI ST	UNIT 111	COLUMBIA	SC	29201	3084
MR	JOHN	W	FUSELER	1100 PULASKI ST	APT 828	COLUMBIA	SC	29201	3658
MS	BRANDI		JUSTICE	1100 PULASKI ST	APT 826	COLUMBIA	SC	29201	3658
MS	GWEN		RAWLS	1324 PULASKI ST	UNIT 201	COLUMBIA	SC	29201	3084
MR	BRIAN	A	MILLER	1324 PULASKI ST		COLUMBIA	SC	29201	3082
MS	STEPHANIE	E	WALZ	615 LADY ST	UNIT B	COLUMBIA	SC	29201	3094
MR	KENNITH		VOGLER	701 GERVAIS ST	APT 305	COLUMBIA	SC	29201	3064
MS	BRITTANY		MITCHELL	1100 PULASKI ST	APT 624	COLUMBIA	SC	29201	3655
MS	REBECCA		ROSER	1100 PULASKI ST	APT 714	COLUMBIA	SC	29201	3657
MR	BENJAMIN	J	DROISEN	1418 GADSDEN ST		COLUMBIA	SC	29201	3004
MR	LAURENCE		SCHMIDT	1100 PULASKI ST	APT 115	COLUMBIA	SC	29201	3647
MS	KAREN		BRITT	1100 PULASKI ST	APT 638	COLUMBIA	SC	29201	3657
MR	JUSTIN	S	BYARS	1100 PULASKI ST	APT 218	COLUMBIA	SC	29201	3648
	CHANTELAY		MOODY	716 WASHINGTON ST	APT 11	COLUMBIA	SC	29201	3060
	CASEY	L	SUITS	1100 PULASKI ST	APT 422	COLUMBIA	SC	29201	3653
MS	KATE		ROBINETTE	1100 PULASKI ST	APT 515	COLUMBIA	SC	29201	3654
	KALLIE	L	LAW	1100 PULASKI ST	APT 223	COLUMBIA	SC	29201	3648
MS	JENNIFER		WALLACE	434 GERVAIS ST		COLUMBIA	SC	29201	3044
MR	RYAN	C	TOTH	1100 PULASKI ST	APT 524	COLUMBIA	SC	29201	3654
MS	RIA		GRIPALDO	1100 PULASKI ST	APT 527	COLUMBIA	SC	29201	3654
MR	JACK	L	CARTER	1100 PULASKI ST	APT 626	COLUMBIA	SC	29201	3655
MR	KIP		WERTS	1100 PULASKI ST	APT 428	COLUMBIA	SC	29201	3654
MR	DON		DANGLER	1100 PULASKI ST	APT 424	COLUMBIA	SC	29201	3654
MS	TAMMIE	L	FABRY	1100 PULASKI ST	APT 737	COLUMBIA	SC	29201	3658
	WEYBURN		BEVAN	620 GERVAIS ST		COLUMBIA	SC	29201	3074
MR	MARTIN		VAN DER HOEK	1100 PULASKI ST	APT 622	COLUMBIA	SC	29201	3655
MS	TIFFANY		SETO	1100 PULASKI ST	APT 126	COLUMBIA	SC	29201	3647
MS	MEAGAN		BROWN	1100 PULASKI ST	APT 538	COLUMBIA	SC	29201	3655
MS	TARYN		LIECHTY	1100 PULASKI ST	APT 823	COLUMBIA	SC	29201	3658
MS	AMANDA		GOTTSCHALL	1100 PULASKI ST	APT 222	COLUMBIA	SC	29201	3648
MR	BLAKE		WILLIAMS	1100 PULASKI ST	APT 318	COLUMBIA	SC	29201	3653
	ABDULAZIZ		KAZEM	1100 PULASKI ST	APT 913	COLUMBIA	SC	29201	3659
MS	LAURA		CORDER	1100 PULASKI ST	APT 931	COLUMBIA	SC	29201	3659
MS	SHIVANI		PATEL	1100 PULASKI ST	APT 824	COLUMBIA	SC	29201	3658
	J	E	THOMAS	1100 PULASKI ST	APT 531	COLUMBIA	SC	29201	3654
MR	JOHN	V	DOUGLAS	1100 PULASKI ST	APT 725	COLUMBIA	SC	29201	3600
MR	TOM		TILDON	1100 PULASKI ST	APT 934	COLUMBIA	SC	29201	3659
MR	WILLIAM	J	MARTIN	1100 PULASKI ST	APT 831	COLUMBIA	SC	29201	3658
MR	TODD		LEFKOWITZ	701 GERVAIS ST	APT 309	COLUMBIA	SC	29201	3064
	JESSE		GROTE	701 GERVAIS ST	APT 308	COLUMBIA	SC	29201	3064
MR	HUGH	R	PENNY	508 HAMPTON ST		COLUMBIA	SC	29201	2759
	CHRIS	A	FLAUGH	1100 PULASKI ST	APT 914	COLUMBIA	SC	29201	3659
	LESLIE		TAYLOR	1100 PULASKI ST	APT 412	COLUMBIA	SC	29201	3653
MS	REBECCA		NICHOLSON	1100 PULASKI ST	APT 523	COLUMBIA	SC	29201	3654
MR	JAY		FINKELSTEIN	1100 PULASKI ST	APT 715	COLUMBIA	SC	29201	3600
MS	JENNIFER		PRUSKOWSKI	1100 PULASKI ST	APT 213	COLUMBIA	SC	29201	3647
MR	ANDREW		GRAFTON	1100 PULASKI ST	APT 634	COLUMBIA	SC	29201	3655
MS	AMELIA	H	BRADLEY	1100 PULASKI ST	APT 518	COLUMBIA	SC	29201	3654
MS	SASHA		COBB	1100 PULASKI ST	APT 738	COLUMBIA	SC	29201	3658
	LAUREN		JARVIS	1100 PULASKI ST	APT 317	COLUMBIA	SC	29201	3653
MS	EMILY		ASHLEY	1100 PULASKI ST	APT 724	COLUMBIA	SC	29201	3600
MS	MOLLY	S	KRONEMEYER	1100 PULASKI ST	APT 721	COLUMBIA	SC	29201	3600
	SATORU		HOBARA	1100 PULASKI ST	APT 207	COLUMBIA	SC	29201	3647
MR	RYAN		WALLACE	1100 PULASKI ST	APT 726	COLUMBIA	SC	29201	3600
MS	DENISE	M	MCCASTON	701 GERVAIS ST	APT 304	COLUMBIA	SC	29201	3064
MR	CHARLIE	W	JENSEN	1100 PULASKI ST	APT 827	COLUMBIA	SC	29201	3658
MR	JOHN	F	MCLEOD	1100 PULASKI ST	APT 734	COLUMBIA	SC	29201	3658
MR	JAMES		HILLEY	1100 PULASKI ST	APT 315	COLUMBIA	SC	29201	3653
MR	CHARLES		FRITZ	1420 GADSDEN ST		COLUMBIA	SC	29201	3004
MS	LISA		HEDGEPATH	1100 PULASKI ST	APT 217	COLUMBIA	SC	29201	3648
MS	SARAH	A	KENNEY	1100 PULASKI ST	APT 727	COLUMBIA	SC	29201	3600
	ZHAOKUAN		LIU	1100 PULASKI ST	APT 616	COLUMBIA	SC	29201	3655
MS	VIRGINIA		BARFIELD	1100 PULASKI ST	APT 613	COLUMBIA	SC	29201	3655
MS	LORI	K	HARLEN	1100 PULASKI ST	APT 713	COLUMBIA	SC	29201	3657
MS	ELIZABETH	A	FOUNTAIN	1100 PULASKI ST	APT 417	COLUMBIA	SC	29201	3653
	T	L	CARPENTER	701 GERVAIS ST	APT 306	COLUMBIA	SC	29201	3064
MR	ANTHONY		BRUNDRETT	1100 PULASKI ST	APT 521	COLUMBIA	SC	29201	3654
	ROULLA	D	NAU	1100 PULASKI ST	APT 633	COLUMBIA	SC	29201	3655
MR	MICHAEL	T	BENNETT	1100 PULASKI ST	APT 811	COLUMBIA	SC	29201	3658
MR	DENNIS	L	GRIERSON	1100 PULASKI ST	APT 815	COLUMBIA	SC	29201	3658
MR	REID		FREEMAN	1100 PULASKI ST	APT 215	COLUMBIA	SC	29201	3648
MR	MATTHEW		CROWE	1430 GADSDEN ST		COLUMBIA	SC	29201	3004
MS	MARILYN		MOLKENTHIN	1100 PULASKI ST	APT 637	COLUMBIA	SC	29201	3657
MS	KATIE		SPEIR	1100 PULASKI ST	APT 612	COLUMBIA	SC	29201	3655
MR	BRADLEY		SEDDON	1100 PULASKI ST	APT 536	COLUMBIA	SC	29201	3655
MR	WILLIAM	O	SPARKS	1100 PULASKI ST	APT 111	COLUMBIA	SC	29201	3647
MR	ERIC		PARTON	808 LADY ST		COLUMBIA	SC	29201	3104
MS	ELIZABETH		BLACKWELL	1100 PULASKI ST	APT 125	COLUMBIA	SC	29201	3647
MR	ZACHARY		CHARLTON	1100 PULASKI ST	APT 124	COLUMBIA	SC	29201	3647
MR	OLAN		ALLEN	716 WASHINGTON ST	APT 7	COLUMBIA	SC	29201	3059
MR	CHRISTOPHER		MEARS	1100 PULASKI ST	APT 114	COLUMBIA	SC	29201	3647
MR	TIM		PENLEY	1100 PULASKI ST	APT 425	COLUMBIA	SC	29201	3654
MR	GREGORY		PLANTER	716 WASHINGTON ST	APT 9	COLUMBIA	SC	29201	3060
MS	MINNIE		DUNBAR	716 WASHINGTON ST	APT 1	COLUMBIA	SC	29201	3059
MR	ROBERT	L	REASER	805 GERVAIS ST	APT B	COLUMBIA	SC	29201	6106
	SHARIDA		ANDERSON	1100 PULASKI ST	APT 426	COLUMBIA	SC	29201	3654
MS	NEVILLEH		ACILLE	3405 MARGRAVE ROAD		COLUMBIA	SC	29203	5705

Congaree River Sediment Cleanup — February 13, 2017

Background

In June 2010, tar-like material in the Congaree River was reported to the S.C. Department of Health and Environmental Control (DHEC). DHEC investigated and determined the tar originated from a former Manufactured Gas Plant (MGP) that was operated by predecessor companies of South Carolina Electric and Gas Company (SCE&G) from around 1906 until the 1950s. MGP operations created coal tar waste that was discharged into a former stream and deposited into the Congaree River just downstream of the Gervais Street Bridge.

Roles and Responsibilities

- **SCE&G** is responsible for the tar found in the Congaree River and has been working with DHEC to develop a plan for cleanup.
- **DHEC** investigated the source and extent of the tar and oversees SCE&G's activities related to the cleanup.
- The **US Army Corps of Engineers (USACE)** is responsible for reviewing the proposed activity to determine if a permit can be issued under Section 404 of the Clean Water Act (placement of fill) and/or Section 10 of the Rivers and Harbors Act (alteration in a navigable water).

Sediment, Soil and Water Sampling

Between September 2010 and March 2012, SCE&G collected sediment and soil samples to determine the depth and extent of the tar. Sample results showed the presence of some volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs). The sediment layer containing tar varies from approximately less than 1 inch in thickness to at least 1 foot. Tar-impacted sediments were found on the river bed between 50 and 300 feet from the eastern shoreline (Columbia side) and approximately 2,000 feet downstream of the Gervais Street Bridge. Water samples have shown no tar-related chemicals of concern.

Evaluation of Cleanup Alternatives and Timeline

The following alternatives were evaluated to address the impacted sediment in the river:

- Alternative 1 – No Action
- Alternative 2 – Monitoring & Institutional Controls
- Alternative 3 – Sediment Capping & Institutional Controls
- Alternative 4 – Removal & Offsite Disposal

In **March 2013**, DHEC held a public meeting to share the assessment results and alternatives. Alternative 4 was initially preferred by DHEC because it provided the most overall protection of human health and the environment. As SCE&G worked through the design and the USACE permitting process for Alternative 4, it was determined that the planned cofferdam posed significant risks to the river. In **September 2015**, SCE&G began a pilot test using sand bags to isolate smaller areas for removal. In early **October 2015**, historic flooding caused a breach in the Columbia Canal upstream of the project area, causing up to 5 feet of new sediment to be deposited on top of the impacted sediment.

In **August 2016**, after determining that a removal option was no longer feasible, DHEC requested that SCE&G begin the design and permitting process for Alternative 3, the next most protective option for human health and the environment. SCE&G has submitted an application to the USACE to determine if permit requirements can be met for this alternative.

Next Steps

After the USACE makes a permitting decision on the capping alternative, **DHEC will provide notification of a new preferred alternative, hold a public meeting, and accept comments on the cleanup options prior to selection of a final cleanup action.**

Visit our webpage for additional information and updates: **www.scdhec.gov/CongareeRiver.** *If you have any questions about the project, please contact Lucas Berresford, DHEC Project Manager, at (803) 898-0747 or berresjl@dhec.sc.gov.*

APPENDIX N

PUBLIC SAFETY PLAN

PUBLIC SAFETY PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

PUBLIC SAFETY PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach site operations scenario.

GENERAL PROJECT DETAILS

Initial project activities will consist of constructing the landside support zone and relocating indigenous freshwater mussels from the planned footprint of the cap area. The landside support zone will consist of a series of gravel roads and equipment/material lay down areas and office trailers.

The project basically entails the placement of a physical barrier in the form of an engineered capping system over the majority of impacted sediment within the project area. Figure 2 provides the limits of the planned sediment cap area. The cap will consist of a geotextile fabric material overlain by articulated concrete blocks (ACBs) connected together to form a mat. It is currently envisioned that the ACBs will be placed from approximately the 116-foot elevation line and they will extend westward, out into the river from approximately 50 to 200 feet, depending on the location.

Due to documented historical activities conducted in the vicinity of the project area, this project will include potential management of Civil War era unexploded ordnance (UXO). At this point, placement of the cap on top of the sediment is not expected to impact any potential UXO. However, UXO management personnel will be on-site at all times to provide assistance and oversight should items of interest be located.

SCE&G intends to ensure that public safety and habitat conservation control measures are completed within the project area at each phase of implementation. Additionally, SCE&G plans to protect the public

during any project-related activities. The following sections describe procedures to ensure the safety of remediation personnel and the public during completion of the project.

GENERAL PUBLIC SAFETY CONCERNS

Throughout completion of the planning and permitting tasks associated with this project, SCE&G has identified the major potential public safety-related concerns and has developed the appropriate plans to manage these concerns. The primary concerns identified by SCE&G, regulatory officials and other interested parties include:

1. Potential traffic-related issues in the general project vicinity;
2. Safe identification, handling and disposal of potential UXO, if encountered;
3. Airborne constituents of concern, dust and odors from the TLM and site operation activities;
4. Construction of the sediment cap; and
5. Continued safe navigation through the project area and use of the Congaree River resources.

PROJECT SAFETY RELATED PLANS AND COMPONENTS

It is SCE&G's intent to address the above concerns and others related to the project through diligent planning. The Sediment Cap Work Plan (SCWP) provides the specific details pertaining to the planned project and includes a number of separate plans that were specifically developed to address project components. These plans are briefly described below and can be reviewed in detail under separate covers as appendices to the SCWP. The plans include:

- **Health and Safety Plan (HASP)** – The HASP is the primary source of safety-related information for the project and includes a project-specific evaluation of the potential hazards and the corresponding control and mitigation activities. Task specific hazard matrices are included as are air monitoring frequencies and action levels, personnel responsibilities, training requirements and emergency procedures. All personnel and visitors entering the site will be given a HASP briefing and will review the HASP prior to conducting work on the site.
- **Traffic Control Plan** – This Plan provides specific routes into and away from the site, to ensure that all site-related traffic movements are conducted safely and with as minimal of an impact on the surrounding community as practical. Local government officials and emergency response agencies were contacted, and their input was utilized in development of the Traffic Control Plan. The Plan will be implemented during completion of the project and project oversight personnel will monitor trucking operations to ensure continued compliance with the Plan.
- **Project Notification Plan** – This document provides the planned steps that SCE&G, USACE and SCDHEC will undergo to notify the third-party stakeholders, local officials and emergency response agencies of anticipated major project milestones or changes, etc. It will ensure timely notification of important project details, as required throughout completion of the project.
- **Navigation Plan** – Developed based on and in accordance with the guidelines located in the "U.S. Coast Guard Aids to Navigation System" publication and through consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office. The Plan provides specific methods for notifying boaters and other users of the river in advance of the construction site (upriver and downriver) and the need to take appropriate measures to avoid the sediment cap construction area. It provides the specific methods for demarcating the area to be avoided and the buoy/signage/lighting scenario for the project.

- **Community Air Monitoring and Odor/Dust Control Plan** – This Plan provides work area and site perimeter air monitoring procedures to ensure that site-related constituents of concern, dust and odors are monitored and controlled throughout completion of the project.
- **UXO Management Plans** – These Plans will provide the specific guidelines for completion of the potential UXO screening, identification and subsequent management and disposal activities. They were developed in accordance with industry standards and were reviewed and approved by the USACE prior to inclusion in the SCWP.
- **Site Operations Plan** – This Plan will provide details pertaining to the actual remediation work including excavation, water management, cap construction, site restoration and other components. The various tasks outlined in the Site Operations Plan were developed with the intent to complete the project as safely, efficiently and with as minimal of an impact as possible on the surrounding community, river ecosystem and the landside support zone.

Finally, an important component of the overall project will be site security. Site security measures are explained in detail in the Site Operations Plan, but since they are likely the most integral public safety component, they are further described below. Maintaining site security will ensure that only properly trained personnel have access to the various work areas associated with the site.

The primary method for securing the site will be the installation of a temporary chain-link fence around the perimeter of the landside support zone. Several man-gates will be positioned along the fence to allow project personnel to access the outside perimeter of the site. These gates will remain locked when not in use. "Restricted Area" signs will be posted at regular intervals along the fence and also posted in the river to the west of the sediment cap construction zone, as noted in the Navigation Plan. The approximate fence location is shown on Figure 2. A locking gate at the corner of Senate and Gist Streets will restrict vehicular traffic into and away from the project area. The Senate and Gist Streets gate will only be entry/exit point utilized by project personnel. Since the capping project will be a relatively low impact activity it is not expected to increase traffic significantly in the area surrounding the site.

To prevent the unauthorized or unknowing entry of third parties onto the site, access gates will remain closed during site activities to the extent practical. The gates will remain locked during non-working hours while project activities are occurring and/or remediation equipment and material are present.

Once site construction operations are initiated, SCE&G will also post security guards on-site during non-working hours. SCE&G has previously successfully utilized off-duty City of Columbia police officers as security guards at other local sites. These guards will conduct regular patrols of the property during non-working hours and at times of low site activity when a minimal number of site personnel are present. The guards and fence will serve to keep unauthorized and untrained personnel out of the active project area.

Implementation of the above plans and security measures will result in the following:

1. Restrict access to the site area to only authorized and properly trained personnel;
2. Ensure that work within the project area is conducted in accordance with industry standards for safety;
3. Control odor, dust and other potential emissions within the work area and the site perimeter, which will protect the site workers and the surrounding community;
4. Control traffic patterns on-site and into and away from the project area, in order to significantly reduce the potential for traffic related incidents in the surrounding community;

5. Inform boaters and other river users of the appropriate means to avoid the restricted area and safely pass by the project area;
6. Conduct UXO screening, identification and management activities in accordance with industry standards for safety and the approved site-specific work plans; and
8. Complete all site-related activities in a safe and efficient manner.

SCE&G believes that the successful implementation of the above plans and security measures will result in the safe completion of the project with as minimal of an impact on the surrounding community, as practical.

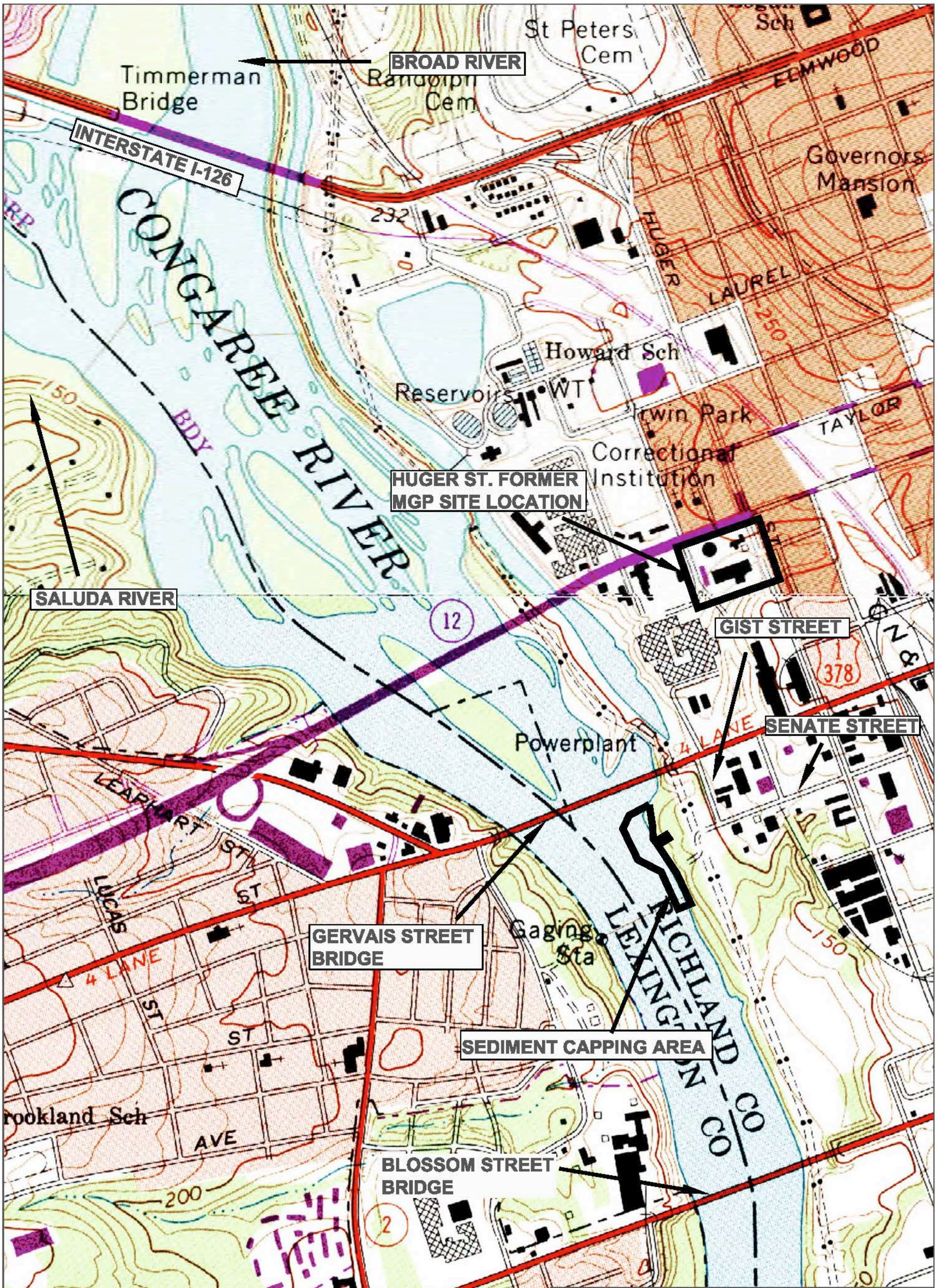


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

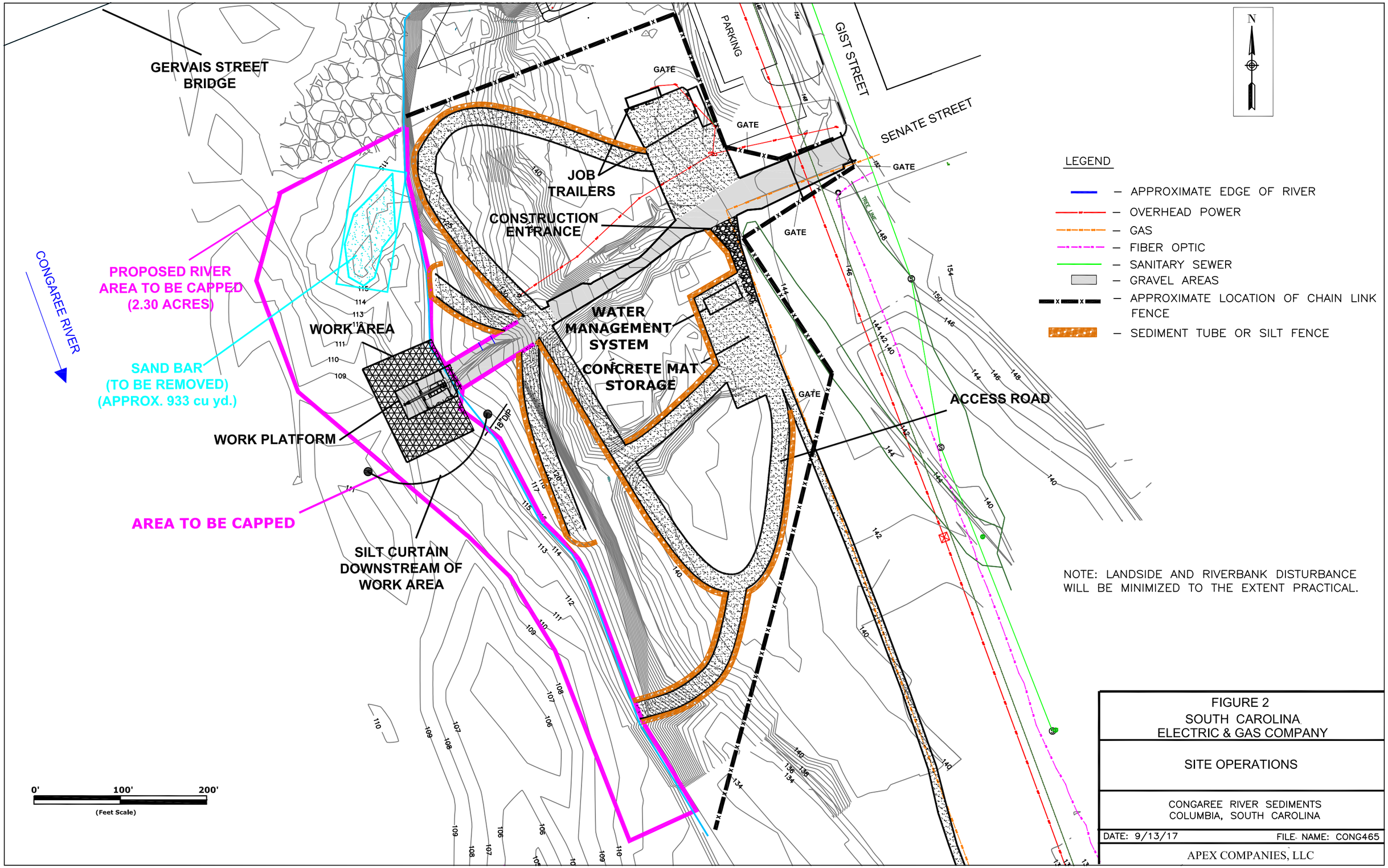


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/13/17 FILE NAME: CONG465

APEX COMPANIES, LLC

APPENDIX O

NAVIGATION PLAN

NAVIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

November 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

NAVIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE), SCDHEC and other agencies. USACE approval of the project under Nationwide Permit #38 was recently received and the approval documentation is provided in Attachment A.

The overall objective of this project is to place a physical barrier in the form of an engineered capping system over the impacted sediment within the Congaree River. The cap will consist of a geotextile fabric material overlain by articulated 8-inch thick concrete blocks (ACBs) connected together to form a mat. It is currently envisioned that the ACBs will be placed from approximately the 116-foot elevation line and will extend westward, out into the river from approximately 50 to 200 feet, depending on the location. Figure 2 provides the current plan for cap placement, and the general specifications for the ACBs is provided in Attachment B. The precise location, orientation, placement techniques and construction/deployment sequence will be at the discretion of the construction contractor and will likely be dictated by actual field conditions encountered during construction.

With an average river flow elevation for the general project area over the last five years of approximately 116.5 foot, most of the ACBs will be placed below normal river flow elevations, except for the erosion prevention area on the boat ramp. The openings in the ACBs, also referred to as cores or cells, will be visible through the water, at low water levels. Even with the underlying geotextile material, it is anticipated that the capping system will settle a few inches into the soft sediment. It is also anticipated that the open cells within the ACB mats will fill with clean sediment [from the top] over time and result in a more natural looking surface.

SCE&G intends to complete the project with as minimal of an impact on navigation and recreational use of the Congaree River as possible. This Plan was developed based on the guidelines provided in the "U.S. Coast Guard Aids to Navigation System" publication. In addition, SCE&G is in consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office (Office) and will complete all required notifications and installation of appropriate navigational aids and safety measures as directed by the Office during implementation of the project.

NAVIGATION WITHIN THE PROJECT AREA

The USACE, Charleston District completed a Navigability Study of the Congaree River Basin in 1977. Excerpts from this study are provided in Attachment C. This document classifies the Congaree River as "navigable waters of the U.S. from its confluence with the Wateree River (R.M. [River Mile] 125.3) to the Gervais Street Bridge, U.S. 378 (R.M. 175.9)." As a result, the planned project area is located at the extreme upriver limit of the classified navigable waters (Figure 2). This study provides historical documentation of significant use of the Congaree River for navigation and commerce, especially during the time frame when the Columbia Canal was operational. However, the study states that use of the river for interstate commerce has not occurred since the 1950s due to the utilization of other forms of transportation.

Current conditions within the Congaree River and the project area are similar to those described in the 1977 study. The river in the vicinity of the Gervais Street Bridge is shallow and rocky with highly variable flow rates that preclude the operation of large watercraft. In fact, it was necessary to utilize multiple forms of small watercraft that ranged in size from a pontoon boat to a canoe to complete the sediment investigative activities within the project area. In some instances, areas were investigated by wading due to the shallow and rocky nature of the river bottom. In other areas, where sufficient water depth was present to allow for the small pontoon boat to operate, the flow rate of the river was too swift to permit safe operation of the watercraft.

Currently, only small personal watercraft such as inner tubes, kayaks, canoes and occasionally a small motorboat are seen operating in the vicinity of the Gervais Street Bridge and the project area. Wading for the purpose of fishing or swimming also occurs in this area.

Potential Impacts to Navigation

As seen on Figure 3, the actual project area is relatively small in comparison to the overall width of the river and at least half of the river's width will be available for continued navigation or other activities during completion of construction activities. The width of the area to be capped ranges from 50 feet wide to approximately 200 feet wide, while the entire river width ranges from approximately 600 to 775 feet in the project area. Once in place, the cap is not expected to hinder the operation of small watercraft since the majority of the cap will be below the water surface during normal river flows. When active construction operations are completed, the area will be completely re-opened to navigation, swimming and fishing.

During construction, the restricted area will be demarcated by caution signs in the river, which will reduce the amount of river area available for the types of small watercraft listed above, but will not prohibit passage. For illustrative purposes, Figure 4 shows the approximate location of the capping area and the river at a moderately low water level. The river discharge rate, measured at the Columbia gage located directly across the river from the project area, on the date of the aerial photograph (September 30, 2016) ranged from 1,630 cubic feet per second (cfs) to 2,650 cfs. The mean monthly discharge rate for water years 1940-2011 is 6,731 cfs. As a result, the river discharge occurring in the aerial photo is roughly one-third of the mean but well above the historical monthly minimum discharge of 1,085 cfs observed in October 2008. The discharge summary for 2010 is provided as Attachment D.

The photograph in Figure 4 shows the varying nature of the river substrate in the vicinity of the project area and clearly illustrates the characteristics that preclude the use of larger watercraft within this portion of the river. The bedrock outcrops are seen to protrude from the river's surface south and west of the project area. The shallow nature of the river in the vicinity of the Gervais Street Bridge can also be seen in the photograph. The open water area west of the approximate area to be capped is also apparent on the figure and the proposed navigation route is highlighted by the arrows. Watercraft of the type typically utilized in this area of the river will be able to continue unobstructed use of the resource during completion of the project by following this general route.

Due to safety requirements, landside support zone activities and construction operations within the river, completion of the project must restrict access of the general public to the Congaree River via the Senate Street Extension (Figure 4). This area is currently utilized as a boat launch and fishing area due to the easy access provided by the asphalt and gravel access road (which is private property) and the gentle slope to the river's edge. Temporary loss of this area will not affect the general public access to the river since this is private property. SCE&G plans to secure the area with a chain-link fence to establish the project support zone, unless an alternative area is utilized.

Other options for the general public to launch small watercraft and access to the river include the Three Rivers Greenway located directly across the river from the project area (Figure 4) and a public boat ramp located approximately 1.8 miles downstream of the Blossom Street Bridge.

Overall, no significant impacts to navigation of small watercraft and use of the river for recreational purposes are expected during completion of the project. As Figure 4 illustrates, greater than one half of the river's width will be available for use by the general public at all times. The temporary restricted access to the river on the east side will be mitigated by the access points located directly across the river at the Three Rivers Greenway and public boat ramp located downstream. Additional safety measures that will be taken to ensure that safe navigation around the project area that will be installed and maintained are described below.

SAFETY MEASURES (PRIVATE AIDS TO NAVIGATION)

The Office was consulted with regard to maintaining safe navigation throughout completion of the project. The U.S. Coast Guard navigation specialist from the district has been provided details associated with the project plans and proposed aids to navigation. In accordance with the regulations, following USACE approval of the project (dated October 18, 2017), the U.S. Coast Guard will review this Navigation Plan. The completed U.S. Coast Guard Private Aids to Navigation Application is provided in Attachment E.

The safety measures (private aids to navigation) and details listed below are provided to illustrate the current plan. The three main objectives of the safety measures are:

1. Provide boaters and other users of the river with advance notice of the construction site and the need to take appropriate measures to avoid the active construction zone;
2. Demarcate the area to be avoided; and
3. Alert boaters and other users of the river that the cap construction area and any landside support zone are restricted areas and off limits to non-construction related personnel.

These three objectives will be accomplished by the publication of a “Notice to Navigation Interests” (Notice) prior to initiation of the project. This Notice will provide specific details pertaining to the project area and the navigational requirements. A draft copy of the Notice is provided as Attachment F.

In addition, strategic placement of warning and restricted access signs, solar powered lights and regulatory buoys (Figure 4) will provide real-time notification to boaters as they enter and make their way through the project area from either direction. Table 1 provides a summary of the required quantities of aids to navigation as well as recommended manufacturer identification and model numbers. Proposed alternative aids to navigation that meet or exceed the criteria below will also be considered.

The warning signs will be placed up and downriver and the sign locations will be determined in the field and will be based on existing conditions. The signs will be located in areas that are readily visible to river users. The warning signs will be relatively large (approximately 4 feet by 4 feet) and state “Warning - River Construction Zone Ahead”. The signs placed in the river will be bolted to metal posts and attached to a weighted base and secured in-place with concrete blocks or large boulders.

The signs will be placed on poles and anchored in the river, and along the shoreline. The signs will be placed at a sufficient height (i.e., eye level - 3 to 5 feet above the water or land surface). For boaters, the elevation of the signs will be based on average river flows when most recreational boating activity is expected to occur. The average river elevation is approximately 116.5 feet (NGVD ‘29). This equates to an approximate sign elevation of 120 feet (NGVD ‘29). During completion of the investigative activities it was observed that river elevations above approximately 117 feet (NGVD ‘29) produced flows that were not conducive to the safe operation of small watercraft within the project area. As a result, the 118 feet elevation will place the signs above the water level at flows where most recreational boating and use of the river is expected to take place. For the landside sign installations, eye level, or approximately 5 feet above the surface elevation, will be used to establish the correct position of the sign.

The U.S. Coast Guard Aids to Navigation System specifies the use of an information or regulatory buoy (white with an orange band) to designate areas that should be avoided by watercraft. For this project, the buoys will also be marked with a danger symbol that specifies the presence of the construction area. Example specifications of this type of buoy and markings are provided in Attachment G. Generally, the buoys will be properly secured approximately 20 feet away from the outboard edge of the construction area and alert river users to the presence of the river construction site. The buoys will direct both downstream and upstream traffic away from the area. They will be relocated, if necessary, as the project progresses.

Marine-application lights will also be positioned above the top of the warning signs to help identify the perimeter of the construction area in the unlikely event that boating traffic is in the area during nighttime or low light conditions. As part of the aids to navigation, solar powered LED lights with signs will be placed along the riverside perimeter of the construction area. The lights will have a standard flash rate of 60 flashes per minute (FPM) and will be visible for 1 mile, under clear conditions. At a minimum, 10 lights will be utilized during capping activities. An example of solar powered nautical lights is provided in Attachment G.

Finally, “Restricted Area” signs will be positioned at regular intervals along the outboard perimeter of the construction site. Project personnel will conduct regular inspections of the buoys, lights and signs to

ensure that they are still visible, in the correct locations, securely moored in place and operating properly. The minimum inspection frequency will be once per week and as soon as possible following high water/high river flow events. Any issues identified during the inspections will be corrected as soon as possible.

ATTACHMENTS

TABLE 1

SUMMARY OF AIDS TO NAVIGATION

Congaree River Sediments
Columbia, South Carolina

Quantity	Description	Model No.	Manufacturer
10	Regulatory buoys ABS type 9" diameter or equivalent, with required anchors and mandatory restricted area symbol, "Keep Out"	B1147R	Roylan
6	48" x 48" flourescent/reflective signs "Warning River Construction Zone Ahead" black message on white reflective background with orange border	B2211	Roylan
10	Solar lights (LEDs), clear, to be positioned on each "corner" of construction area, 60 FPM (flashes per minute) mounted on 4" x 4" treated posts or equivalent	One mile #101 Series	Roylan

Note:
Signs, buoys and lights will be deployed during each phase of the project.

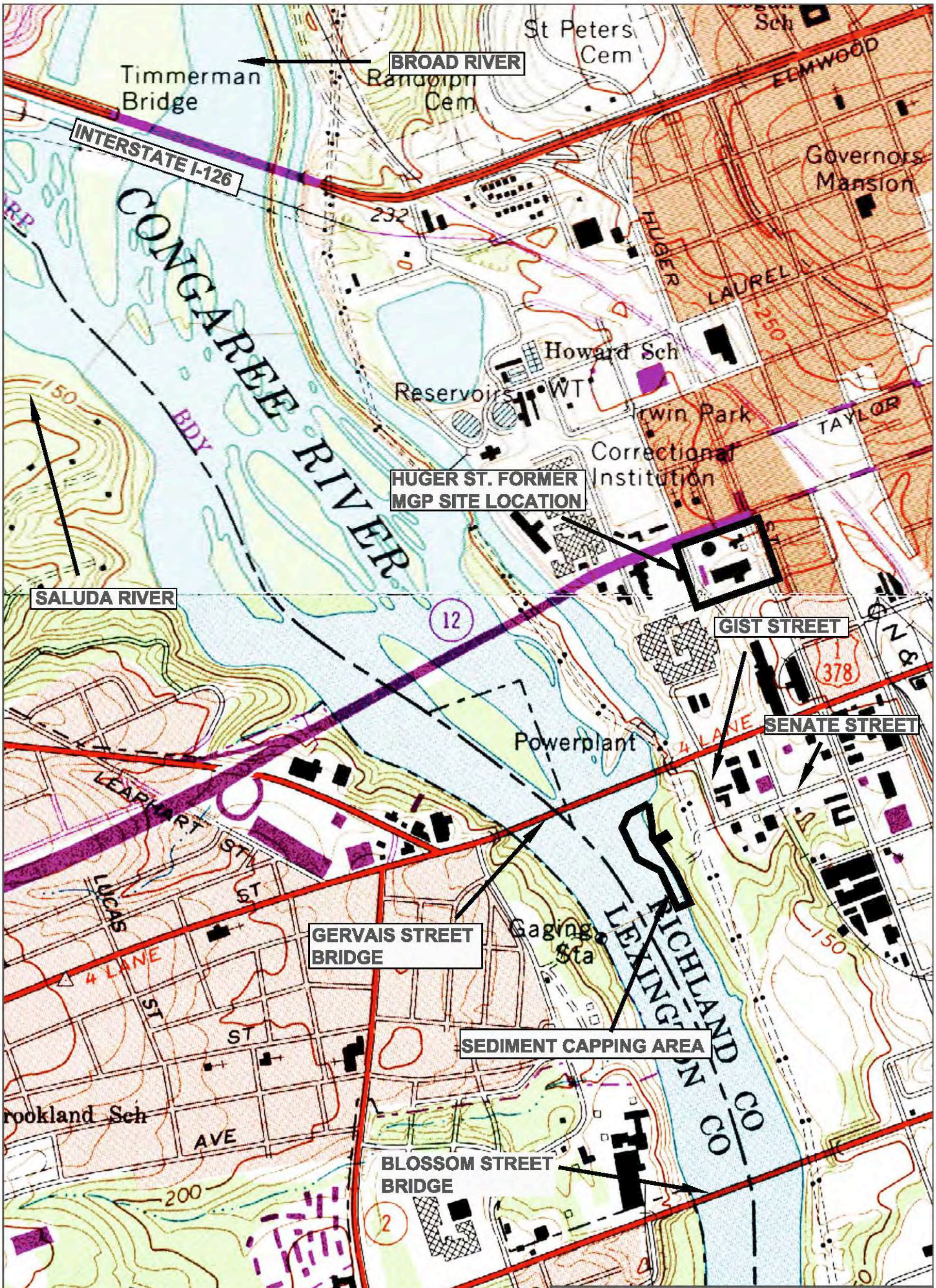


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

18"DIP

CONGAREE RIVER

LEGEND

- — APPROXIMATE EDGE OF RIVER
- — APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.
- — BATHYMETRIC LINE (FEET NAVD '88) – 2010
- — ARTICULATED CONCRETE BLOCK MATS (ACBs)

40' 80' 120'

(Feet Scale)

FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION
AND DESIGN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/2017 FILE NAME: CONG461

APEX COMPANIES, LLC

LEGEND

- W — CONSTRUCTION SITE WARNING SIGNS
- — CONSTRUCTION SITE WARNING LIGHTS AND SIGNS
- ▲ — REGULATORY BUOYS
- —— — APPROXIMATE AREA TO BE CAPPED

NOTES:
1) FINAL PLACEMENT OF SIGNS, LIGHTS AND BUOYS WILL BE DETERMINED AT THE TIME OF INSTALLATION AND WILL DEPEND ON FIELD CONDITIONS.
2) RESTRICTED AREA SIGNS WILL BE PLACED IN THE RIVER AND LANDSIDE AREA CHAIN LINK FENCE.

FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PRIVATE AIDS TO NAVIGATION -
PROPOSED LOCATIONS FOR PHASE 2

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/17 FILE NAME: CONG462

APEX COMPANIES, LLC

LEGEND

– POTENTIAL SMALL CRAFT NAVIGABLE PATHWAY

NOTES

– AERIAL PHOTGRAPH TAKEN FROM GOOGLE EARTH. IMAGERY DATE WAS 09/30/2016. DISCHARGE RATE OF RIVER RANGED FROM 1,630 TO 2,650 CFS.

FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PROJECT AREA AND NAVIGABILITY INFORMATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/17 FILE NAME: CONG425

APEX COMPANIES, LLC

Attachment A

USACE Project Approval

DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT, CORPS OF ENGINEERS
1835 ASSEMBLY STREET, ROOM 865B-1
COLUMBIA, SOUTH CAROLINA 29201

OCT 18 2017

Regulatory Division

Mr. Tom Effinger
SCANA, Director of Environmental Services
C-221
100 SCANA Parkway
Cayce, South Carolina 29033

Dear Mr. Effinger:

This letter is in response to a Pre-Construction Notification (PCN) (SAC-2011-01356) which we received on September 26, 2016, and was considered complete on July 31, 2017. By submittal of the PCN, you requested verification that the proposed project is authorized by a Department of the Army (DA) Nationwide Permit (NWP).

The PCN contains the following identifying information for this project. The work affecting waters of the United States is part of an overall project known as Congaree River-Sediment Capping Project, to place a physical barrier over newly deposited sediment and the pre-existing tar-like material (TLM) impacted sediment. The activities in waters of the United States include the placement of an 8-inch engineered capping system over newly deposited sediment and the pre-existing TLM impacted sediment. This will also include the excavation of approximately 930 cubic yards of sand bar to facilitate the smooth and continuous mat placement. 1-2 feet of material will be excavated from the area. The project involves impacts to not more than 2.3 acres of waters of the United States. Specifically, this letter authorizes impacts to 900 linear feet or 2.3 acres of tributaries. The project is located on the Congaree River, south of Gervais Street and west of Senate Street, Richland County, South Carolina (Latitude: 33.9927 °N, Longitude: 81.0480 °W). The PCN also includes the following supplemental information:

a. Drawing sheets 1-3 of 3 titled "SAC-2011-01356, Congaree River Sediment Capping, Richland County, South Carolina" and dated August 18, 2017;

b. A mitigation plan that includes minimization measures.

Based on a review of the PCN, including the supplemental information indicated above, it has been determined that the proposed activity will result in minimal individual and cumulative adverse environmental effects and is not contrary to the public interest. Furthermore, the activity meets the terms and conditions of NWP 38 Cleanup of Hazardous and Toxic Waste.

For this authorization to remain valid, the project must comply with the enclosed NWP General Conditions, Charleston District Regional Conditions, and the following special conditions:

a. **That impacts to aquatic areas do not exceed those specified in the above mentioned PCN, including any supplemental information or revised permit drawings that were submitted to the Corps by the permittee.**

b. **That the construction, use, and maintenance of the authorized activity is in accordance with the information given in the PCN, including the supplemental information listed above, and is subject to any conditions or restrictions imposed by this letter.**

c. **That the permittee shall submit the attached signed compliance certification to the Corps within 30 days following completion of the authorized work.**

d. **That the permittee agrees the project construction will be limited to May 1st through October 31st to reduce impacts to the Shortnose Sturgeon.**

e. **That the permittee agrees to follow the terms and conditions of the Memorandum of Agreement among the U.S. Army Corps of Engineers, Charleston District; the South Carolina State Historic Preservation Officer; and SCANA Corporation regarding the Congaree River Remediation Project, Richland County South Carolina, dated May 30, 2017.**

f. **That the permittee agrees to follow the final safety plan prepared by EOTI is entitled "Final Work Plan for Munitions Response Removal Action and Construction Report, Congaree River Project" and is dated May 2015 (Revised January 2017) and all other associated safety plans.**

g. **The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.**

h. **Use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the U.S.**

i. **The permittee must install and maintain, at their expense, any safety lights and signals prescribed by the U.S. Coast Guard (USCG), through regulations or otherwise, on authorized facilities. The USCG may be reached at the following address and telephone number: (as of February 2013) U. S. Coast Guard District Seven, Waterways Management Branch, 909 SE 1st Ave, Suite 406, Miami, FL. 33131, and 305-415-6755 or 305-415-6750.**

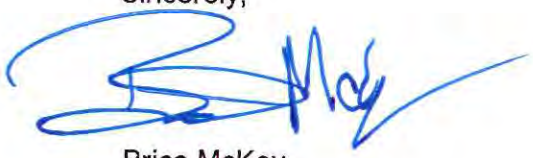
This verification is valid until March 18, 2022, unless the district engineer modifies, suspends, or revokes the NWP authorization in accordance with 33 CFR 330.5(d). If prior to this date, the NWP authorization is reissued without modification or the activity complies with

any subsequent modification of the NWP authorization, the verification continues to remain valid until March 18, 2022. If you commence, or are under contract to commence, this activity before the NWP expires, or the NWP is modified, suspended, or revoked by the Chief of Engineers or division engineer in accordance with 33 CFR 330.5(b) or (c), respectively, so that the activity would no longer comply with the terms and conditions of the NWP, you will have 12 months after the date the NWP expires or is modified, suspended, or revoked, to complete the activity under the present terms and conditions of this NWP.

This NWP is being verified based on the information you have provided. It is your responsibility to read the attached NWP(s) along with the General, Regional, and Special Conditions before you begin work. If you determine that your project will not be able to meet the NWP and the conditions, you must contact the Corps before you proceed.

In all future correspondence concerning this matter, please refer to our file number SAC-2011-01356. A copy of this letter is being forwarded to certain State and/or Federal agencies for their information. If you have any questions concerning this matter, please contact Kristin Andrade at (803) 253-3903.

Sincerely,



Brice McKoy
Chief, Northwest Branch

Enclosures
Permit Drawings
NWP 38 Cleanup of Hazardous and Toxic Waste.
Nationwide Permit General Conditions
Nationwide Permit Regional Conditions
Compliance Certification Form

Copies Furnished:

Mr. Andrew Contrael
ACE, Inc.
132 South Grant Avenue
Kittanning, Pennsylvania 16201

South Carolina Department of
Health and Environmental Control
Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

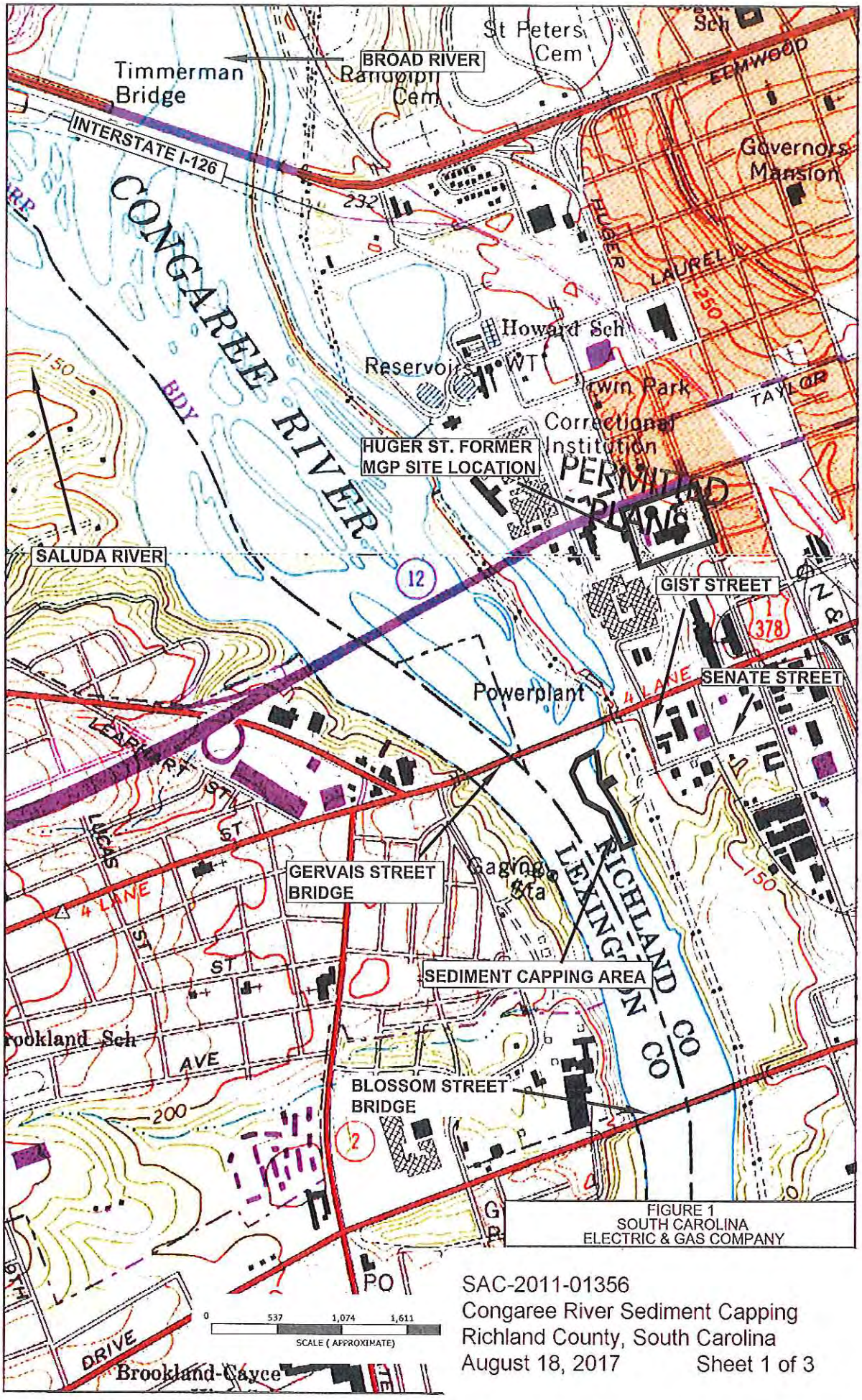
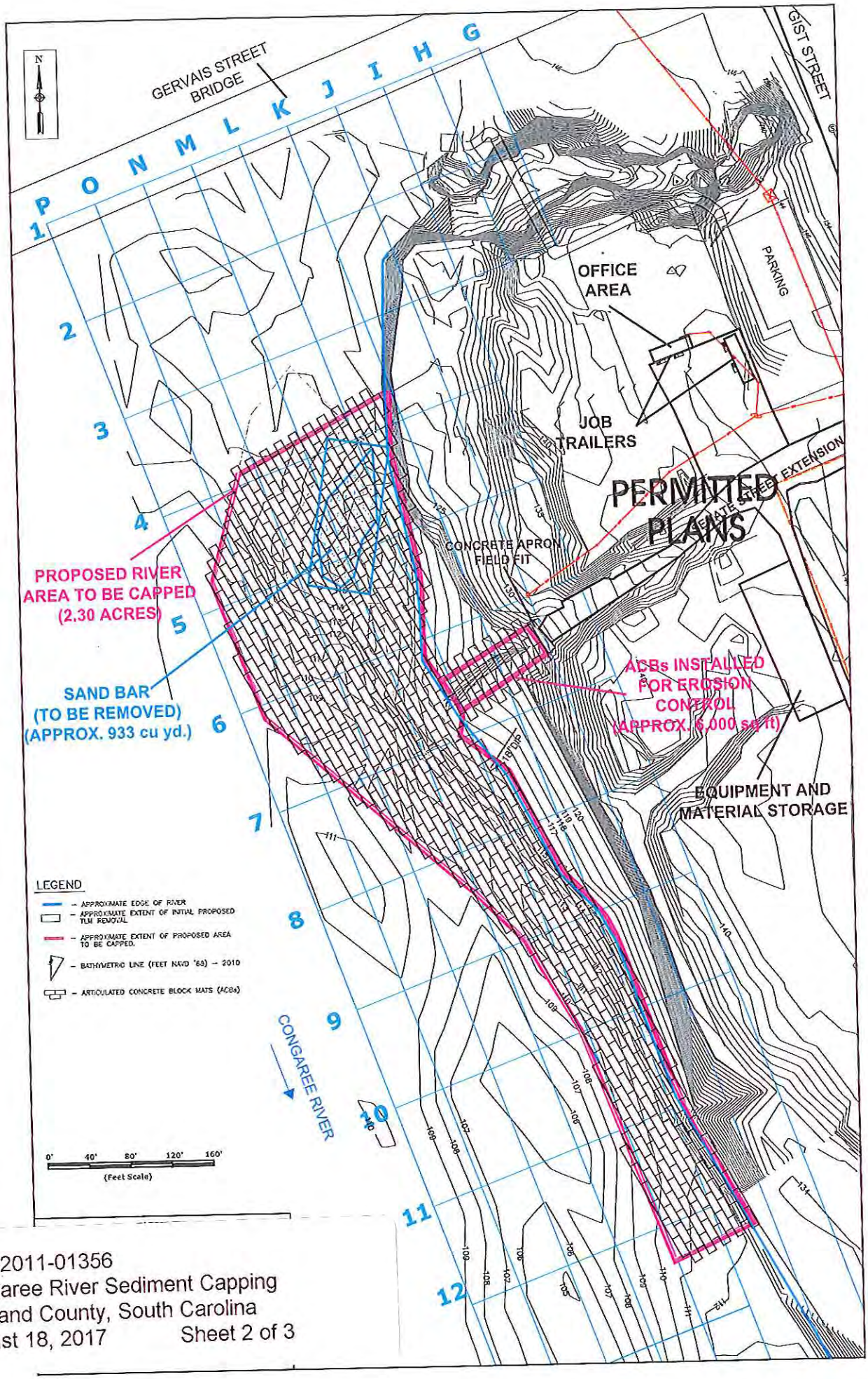


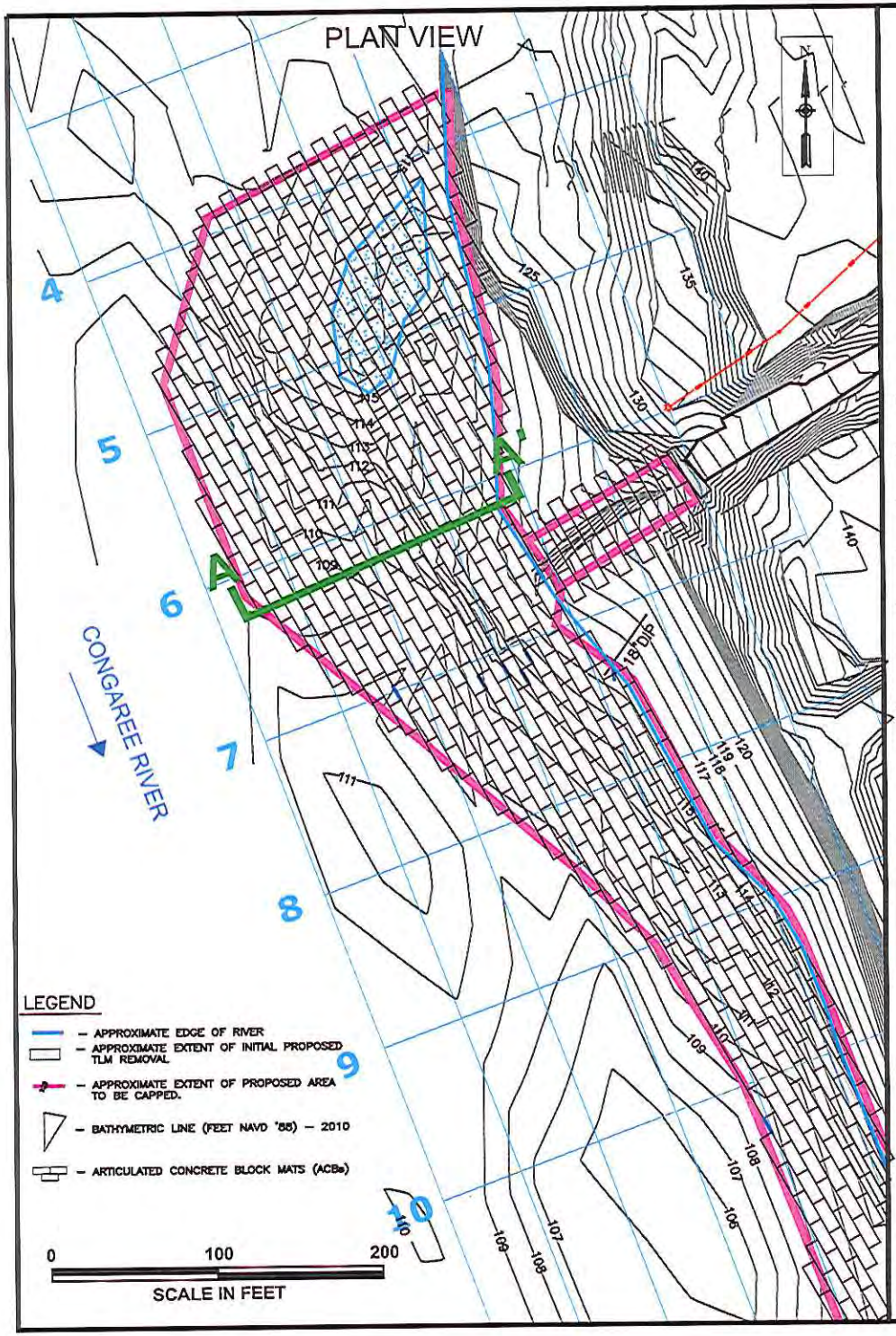
FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SAC-2011-01356
Congaree River Sediment Capping
Richland County, South Carolina
August 18, 2017 Sheet 1 of 3

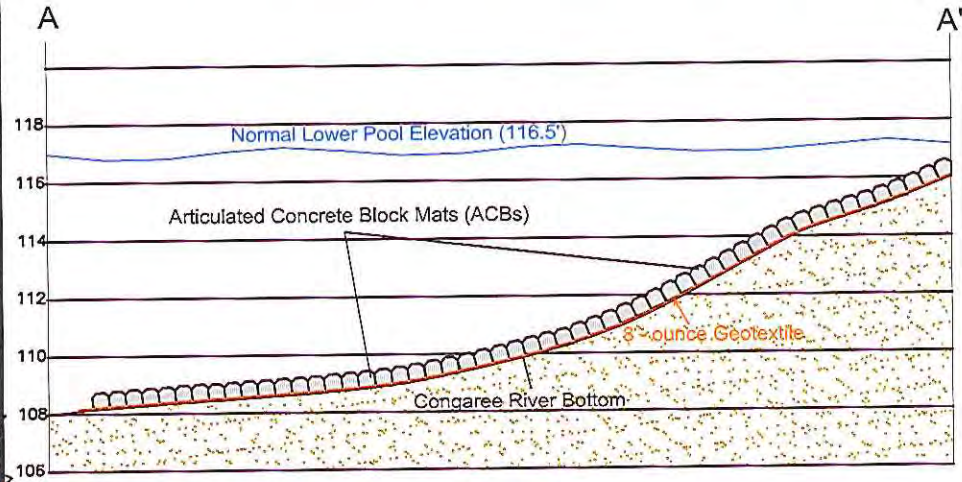


SAC-2011-01356
Congaree River Sediment Capping
Richland County, South Carolina
August 18, 2017 Sheet 2 of 3

PLAN VIEW



CROSS SECTIONAL VIEW A-A'
(TYPICAL)



PERMITTED PLANS

NOTE

CROSS SECTION VIEW NOT TO SCALE
FOR ILLUSTRATIVE PURPOSES ONLY.

SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SAC-2011-01356
Congaree River Sediment Capping
Richland County, South Carolina
August 18, 2017 Sheet 3 of 3

38. *Cleanup of Hazardous and Toxic Waste.* Specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority. Court ordered remedial action plans or related settlements are also authorized by this NWP. This NWP does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste.
Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity. (See general condition 32.)
(Authorities: Sections 10 and 404)
Note: Activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA as approved or required by EPA, are not required to obtain permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act.

C. Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. *Navigation.* (a) No activity may cause more than a minimal adverse effect on navigation. (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States. (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. *Aquatic Life Movements.* No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. *Spawning Areas.* Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (*e.g.,* through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. *Migratory Bird Breeding Areas.* Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. *Shellfish Beds.* No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. *Suitable Material.* No activity may use unsuitable material (*e.g.,* trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. *Water Supply Intakes.* No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. *Adverse Effects From Impoundments.* If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. *Management of Water Flows.* To the maximum extent practicable, the preconstruction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the preconstruction course, condition, capacity, and location of open waters if it benefits the aquatic environment (*e.g.,* stream restoration or relocation activities).

10. *Fills Within 100-Year Floodplains.* The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. *Equipment.* Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. *Soil Erosion and Sediment Controls.* Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. *Removal of Temporary Fills.* Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. *Proper Maintenance.* Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. *Single and Complete Project.* The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. *Wild and Scenic Rivers.* (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. (b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status. (c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (*e.g.,* National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: *http://www.rivers.gov/.*

17. *Tribal Rights.* No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. *Endangered Species.* (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which ''may affect'' a listed species or critical habitat, unless ESA section 7consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur. (b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If preconstruction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA. (c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district

engineer will determine whether the proposed activity ''may affect'' or will have ''no effect'' to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, he applicant shall not begin work until the Corps has provided notification that the proposed activity will have ''no effect'' on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps. (d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species specific permit conditions to the NWPs. (e) Authorization of an activity by an NWP does not authorize the ''take'' of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (*e.g.,* an ESA Section 10 Permit, a Biological Opinion with ''incidental take' provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word ''harm'' in the definition of ''take'' means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. (f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required. (g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their worldwide Web pages at *http://www.fws.gov/* or *http://www.fws.gov/ipac* and *http://www.nmfs.noaa.gov/pr/species/esa/* respectively.

19. *Migratory Birds and Bald and Golden Eagles.* The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether ''incidental take'' permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. *Historic Properties.* (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied. (b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106. (c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the preconstruction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed. (d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106consultation is completed. If the non- Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps. (e) Prospective permittees should be aware that section 110k of the

NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. *Discovery of Previously Unknown Remains and Artifacts.* If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. *Designated Critical Resource Waters.* Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment. (a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. (b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. *Mitigation.* The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal: (a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (*i.e.,* on site). (b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal. (c) Compensatory

mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require preconstruction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require preconstruction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects. (d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult to-replace resources (see 33 CFR 332.3(e)(3)). (e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (*e.g.,* conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (*e.g.,* riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses. (f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332. (1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation. (2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)). (3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation. (4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33

CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). (5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided. (6) Compensatory mitigation requirements (*e.g.*, resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33CFR 332.4(c)(1)(ii)). (g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2- acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs. (h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management. (i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. *Safety of Impoundment Structures.* To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. *Water Quality.* Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. *Coastal Zone Management.* In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. *Regional and Case-By-Case Conditions.* The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. *Use of Multiple Nationwide Permits.* The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. *Transfer of Nationwide Permit Verifications.* If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature: When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

_____

(Transferee)

_____

(Date)

30. *Compliance Certification.* Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include: (a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions; (b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the

permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and (c) The signature of the permittee certifying the completion of the activity and mitigation. The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. *Activities Affecting Structures or Works Built by the United States.* If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a' 'USACE project''), the prospective permittee must submit a preconstruction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. *Pre-Construction Notification.* (a) *Timing.* Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the, additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either: (1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or (2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is ''no effect'' on listed species or ''no potential to cause effects'' on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's

right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2). (b) *Contents of Pre-Construction Notification:* The PCN must be in writing and include the following information:
(1) Name, address and telephone numbers of the prospective permittee;
(2) Location of the proposed activity;
(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposedactivity;
(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (*e.g.,* a conceptual plan), but do not need to be detailed engineering plans); (5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate; (6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan. (7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act; (8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for

listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act; (9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the ''study river'' (see general condition 16); and (10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project. (c) *Form of Pre-Construction Notification:* The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals. (d) *Agency Coordination:* (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal. (2) Agency coordination is required for: (i) All NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of streambed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes. (3) When agency coordination is required, the district engineer will immediately provide (*e.g.,* via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or email that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the preconstruction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were

considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5. (4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act. (5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of preconstruction notifications to expedite agency coordination.

2017 APPROVED
NATIONWIDE PERMIT REGIONAL GENERAL CONDITIONS
FOR SOUTH CAROLINA (REVISED)

The following Regional Conditions have been approved by the Charleston District for the Nationwide Permits (NWP) published in the January 6, 2017, Federal Register as authorized under General Condition #27. Regional conditions are authorized to modify NWPs by adding conditions on a generic basis applicable to certain activities or specific geographic areas. Certain terminologies used in the following conditions are identified in *italics* and are defined in the above referenced Federal Register under Definitions.

Note: The acronym "*PCN*" used throughout the Regional Conditions refers to *Pre-Construction Notification.*

For All Nationwide Permits:

1. The applicant must implement *best management practices* during and after all construction to minimize erosion and migration of sediments off site. These practices may include use of devices capable of preventing erosion and migration of sediments in waters of the United States., including wetlands. These devices must be maintained in a functioning capacity until the area is permanently stabilized. All disturbed land surfaces must be stabilized upon project completion. Stabilization refers to the minimization of erosion and migration of sediments off site.

2. All wetland and stream crossings must be stabilized immediately following completion of construction/installation and must be aligned and designed to minimize the *loss of waters of the United States.*

3. Necessary measures must be taken to prevent oil, tar, trash, debris and other pollutants from entering waters of the United States, including wetlands that are adjacent to the authorized activity.

4. Any excess excavated materials not utilized as authorized back fill must be placed and contained on uplands and permanently stabilized to prevent erosion into waters of the United States, including wetlands.

5. Placement and/or stockpiling (double handling) of excavated material in waters of the United States, including wetlands, is prohibited unless specifically authorized in the nationwide permit verification. Should double handling be authorized, the material must be placed in a manner that does not impede circulation of water and will not be dispersed by currents or other erosive forces.

6. Once project construction is initiated, it must be carried to completion in an expeditious manner in order to minimize the period of disturbance to aquatic resources and the surrounding environment.

7. If you discover any previously unknown historic, cultural or archeological remains and

artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent *practicable*, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places. Archeological remains consist of any materials made or altered by man, which remain from past historic or prehistoric times (i.e., older than 50 years). Examples include old pottery fragments, metal, wood, arrowheads, stone implements or tools, human burials, historic docks, *structures*, or non-recent (i.e., older than 100 years) vessel ruins.

8. Use of nationwide permits does not obviate requirements to obtain all other applicable Federal, State, county, and local government authorizations.

9. No NWP is authorized in areas known or suspected to have sediment contamination, with the exception of NWP 38, and NWP 53 when used in combination with NWP 38.

10. In accordance with General Condition #31, "Activities Affecting *Structures* or Works Built by the United States," a *PCN* must be submitted if a NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE" project"). See General Condition #32 for *PCN* content and timing requirements and particularly paragraph (b)(10) for an activity that requires permission from the Corps pursuant to 33 U.S.C. 408. An activity in South Carolina that requires section 408 permission is not authorized by a NWP until the Charleston District issues the section 408 permission to alter, occupy, or use the USACE project, and the District Engineer issues a written NWP verification.

11. For all proposed activities that would be located in or adjacent to an authorized Federal Navigation project, as listed in Regional Condition #18, the *PCN* must include project drawings that have the following information: a) location of the edges of the Federal channel; b) setback distances from the edge of the channel; c) the distance from watermost edge of the proposed *structure* or fill to the nearest edge of the channel and the Mean High and Mean Low water lines; and d) coordinates of both ends of the watermost edge of the proposed *structure* or fill (NAD 83 State Plane Coordinates in decimal degrees). This notification requirement is in addition to the *PCN* requirements listed in General Condition #32.

12. For all proposed activities that would be located in waters that are designated critical habitat under section 7 of the Endangered Species Act, and waters that are proposed critical habitat, the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32. Refer to the following National Oceanic and Atmospheric Administration (NOAA) Fisheries website for the most up-to-date information regarding Critical Habitat designations under the jurisdiction of the National Marine Fisheries Service (NMFS):
http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/

13. For all proposed activities that would be located within a FEMA designated floodway, the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32.

14. The permittee must comply with all FEMA regulations and requirements. The permittee is advised that the National Flood Insurance Program (NFIP) prohibits any development within a designated floodway within the FEMA Special Flood Hazard Area (SFHA), including placement of fill, without a "No Impact Certification" approved by the local NFIP flood plain manager. If the proposed action is located in a designated FEMA SFHA (e.g.,100 year flood plain), the permittee must coordinate with the local NFIP flood plain manager and comply with FEMA requirements prior to initiating construction. A list of NFIP floodplain managers may be found at: http://www.dnr.sc.gov/water/flood/index.html.

15. The permittee must comply with all FEMA regulations and requirements. The permittee is advised that development activities in a designated FEMA Special Flood Hazard Area (SFHA) are subject to the floodplain management regulations of the National Flood Insurance Program (NFIP). If the proposed action is located in a designated FEMA SFHA (e.g.,100 year flood plain), the permittee must coordinate with the local NFIP flood plain manager and comply with FEMA requirements prior to initiating construction. A list of NFIP floodplain managers may be found at: http://www.dnr.sc.gov/water/flood/index.html.

For Specific Nationwide Permits:

16. **For NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51 and 52,** in accordance with General Condition # 22(a), Designated Critical Resource Waters, the discharges of dredged or fill material into waters of the United States within, or directly affecting, critical resource waters, including wetlands adjacent to such waters, are NOT authorized by these NWPs. Note: The ACE Basin National Estuarine Research Reserve and the North Inlet Winyah Bay National Estuarine Research Reserve are Designated Critical Resource Waters.

17. **For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38 and 54,** in accordance with General Condition # 22(b), Designated Critical Resource Waters, a *PCN* is required for any activity proposed in designated critical resource waters including wetlands adjacent to those waters. Refer to General Condition #32 for *PCN* requirements. Note: The ACE Basin National Estuarine Research Reserve and the North Inlet Winyah Bay National Estuarine Research Reserve are Designated Critical Resource Waters.

18. **For NWPs 1, 3, 5, 7, 8, 10, 11, 12, 13, 14, 15, 19 and 36,** the prospective permittee must submit a *PCN* to the District Engineer for any activity that would be located in or adjacent to an authorized Federal Navigation project. These Federal navigation areas include Adams Creek, Atlantic Intracoastal Waterway (AIWW), Ashley River, Brookgreen Garden Canal, Calabash Creek Charleston Harbor (including the Cooper River and Town Creek), Folly River, Georgetown Harbor (Winyah Bay, Sampit River, and Bypass Canal), Jeremy Creek, Little River Inlet, Murrells Inlet (Main Creek), Port Royal Harbor, Savannah River, Shem Creek

(including Hog Island Channel & Mount Pleasant Channel), Shipyard Creek, Village Creek and the Wando River.

19. **For NWPs 3, 11, 12, 13, 14, 15, 20, 22 and 33,** temporary *structures*, fills, and/or work, including the use of temporary mats, are only authorized for a period of 90 days per temporary impact area and/or phase of the overall project. The permittee may submit a written request at least 15 days prior to the expiration of the original period of 90 days requesting an extension of up to an additional 90 days. The Charleston District Engineer may extend the 90-day period up to an additional 90 days, not to exceed more than a total of 180 days, where appropriate. After expiration of the authorized period (i.e., initial 90 days or up to an additional 90 days), all temporary *structures*, fills, and/or work, including the use of temporary mats, for the temporary impact area and/or phase of the overall project must be removed and the disturbed areas restored to pre-disturbance conditions. Activities that require the use of temporary *structures*, fills, and/or work, including the use of temporary mats, in excess of 180 days will require Individual Permit authorization from the Corps prior to construction.

20. **For NWPs 3, 11, 12, 13, 14, 15, 20, 22 and 33,** that require *PCN*s and that involve temporary *structures*, fills, and/or work, including the use of temporary mats, the *PCN* must include a written description and/or drawings of the proposed temporary activities that will be used during project construction. This requirement is in addition to the *PCN* requirements listed in General Condition #32.

21. **For NWPs 29, 39, 40, 42, 43, 44, 51 and 52,** impacts to stream beds** must be provided in both linear feet and acreage.

22. **NWPs 12, 14, 29, 39, 43, 51 and 52,** will not be used in conjunction with one another for an activity that is considered a *single and complete project.*

23. **For NWPs 12, 14, 29, 39, 46, 51 and 52,** all *PCN*s must include appropriately sized and positioned culverts that meet the requirements of General Conditions #2, #9 and #10 for each individual crossing of waters of the United States. This requirement is in addition to the *PCN* requirements listed in General Condition #32.

24. **For NWPs 12, 14, 29, 39, 46, 51 and 52,** that include the new construction and/or replacement of culverted road crossings, at a minimum, the width of the base flow culvert(s) shall be approximately equal to the average channel width and will not reduce or increase stream depth. This is a minimum requirement that does not replace local and State requirements for roadway design.

25. **For NWPs 12, 14, 18 and 27,** the *discharge* must not cause the *loss* of more than 300 linear feet of stream bed**, unless for *intermittent* and *ephemeral* stream beds the District Engineer waives the 300 linear foot limit by making a written determination concluding that the *discharge* will result in no more than minimal adverse environmental effects.

26. **For NWPs 12, 14, 18 and 27,** the *discharge* cannot cause the *loss* of more than 300 linear feet

of *perennial stream* beds**.

27. **For NWPs 12, 14, and 18,** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32, prior to commencing the activity if the proposed *discharge* will impact more than 25 linear feet of streambed. This notification requirement is in addition to the *PCN* requirements listed in General Condition #32.

28. **For NWP 3,** paragraph (a) and (c) activities, the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition # 32, if the proposed *discharge* of dredged or fill material will cause the loss of greater than 1/10-acre of waters of the United States or if the proposed *discharge* of dredged or fill material will be located within a special aquatic site, which includes but is not limited to, wetlands, mudflats, vegetated shallows, *riffle and pool complexes*, sanctuaries, and refuges.

29. **For NWP 3,** paragraph (a) activities, the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition # 32, for the repair, rehabilitation or replacement of existing utility lines constructed over *navigable waters* of the United States (i.e., Section 10 waters) and existing utility lines routed in or under *navigable waters* of the United States (i.e., Section 10 waters), even if no *discharge* of dredged or fill material occurs.

30. **For NWP 3,** paragraph (b) activities, excavation of accumulated sediment or other material is not authorized in areas within the immediate vicinity of existing *structures* (e.g., private or commercial dock facilities, piers, canals dug for boating access, marinas, boat slips, etc.).

31. **For NWPs 7 and 12,** the associated intake *structure* must be screened to prevent entrainment of juvenile and larval organisms, and the inflow velocity of the associated intake *structures* cannot exceed 0.5 feet/second.

32. Activities authorized by **NWP 7** must occur in the immediate vicinity of the outfall, and must be necessary for the overall construction or modification of the outfall. **NWP 7** shall not be used to authorize ancillary activities such as construction of access roads, installation of utility lines leading to or from the outfall or intake *structures*, construction of buildings, distant activities, etc.

33. **For utility line activities authorized by NWP 12 (as well as utility lines associated with projects authorized by NWP 29 and 39)** that involve horizontal directional drilling beneath *navigable waters* of the United States (i.e., section 10 waters), the *PCN* must include a proposed remediation plan (i.e., frac-out plan). This requirement is in addition to the *PCN* requirements listed in General Condition #32.

34. **For utility line activities authorized by NWP 12 (as well as utility lines associated with projects authorized by NWP 29 and 39),** excavated material shall be returned to the trench and any remaining material shall be relocated and retained on an upland disposal site. Substrate containing roots, rhizomes, seeds, and other natural material must be kept viable and replaced at the surface of the excavated site. Impacted wetlands will be replanted with native wetland

species or allowed to naturally re-vegetate from the replaced substrate, as long as the resulting vegetation is native.

35. **For utility line activities authorized by NWP 12 (as well as utility lines associated with projects authorized by NWP 29 and 39),** stream banks that are cleared of vegetation will be stabilized using bioengineering techniques and/ or the planting of deep-rooted native species.

36. **For utility line activities authorized by NWP 12 (as well as utility lines associated with projects authorized by NWP 29 and 39),** construction techniques to prevent draining, such as anti-seep collars, will be required for utility lines buried in waters of the United States when necessary. If no construction techniques to prevent draining are proposed, the prospective permittee must provide appropriate documentation to support that such techniques are not required to prevent drainage of waters of the United States.

37. **For NWP 12,** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32 prior to commencing the activity if the activity will involve temporary *structures*, fills, and/or work. To be complete, the *PCN* must also include the specifications of how pre-construction contours will be re-established and verified after construction. This notification requirement is in addition to the notification criteria listed for this NWP.

38. **For utility line activities authorized by NWP 12, (as well as utility lines associated with projects authorized by NWP 29 and 39),** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32, prior to commencing the activity if the activity will involve maintained utility crossings. To be complete, the *PCN* must also include a justification for the required width of the maintained crossing that impacts waters of the United States. This notification requirement is in addition to the notification criteria listed for this NWP.

39. **For NWP 12,** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32 prior to commencing the activity if the activity will involve the construction of a sub-station in waters of the United States. To be complete, the *PCN* must also include a statement of avoidance and minimization for the *loss of waters of the United States* impacted by the utility line sub-station. This requirement is in addition to the *PCN* requirements listed in General Condition #32.

40. **For NWP 12,** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32 prior to commencing the activity if the activity will involve the permanent conversion of forested wetlands to herbaceous wetlands. To be complete, the *PCN* must also include the acreage of conversion impacts of waters of the United States and a *compensatory mitigation* proposal or a statement of why *compensatory mitigation* should not be required. This requirement is in addition to the *PCN* requirements listed in General Condition #32.

2017 APPROVED
NATIONWIDE PERMIT REGIONAL GENERAL CONDITIONS
FOR SOUTH CAROLINA (REVISED)

41. **For NWP 13 activities, NWP 54 activities, and living shoreline projects authorized by NWP 27** that require submittal of a *PCN*, the *PCN* must include the following information:

    a. Habitat type along the shoreline;
    b. The presence of stabilization *structures* in the vicinity of the project;
    c. Cause/s, extent, and approximate rate of erosion (if known);
    d. Site specific information which may include: shoreline orientation, slope, bank height, tidal range, nearshore bathymetry, fetch, substrate stability, etc.;
    e. Rationale for selecting the preferred stabilization technique;
    f. A statement that structural materials toxic to aquatic organisms will not be used and if stone is proposed, a statement that only clean stone, free of exposed rebar, asphalt, plastic, soil, etc., will be used; and
    g. A statement that filter fabric will be used as appropriate when stone or other heavy material is proposed.

    These requirements are in addition to the *PCN* requirements listed in General Condition #32.

42. Projects qualifying for **NWP 27 and/or NWP 54** will require coordination with appropriate Federal, State, and local agencies. The coordination activity will be conducted by the Corps of Engineers. Agencies will generally be granted 15 days to review and provide comments unless the District Engineer determines that an extension of the coordination period is reasonable and prudent.

43. **For NWP 29,** the *loss of waters of the United States* is limited to a maximum of ¼-acre for a single family residence.

44. **For NWPs 29 and 39,** the *discharges* of dredged or fill material for the construction of *stormwater management facilities* in *perennial streams* are not authorized.

45. **For NWP 33,** the prospective permittee must submit a *PCN* to the District Engineer in accordance with General Condition #32, for temporary construction, access, and dewatering activities that occur in non-tidal waters of the United States, including wetlands. In addition, the *PCN* shall include a restoration plan.

46. **For NWP 36,** only one boat ramp may be constructed on a single lot or tract of land (e.g., each lot within a subdivision).

47. **For NWP 38,** the *PCN* must contain the following information:

    a. documentation that the specific activities are required to effect the containment, stabilization, or removal of hazardous or toxic waste materials as performed, ordered, or sponsored by a government agency with established legal or regulatory authority;

    b. a narrative description indicating the size and location of the areas to be restored, the work involved and a description of the anticipated results from the restoration; and

c. a plan for the monitoring, operation, or maintenance of the restored area.

This requirement is in addition to the *PCN* requirements listed in General Condition #32.

48. **For NWP 41,** a *PCN* must be submitted to the District Engineer for projects that require mechanized land clearing in waters of the United States, including wetlands, in order to access or perform reshaping activities.

49. **NWP 41** is prohibited in channelized streams or stream relocation projects that exhibit natural stream characteristics and/or perform natural stream functions.

50. **For NWP 48,** changing from bottom culture to floating or suspended culture will require submittal of a *PCN* to the District Engineer. Additionally, new aquaculture activities involving suspended or floating culture will require submittal of a *PCN* to the District Engineer. Refer to the *PCN* requirements listed in General Condition #32. Note: If the District Engineer determines that the proposed floating or suspended culture will result in more than minimal adverse environmental effects, an Individual Permit will be required for the proposed activity.

51. **For NWP 48,** when a new commercial shellfish aquaculture activity will occur adjacent to property that is not owned by the prospective permittee, the activity will require submittal of a *PCN* to the District Engineer. The *PCN* must include the following information in addition to the *PCN* requirements listed in General Condition #32:

    a. A map or depiction that shows the adjacent property(ies) and adjacent property owners' contact information. Note: This information may be obtained online from the applicable county's tax information pages.

    b. A signed letter(s) of "no objection" to the proposed commercial shellfish activity from each of the adjacent property owner(s). Each letter shall include the name, mailing address, property address, property Tax Map Parcel (TMS) number, and signature of the property owner.

52. **For NWP 53,** the *PCN* must include a Tier I evaluation, in accordance with the Inland Testing Manual, for the project area immediately upstream of the low-head dam. If the Tier I evaluation indicates contaminated sediments are present, a Tier II evaluation may be required.

53. **For NWP 54 projects and living shoreline and/or oyster restoration projects authorized by NWP 27,** the *PCN* must include the following information in addition to the *PCN* requirements listed in General Condition #32:

    a. A plan view project sketch that shows the proposed project footprint; the Mean High Water (MHW) Line; the Mean Low Water (MLW) Line; marsh line (if applicable); shoreline; width of the waterway at the project location; location of adjacent *structures*,

such as docks and boat ramps (if applicable); distance of the project footprint from the MHW line; distance of the project footprint from adjacent *structures*; and proposed location of informational or navigation markers. Refer to c. and d. below, if applicable. Note: Refer to Regional Condition #11 if the proposed project is located in or adjacent to an authorized Federal Navigation project for the additional information that will be required.

b. A cross-section sketch that shows the height of the proposed project above substrate and the water depth at MHW Line and MLW Line in relation to the proposed project.

c. For projects that are 18 inches or less in height above substrate AND consist of hard *structures* or fill material, such as, but not limited to, riprap, oyster castles, bagged oyster shell and wooden sills, informational signs to alert boaters to the presence of the project area will be required. The *PCN* must include a depiction and description of proposed informational signs. The signs must be made of reflective material or must include reflective tape on the sign or sign post. The signs must be located at each end of the project area and at 100-foot increments along the project area, if applicable. Note 1: Projects that include ONLY the use of loose shell will not require the installation of informational or navigational signs. Note 2: The prospective permittee shall be made aware that the U.S. Coast Guard (USCG) may require the project area to be marked. Prior to commencing work, the permittee shall contact the USCG at U. S. Coast Guard Charleston District Seven, Waterways Management Branch, 909 SE 1st Ave, Suite 406, Miami, FL 33131, or by phone at 305-415-6755 or 305-415-6750, regarding possible markers and/or lighting requirements. The permittee shall install all markers and/or lighting as required by the USCG. In the event that the USCG does not require markers or lighting, the permittee shall mark the project area with Corps approved informational signs as described above. Note 3: These requirements will be added to the NWP verification as special conditions.

d. For projects that are more than 18 inches in height above substrate AND consist of hard *structures* or fill material, such as, but not limited to, riprap, oyster castles, bagged oyster shell, and wooden sills, the prospective permittee must mark the project area with diamond-shaped white day markers with orange border and black print stating "Danger Obstruction". The signs shall be located at each end of the project area and at 100-foot increments along the project area, if applicable. Note 1: Projects that include ONLY the use of loose shell will not require the installation of informational or navigational signs. Note 2: Prior to commencing work, the permittee shall contact the USCG at U. S. Coast Guard Charleston District Seven, Waterways Management Branch, 909 SE 1st Ave, Suite 406, Miami, FL 33131, or by phone at 305-415-6755 or 305-415-6750, regarding potential project specific approval of the markers. The permittee shall install all markers and/or lighting as required by the USCG. In the event the USCG does not require these or other markers and/or lighting, the "Danger Obstruction" markers are still required by the Corps. Note 3: These requirements will be added to the NWP verification as special conditions.

2017 APPROVED
NATIONWIDE PERMIT REGIONAL GENERAL CONDITIONS
FOR SOUTH CAROLINA (REVISED)

** For the purpose of these regional conditions, the term "stream bed" also includes features determined to be a "tributary" and a "relatively permanent water."

Note 1: For the purpose of these regional conditions, bankfull is defined as the top-of-bank to top-of bank of the channel in a cross-sectional view.

Note 2: Regional conditions # 14, #15, and #53d were revised on September 7, 2017.

Permit Number: _____

Name of Permittee: _____

Date of Issuance: _____

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U.S. Army Corps of Engineers
Regulatory Division
69A Hagood Avenue
Charleston, South Carolina 29403-5107

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

==========

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

_____
Signature of Permittee

Attachment B

Sediment Cap Example Specifications

SHORETEC®

SHORETEC, LLC
510 O' Neal Lane
Baton Rouge, LA 70819

225-408-1444 (phone)
225-408-1445 (fax)
shoretec.com (web)

DISTRIBUTED BY:

SHORETEC®

SHOREBLOCK®
SD SERIES
Concrete Revetment Block

PROTECTING OUR NATURAL RESOURCES

SHOREBLOCK® SD blocks of different heights and weights can be assembled to provide a castellated cover layer for a higher coefficient of hydraulic friction or improved wave energy absorption and retention.

SHOREBLOCK® SD is a flexible, interlocking matrix of concrete blocks of uniform size, shape and weight connected by a series of cables which pass longitudinally through preformed ducts in each block. SHOREBLOCK® SD revetment systems combine the favorable aspects of lightweight blankets and meshes, such as porosity, flexibility, vegetation encouragement and habitat enhancement with non-erodible, self-weight and high tractive force resistance of a rigid lining.

SHOREBLOCK® SD has proven to be an aesthetic and functional alternative to rip-rap, poured in place concrete and other heavy-duty, erosion protection systems. SHOREBLOCK® SD is easy to install, therefore, can dramatically reduce overall project costs. More specifically, when compared to other systems, life-cycle costs have been reduced because SHOREBLOCK® SD is a permanent system and saves on subsequent maintenance expenses.

Research and Design

SHOREBLOCK® SD is the most durable, effective and environmentally-friendly erosion control revetment method of fighting severe erosion problems. SHOREBLOCK® SD mats are available in eight foot widths in lengths up to 40 feet. Mats can be joined to achieve greater lengths. Different sizes of SHOREBLOCK® SD are available depending on the severity of the application. In most markets, Articulated Concrete Blocks (ACBs) are competitive in cost to 12" diameter (or greater) rock (or rip-rap) placed in an 18" or greater blanket thickness, are competitive with gabion mattresses and ACBs are typically more economical than poured in place concrete.

ACBs were successfully tested by the U.S. Bureau of Reclamation and U.S. Federal Highway Administration (FHWA-RD-89-199). The Corps of Engineers has used ACBs on numerous designs for both channel and shoreline stability. Comprehensive wave tank testing was evaluated in 1983 at Oregon State University. ACB installations have been performing successfully since 1980.

SHOREBLOCK® SD DESIGN ADVANTAGES

- Each block has an open area of up to 20% to allow for superior hydrostatic pressure relief and ecologically pleasing vegetative cover.
- Interlocking cabling allow greater flexibility through the axes of articulation — conforms better to ground contours and settlement.
- Prefabricated mats offer quick installation, even underwater.
- Tests have shown that the force needed to remove a block from a revegetated cover layer may be equal to 20 times the weight of the block.

SHOREBLOCK® SD has been successfully tested by Colorado State University, in accordance with the hydraulic performance testing protocol established by the U.S. Federal Highway Administration. (FHWA-RD-89-199).

MIN. DENSITY (IN AIR) (Lbs./Ft.³)		MIN. COMPRESSIVE STRENGTH (PSI)		MAX. WATER ABSORPTION (Lbs./Ft.³)	
AVE. OF 3 UNITS	INDIVIDUAL UNIT	AVE. OF 3 UNITS	INDIVIDUAL UNIT	AVE. OF 3 UNITS	INDIVIDUAL UNIT
130	125	4,000	3,500	9.1	11.7

* Unit weight and density values may vary due to availability of local materials.

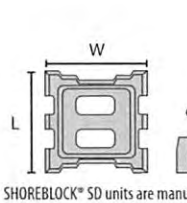
Specifications

Fabrication of a SHOREBLOCK® SD mat is accomplished by threading corrosive resistant steel or special synthetic cable in one direction through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to ensure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring. The open cells of SHOREBLOCK® SD comprise about 20% of the mat area.

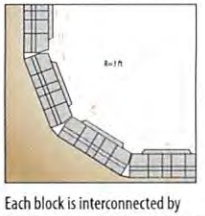
OPEN CELL								
BLOCK CLASS	DIMENSIONS IN.			BLOCK		UNIT COVERAGE Sq. Ft.	OPEN AREA
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq. Ft.		
SD-400 OC	4.00	15.50	17.40	50-57	28-32	1.78	20%
SD-475 OC	4.75	15.50	17.40	62-71	35-40	1.78	20%
SD-600 OC	6.00	15.50	17.40	81-94	46-53	1.78	20%
SD-800 OC	8.00	15.50	17.40	108-118	61-67	1.78	20%
SD-900 OC	9.00	15.50	17.40	120-138	68-78	1.78	20%

CLOSED CELL							
BLOCK CLASS	DIMENSIONS IN.			BLOCK		UNIT COVERAGE Sq. Ft.	OPEN AREA
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq. Ft.		
SD-400 CC	4.00	15.50	17.40	66-73	37-41	1.78	10%
SD-475 CC	4.75	15.50	17.40	78-89	43-50	1.78	10%
SD-600 CC	6.00	15.50	17.40	94-108	53-61	1.78	10%
SD-800 OC	8.00	15.50	17.40	125-135	71-76	1.78	10%
SD-900 CC	9.00	15.50	17.40	145-167	82-98	1.78	10%

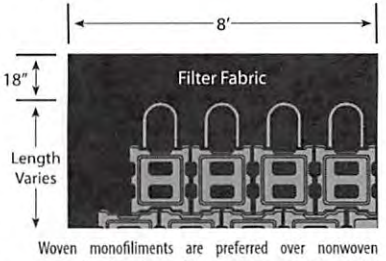
*The SD Series denotes Single Directional Cable System. Note: Additional block styles may be available in some areas. Check with your local SHORETEC® representative for product availability.



SHOREBLOCK® SD units are manufactured in accordance with ASTM C90, C140 and D6684-04.



Each block is interconnected by flexible cables, providing articulation between adjacent blocks.



Woven monofiliments are preferred over nonwoven geotextiles. The soil's particle size (among other factors) will ultimately determine the fabric selection.

Features & Benefits

DURABILITY
SHOREBLOCK® SD will not suffer loss of function due to chemical degradation, UV degradation, biological degradation, vandalism or aging throughout its design life.

STABILITY
SHOREBLOCK® SD has the necessary strength characteristics to resist displacement due to imposed tractive forces and wave loads and the necessary strength to resist both lateral displacement and vertical uplift.

ACCEPTABILITY
SHOREBLOCK® SD becomes part of the landscape and the local ecosystem. Its construction is free of hazardous projections thus offering opportunities for recreation as native grasses are quick to germinate in the soil-filled cells.

AFFORDABILITY
The SHOREBLOCK® SD System is engineered to ensure comprehensive project design, and high quality components at 20-50% lower than alternative erosion control methods.

SHORETEC

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Case Studies
FAQs
Photo Gallery
Performance Testing
Project Specifications
NCMA TEK Note 11-9A
Geotextile Selection Guidelines
Installation Guidelines
CAD Details

Contact Us

Let us quote your next project!
Whether you have a spec or an idea, our team can assist in all phases of your project requirements.

Request a Lunch 'n Earn and Receive PDH's

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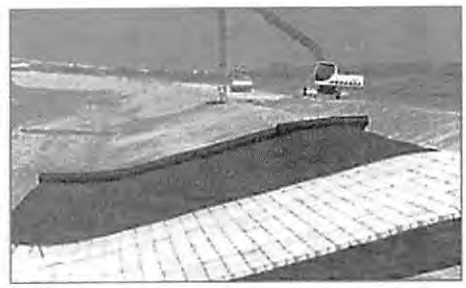
Installation Guidelines

Geotextile Installation



The geotextile should be placed on the prepared slope or other surface to be protected. All folds and wrinkles should be removed from the geotextile before the block is placed on top of it.

Place the geotextile so that there is sufficient overlap to seal the seams for intrusion of water and ensure minimal stretch of the geotextile material. Upstream strips of material must overlap the downstream strips and upslope strips overlap down-slope strips. The amount of overlap (X) is usually specified by the engineering firm and may be a minimum of 3 feet for wet installations and a minimum of 1.5 feet for dry installations.

The upstream strips of material must overlap the downstream strips and upslope strips overlap down-slope strips. (See Diagram 4)

Diagram 4

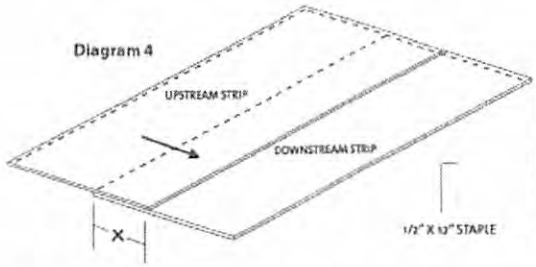


Diagram 5

There should be no voids or airspace between the subgrade and the geotextile so intimate contact can be maintained with the two surfaces. Once the geotextile is placed, the work area should not be disturbed. This is necessary to avoid any contact loss between the ACBs and the geotextile and the geotextile and the subgrade. (See Diagram 5)

Spreader Bar | Subgrade Preparation | Geotextile Installation | Loading and Unloading Cabled Mattresses
Placement of ACBs | Cabling Anchoring and Crimping | Grouting | Bibliography

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Products
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Whether you have a spec or an idea, our team can assist in all phases of your project requirements.

Request a Lunch 'n Earn and Receive PDH's

Signup Online!

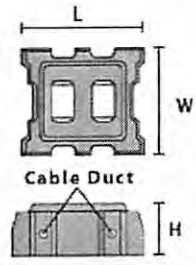
Shoreblock® SD

Fabrication of a Shoreblock SD mat is accomplished by threading corrosive resistant steel or special synthetic cable in one direction through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to insure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring. In most markets, ACBs are competitive in cost to 12" diameter (or greater) rock (or riprap) placed in an 18" or greater blanket thickness. In most markets, ACBs are competitive with gabion mattresses and ACBs are typically cheaper than cast in place concrete.

Shoreblock SD mats are assembled according to the size required for a particular project. Each individual block is inspected prior to being incorporated into a revetment mat. Fabrication of a Shoreblock concrete mat is accomplished by threading corrosive resistant steel or special synthetic cable through a series of blocks. Cables are then secured to the mattress with corrosive resistant hardware. Cables are sized to provide a 5 to 1 cable strength to mat weight ratio to insure safe handling while providing extraordinary strength in the system. Longitudinal cables are looped together at the ends of each row of blocks in the mat assembly for easy handling and anchoring.

Shoreblock Units are manufactured in accordance with ASTM C90, D6684-04 and C140 and the following criteria:

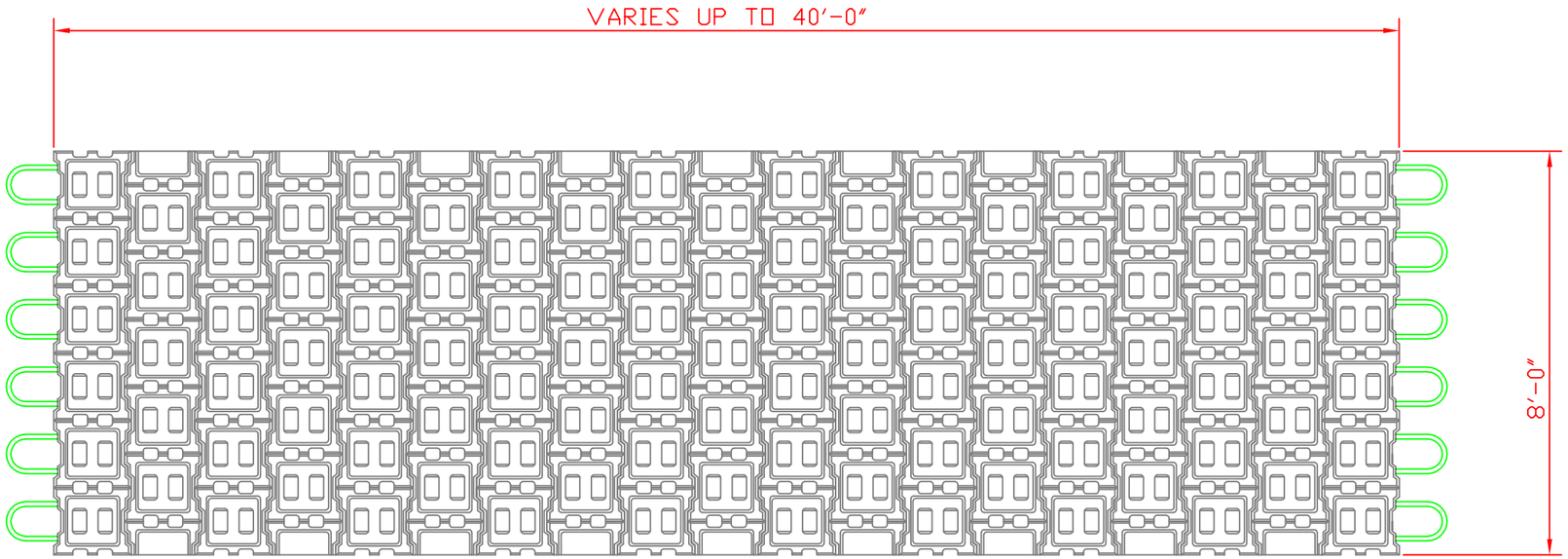
1. Concrete Unit Weight 130-150 lbs./CF
   A. Minimum Compression Strength 4,000 PSI
   B. Maximum Absorption 7%
   C. Dimensional Tolerance + 1/8"
2. Galvanized or Polyester Cabling



Shoreblock® SD Series
Mat Sizes and Weights

OPEN CELL UNITS	Dimensions In.			Block		Unit Coverage Sq. Ft.	Open Area %
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq. Ft.		
SD-400 OC	4.00	15.50	17.40	51-57	29-32	1.78	20
SD-475 OC	4.75	15.50	17.40	62-67	35-38	1.78	20
SD-600 OC	6.00	15.50	17.40	81-88	46-50	1.78	20
SD-800 OC	8.00	15.50	17.40	108-118	61-67	1.78	20
SD-900 OC	9.00	15.50	17.40	120-129	68-73	1.78	20

CLOSED CELL UNITS	Dimensions In.			Block		Unit Coverage Sq. Ft.	Open Area %
	H	W	L	Unit Weight Lbs.	System Weight Lbs./Sq.Ft.		
SD-400 CC	4.00	15.50	17.40	66-73	37-41	1.78	10
SD-475 CC	4.75	15.50	17.40	78-84	44-48	1.78	10
SD-60 CC	6.00	15.50	17.40	94-101	53-57	1.78	10
SD-800 CC	8.00	15.50	17.40	125-135	71-76	1.78	10
SD-900 CC	9.00	15.50	17.40	145-156	82-88	1.78	10

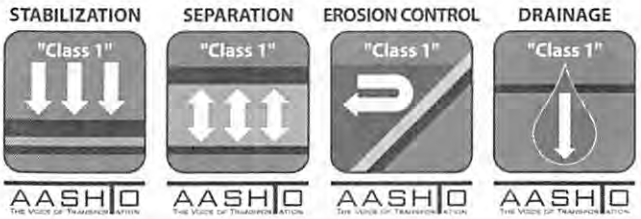


SHORETEC® L.L.C.
510 O'NEAL LANE
Baton Rouge, Louisiana 70819
(225) 408-1444 - Phone
(225) 408-1445 - Fax
www.shoretec.com

Client:	Title:			
	SHOREBLOCK® SD SERIES TYPICAL MAT			
Scale: N.T.S.	Drawn By: A. CASE	File Name:	Project No:	Drawing No: 3

No.	Date	Revision	By

Construction Geosynthetics



US 205NW

NTPEP APPROVED - GTX-2016-01-100. US 205NW is a nonwoven needlepunched geotextile made of 100% polypropylene staple filaments. US 205NW resists ultraviolet and biological deterioration, rotting, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. US 205NW will satisfy the requirements as outlined in AASHTO M-288-06 for Class 1 applications and meets the following M.A.R.V. values except where noted:

Property	Test Method	English	Metric
Weight - Typical	ASTM D-5261	8.0 oz/sy	271 g/sm
Tensile Strength	ASTM D-4632	205 lbs	912 N
Elongation @ Break	ASTM D-4632	50%	50%
Mullen Burst*	ASTM D-3786*	350 psi	2,413 kPa
Puncture Strength*	ASTM D-4833*	130 lbs	579 N
CBR Puncture	ASTM D-6241	535 lbs	2,381 N
Trapezoidal Tear	ASTM D-4533	85 lbs	378 N
Apparent Opening Size	ASTM D-4751	80 US Sieve	0.180 mm
Permittivity	ASTM D-4491	1.35 Sec-1	1.35 Sec-1
Water Flow Rate	ASTM D-4491	90 g/min/sf	3,657 l/min/sm
UV Resistance @ 500 Hours	ASTM D-4355	70%	70%

Roll Size	Roll Diameter	Area	Weight
12.5' x 360'	16.0 in	500 sys	270 lbs
15' x 300'	16.0 in	500 sys	270 lbs

* Historical averages (current values not available): Mullen Burst Strength ASTM D3786 is no longer recognized by ASTM D-35 on Geosynthetics as an acceptable test method. Puncture Strength ASTM D4833 is not recognized by AASHTO M288 and has been replaced with CBR Puncture ASTM D6241.

US Fabrics, Inc. | 3904 Virginia Avenue | Cincinnati, OH 45227

Phone: (800) 518-2290 | Fax: (513) 217-4420 | email: info@usfabrics.com

Construction Geosynthetics

Underwater Polypropylene Geotextile Installation Guide

1.0 General

1) This guideline covers general installation of polypropylene geotextiles in underwater applications.
2) Where contradictions occur follow the instructions of the project engineer.

2.0 Geotextiles Float

1) All woven and most needle-punched nonwoven geotextiles are made from 100% polypropylene.
   a) Polypropylene has a density of 0.91.
      i) As such, geotextiles will float in water and require a ballast.

3.0 Shallow Slope Projects

1) When a machine can reach the full extent of the geotextile placement:
   a) Place a steel pole with a buoy attached at one end through the geotextile roll core.
   b) Anchor the geotextile at the top of the slope by unrolling a portion and carefully driving the excavator onto it.
   c) Lower the geotextile into place.
   d) Immediately place a layer of rock on the geotextile to ballast it.
   e) Retrieve the pole by pulling on buoy ropes.

4.0 Larger Slope Projects

1) Create larger sewn panels on site with a portable sewing machine.
   a) Use a prayer seem.
   b) They achieve 60% of the geotextile's tensile strength.
2) Slope Installation.
   a) Lay sewn panel on level ground and attach sacrificial ballast.
      i) Typically scrap 20 mm rebar pieces attached along geotextile length at 6 foot centers.
      ii) Cable ties, wire or tape are attachment options.
      iii) Holes are made in fabric with a push rod the same diameter as the fastener.
   b) Place a steel core at one end of the panel.
   c) Attach two lengths of rope to the core and lay the rope along the geotextile.
   d) Roll the fabric, rebar and ropes onto the core and transport it to the installation area.

e) The rolled geotextile panel can now be lowered into position by unwinding the ropes.
    i) On long slopes, it may be more effective to place the roll on the slope shoulder and have the ropes hauled on board from a barge.
3) Immediately place a layer of rock on the geotextile to ballast it.

5.0 Anchoring

4) If required, use key trenches or aprons at the crest and toe of the slope to anchor the ends of the geotextile.
    a) The anchor trench should be backfilled with soil and compacted on completion of the geotextile installation.
    b) It is recommended that the front of anchor trenches are rounded and smooth to reduce stress on the geotextile.

6.0 Deep Water Installation

1) Float the prefabricated panel out to sea.
2) Ballast it into position on the seabed by dropping rock from a barge onto the floating panel as it sinks.
3) Prefabricated straps and weight pocket options.
    a) Geotextiles can be manufactured with special straps sewn into the fabric to assist with connection to installation rafts or similar.
        i) Folds or pockets can also be sewn in the fabric to contain weights such as sinking poles.
        ii) Contact US Fabrics for more information.
            (1) (800)518-2290
            (2) info@usfabrics.com
4) Immediately place a layer of rock on the geotextile to ballast it.

7.0 Overlapping

1) Panel overlap widths are site specific and generally at the discretion of the site engineer.
    a) A minimum overlap of 3 feet is recommended for under water geotextile placement.
2) Overlaps are required to ensure that all of the underlying soils are fully covered.
    a) Keep in mind the geotextile can move during placement of the rock.
3) Marking the ends of the geotextile.
    a) Spraying white lines on the fabric where the overlap occurs may be useful in some waters.
        i) For example, 3 feet in from the edge of the panels.
    c) Attaching floats to the edges of the rolled geotextile panel is another option.

8.0 Storage

1) Geotextile rolls are wrapped in a UV protective cover.
2) If stored outdoors for a prolonged period, the geotextile should be elevated from the ground and covered with a tarpaulin or opaque plastic.
   a) Contractor should insure rolls are adequately protected from:
      i) Moisture
      ii) Ultraviolet radiation
      iii) Chemicals that are strong acids or bases
      iv) Temperatures in excess of 140°F
      v) Animal destruction

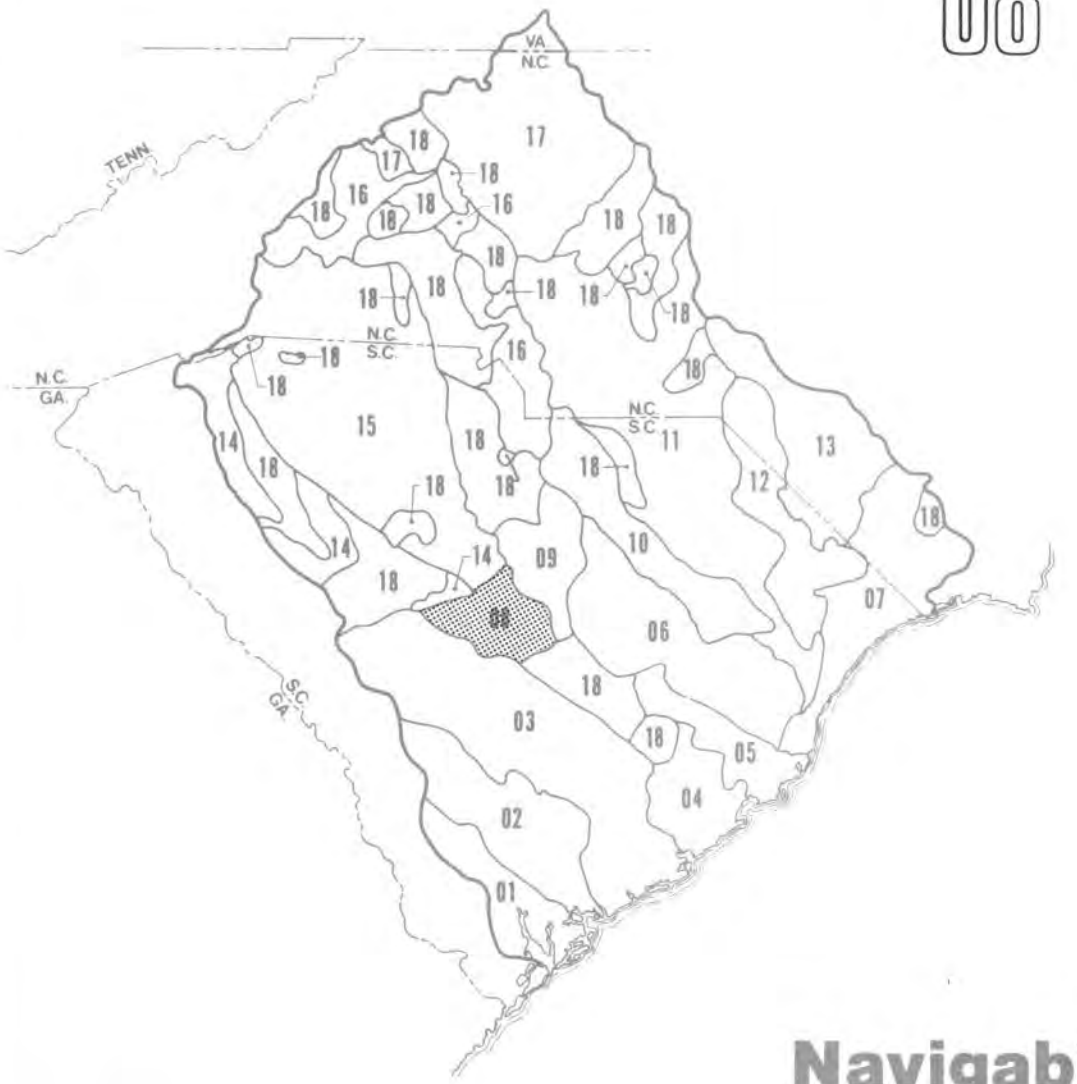
Attachment C

Excerpts from the 1977 Navigability Study of the Congaree River Basin

U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina

CONGAREE RIVER BASIN

Report No. 08



Navigability Study 1977

STANLEY CONSULTANTS

Navigation Classification Categories

This study classifies streams into several different categories, each of which is discussed subsequently:

1. Present "navigable waters of the U. S." (by regulatory procedures).
2. Historically navigable waters (based on literature review).
3. Recommended "navigable waters of the U. S." (based upon data developed as a part of this investigation).
4. Recommended waters for practical navigation (within "navigable waters of the U. S.").
5. Headwaters for all waterbodies (five cfs points).

The first four navigation classifications are displayed on the plates presented later in this report. The headwater limits are summarized in Appendix A.

Present Navigable Waters of the U. S.

Currently, the Congaree River is classified as "navigable waters of the U. S." from its confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378, (R.M. 175.9). (3)(4)(20) This classification is based on the limits of the Federally authorized project, as discussed in Section 3, as well as Federal and state court decisions, as discussed in Section 5. (See plate 08-2 for map location.)

Historically Navigable Waters

The Congaree River was extensively used for navigation throughout the earlier development of the state. After the construction of the Columbia Canal, as referred to in Section 4, navigation extended over the entire length of the Congaree River (R.M. 176.9), and continued up the Broad River (see Report 15).

Recommended and Practical Navigable Waters of the U. S.

The recommended and practical limit of "navigable waters of the U. S." is at the Gervais Street bridge (R.M. 175.9). This is the same limit as the present classification, and is based on the Federal court

decisions and authorized project limits that established the present classification, as well as observations and calculations, which establish the practicality of navigation at all six bridges crossing the river. Analysis at each of the locations resulted in an approximate mean water depth of at least 7 feet, approximate channel width of at least 50 feet, and an average slope within the ranges for practical navigation. The river extends upstream for about one mile beyond R.M. 175.9; however, it becomes shallower and spotted with sandbars as it nears the confluence of the Broad and Saluda Rivers and would require extensive improvements to be navigable. In addition, entrance to the Columbia Canal, used at one time to by-pass this shallow area, is no longer operational due to installation of electric generating turbines and would also require extensive renovation to become functional.

These conclusions on the navigation limit meet the criteria established for the Federal test of navigability that the body of water is used, or is capable of being used, in conjunction with other bodies of water to form a continuous highway upon which commerce with other states or countries might be conducted.

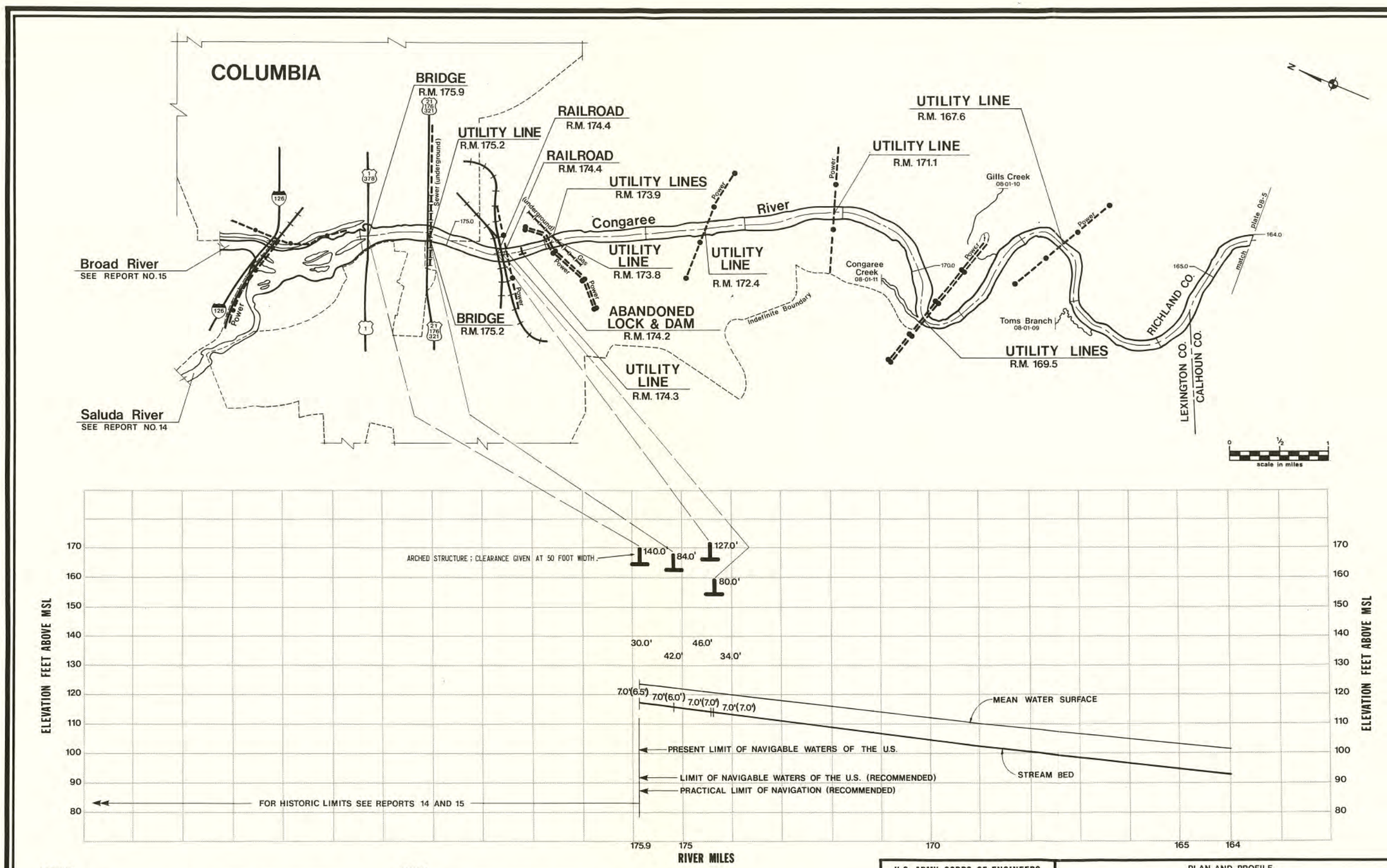
There are no significant tributaries to the Congaree River capable of supporting navigation.

Plates 08-4 through 08-6 are plan and profiles of the recommended "navigable waters of the U. S." The plan and profile plates show mean water surface as determined from USGS maps, stream bed depth, 50 feet wide navigable channel depth, pier spacing for bridges crossing the river, and vertical clearances at structures. Approximate vertical clearances for overhead utilities are shown later in this Section in Table 4. It is emphasized that all references to elevation are approximate since vertical control was established from USGS contour maps and not field instrument surveys. Water depth and structure vertical clearance measurements are also approximate due to the accuracy inherent in the field techniques. (See the Summary Report for a detailed description of field procedures and the methodology used to calculate water depth at mean flow.)

SECTION 7 - CONCLUSIONS AND RECOMMENDATIONS

Five classifications of navigation on streams in the Congaree River basin have been determined and are presented below. The first two are classifications developed from historical evidence and current Federal stream classifications. Classification 3 is based on field measurements, observations, and data analysis for the river. Classification 4 is based on review of all previously determined limits with a recommendation of the most upstream location with supporting evidence of navigability. The fifth classification accounts for all streams not otherwise classified and was determined based on the drainage area and hydrological aspects of the stream.

1. The Congaree River is presently classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge in Columbia (R.M. 175.9).
2. The historical limit of navigation on the Congaree River is, with the use of the Columbia Canal, to R.M. 177. The classification extends beyond the Congaree basin boundary to the Broad River (see Report 15).
3. The recommended practical limit of navigation is at the Gervais Street bridge (R.M. 175.9). Reasonable channel improvements will be necessary for commercial river traffic to actually use the river up to this point.
4. It is recommended that the Congaree River be classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378 (R.M. 175.9) based on the analytical procedures and tests of navigability used in this study effort.
5. All streams not recommended for classification as "navigable waters of the U. S." are recommended for classification as "waters of the U. S." throughout their entire length.



LEGEND:

OVERHEAD STRUCTURE — 75' — HORIZONTAL CLEARANCE IN MAIN CHANNEL

12' — VERTICAL CLEARANCE TO STRUCTURE

MEAN WATER SURFACE — MAXIMUM DEPTH AT MEAN FLOW

STREAM BED — 8' (6') — MAXIMUM DEPTH OF 50 FOOT WIDE CHANNEL AT MEAN FLOW

STRUCTURE RIVER MILE LOCATION

NOTES:

1. ELEVATION AND SLOPE OF MEAN WATER SURFACE ARE BASED ON USGS TOPOGRAPHIC MAPS AND ARE THEREFORE ONLY APPROXIMATIONS. VERTICAL DIMENSIONS FROM STREAM BED TO OVERHEAD STRUCTURES ARE FIELD MEASUREMENTS. RELATIVE LOCATION OF MEAN WATER SURFACE IS APPROXIMATED FROM CONTOUR MAPS, MEASURED CROSS SECTIONS AND VELOCITIES, STREAM FLOW RECORDS, THE MANNING EQUATION, AND FIELD OBSERVATIONS. SEE SUMMARY REPORT FOR COMPLETE EXPLANATION.

1977

U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina

STANLEY CONSULTANTS

PLAN AND PROFILE

CONGAREE RIVER

Congaree River Basin

CALHOUN-LEXINGTON-RICHLAND CO., S.C.

NAVIGABILITY STUDY

Miles 164.0-175.9 Plate 08-6

Attachment D

2010 Discharge Summary

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:02169500 CONGAREE RIVER AT COLUMBIA, SC TYPE:STREAM AGENCY:USGS STATE:45 COUNTY:063
LATITUDE: 335935 LONGITUDE: 0810300 NAD27 DRAINAGE AREA:7850* CONTRIBUTING DRAINAGE AREA: DATUM:113.02 NGVD29
Date Processed: 2012-03-23 09:22 By wjstring
Lowest aging status in period is APPROVED
DD #1, FROM DCP
Discharge, cubic feet per second
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2540	2600	2680	2090	2360	3150	19600	3070	3560	1610	1280	753
2	1680	1750	8140	2330	2410	4490	11900	2520	2990	1870	1120	730
3	1400	2300	12000	2860	3400	4760	8300	3750	3000	1650	1090	747
4	1430	2510	6810	2770	7390	3970	9310	3450	3970	1430	945	749
5	1320	2100	5000	3070	6910	3000	5840	3830	2900	1830	1260	1490
6	1560	2250	4190	2920	10400	3350	7570	4270	2530	1560	1680	1820
7	1830	2290	3940	2710	11700	8490	9590	6460	2540	2090	1750	1080
8	1650	2500	2900	3590	6900	17700	7750	3000	2600	1640	1610	1250
9	1430	2190	2830	2420	5090	13200	7030	4350	2300	1400	2880	1390
10	1380	1640	2870	2740	4900	9010	8230	3560	1910	1820	1490	1190
11	1380	1830	2360	7820	4760	11600	7940	3500	1400	2250	1170	1020
12	1330	1580	2320	6640	3690	12700	6450	3200	1240	2370	1420	1080
13	1380	2370	4830	6590	2860	8400	5960	2870	1720	2340	1160	1130
14	1330	1970	10400	7300	4030	6120	8560	3040	2330	1800	1410	1300
15	1320	1840	6670	4660	2720	7410	5960	3280	2320	1300	1470	1140
16	1350	1550	2880	1730	2210	6580	4930	2720	2610	1190	1940	896
17	1370	1550	2690	2830	2460	5860	4200	3310	2960	1430	1420	856
18	1330	2610	2060	4590	3190	6260	7940	3910	2050	1980	1570	853
19	1310	2430	3460	5960	2990	5880	7890	4350	2000	1780	1010	855
20	1330	2230	2960	3410	2910	4960	7920	4860	2180	2170	1110	1300
21	1310	2200	2260	2930	3210	5470	7300	3890	2200	1510	1110	1400
22	1350	2380	2260	2890	2110	5550	3910	3810	2080	1400	1440	1400
23	1880	1460	2490	2860	2700	5400	4560	2930	1490	1370	1300	2730
24	1660	1450	3080	2470	2550	5480	4760	2090	1250	1410	1330	5530
25	1410	2130	2000	2860	2510	5380	4220	3090	2340	1370	1420	5470
26	1760	2500	2730	2160	2400	4490	5110	2870	2650	4010	1270	5120
27	1680	2280	2940	2270	2690	6770	5790	2450	2630	2300	1140	4040
28	3200	9190	2970	2950	3040	13600	5980	3390	2140	1410	1250	2250
29	4700	2570	2920	3200	---	13200	4720	4410	1470	1330	1250	2020
30	4330	2180	2910	3480	---	14400	4580	3630	1400	1180	1220	1300
31	4440	---	2910	2970	---	17200	---	2410	---	1420	960	---
TOTAL	57370	70430	121460	110070	114490	243830	213800	108270	68760	54220	42475	52889
MEAN	1851	2348	3918	3551	4089	7865	7127	3493	2292	1749	1370	1763
MAX	4700	9190	12000	7820	11700	17700	19600	6460	3970	4010	2880	5530
MIN	1310	1450	2000	1730	2110	3000	3910	2090	1240	1180	945	730
CFSM	0.24	0.30	0.50	0.45	0.52	1.00	0.91	0.44	0.29	0.22	0.17	0.22
IN.	0.27	0.33	0.58	0.52	0.54	1.16	1.01	0.51	0.33	0.26	0.20	0.25

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1940 - 2011, BY WATER YEAR (WY)

MEAN	6731	6861	8741	11410	12460	13860	11050	7608	6757	6256	6600	5966
MAX	33460	18960	24450	28430	34910	31290	27670	20460	18730	16730	18650	19250
(WY)	1965	1993	2010	1993	1960	2003	1964	2003	1973	1941	1949	1945
MIN	1085	1191	1804	2967	3211	4074	3851	2283	1427	1109	1342	1328
(WY)	2008	2008	2008	1956	2001	1955	2006	2001	2008	2008	2007	2007

SUMMARY STATISTICS FOR 2010 CALENDAR YEAR FOR 2011 WATER YEAR WATER YEARS 1940 - 2011

Attachment E

U.S. Coast Guard Private Aids to Navigation Application

DEPARTMENT OF HOMELAND SECURITY
U.S. Coast Guard

OMB Approval: 1625-0011
Expiration Date: 12/31/2017

PRIVATE AIDS TO NAVIGATION APPLICATION

(See attached instructions and copy of Code of Federal Regulations, Title 33, Chap. 1, Part 66)

NO PRIVATE AID TO NAVIGATION MAY BE AUTHORIZED UNLESS A COMPLETED APPLICATON FORM HAS BEEN RECEIVED (14 U.S.C. 83; 33 CFR. 66. 01-5).

1. ACTION REQUESTED FOR PRIVATE AIDS TO NAVIGATION: [x] A. ESTABLISH AND MAINTAIN [ ] B. DISCONTINUE [ ] C. CHANGE [ ] D. TRANSFER OWNERSHIP | 2. DATE ACTION TO START: May 2018

3. AIDS WILL BE OPERATED: [ ] A. YEAR-ROUND [x] B. TEMPORARILY UNTIL January 2019 [ ] C. SEASONAL FROM TO

4. NECESSITY FOR AID *(Continue in Block 8)*: Congaree River Sediment Capping Project

5. GENERAL LOCALITY: Columbia, SC

6. AUTHORIZING PERMIT FOR THIS STRUCTURE OR BUOY: USACE [ ] PERMIT AND/ OR STATE [ ] PERMIT (Valid Permit Number) _____

FOR DISTRICT COMMANDERS ONLY		7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS									
LIGHT LIST NUMBER	NAME OF AID	NO. OR LTR (7a)	LIGHT: FLASH PERIOD (7b)	LIGHT: FLASH LENGTH (7c)	LIGHT: COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CANDELA (7g)	FOCAL PLANE HEIGHT (7h)	STRUCTURE: TYPE, COLOR, AND HEIGHT ABOVE GROUND (7i)	REMARKS *(See instructions)* (7j)
		1				20' from perimeter of construction area	< 1'-20'				Information
		2	60s	1s	W	10' from perimeter of construction area	N/A	1 mile	10.5	Solar Power, LED Marine Application	Visible for 1 mile during clear conditions
		3				Up and down river	N/A	3'-5'		Reflective Sign - "Warning River Construction Zone .."	White/Orange 4'x4'

8. ADDITIONAL COMMENTS
The project area is located at 33 59' 401.59" N, 81 02' 56.80" W

9a. NAME AND ADDRESS OF PERSON IN DIRECT CHARGE OF THE AID(S)
Paul Biery - SCANA
220 Operation Way, Cayce, SC 29033

9b. TELEPHONE NO.
803-465-7736

9c. E-MAIL ADDRESS
paul.biery@scana.com

10a. NAME AND ADDRESS OF PERSON OR CORPORATION AT WHOSE EXPENSE THE AID(S) WILL BE MAINTAINED
SCE&G
220 Operation Way
Cayce, SC 29033-3701

10b. THE APPLICANT AGREES TO SAVE THE COAST GUARD HARMLESS WITH RESPECT TO ANY CLAIM OR CLAIMS THAT MAY RESULT ARISING FROM THE ALLEGED NEGLIGENCE OF THE MAINTENANCE OR OPERATION OF THE APPROVED AID(S).

10c. DATE

10d. SIGNATURE AND TITLE OF OFFICIAL SIGNING

FOR USE BY DISTRICT COMMANDER		RECD	DATE APPROVED	SIGNATURE *(By direction)*
SERIAL NO.	CLASSIFICATION OF AIDS(S)	CHART		
		LNM		

REMARKS

DATE	REFERENCE	ACTION AND REMARKS

J F M A M J J A S O N D

NAME OF AID

LIGHT LIST NO.

Privacy Act Statement

Authority: Under 14 U.S.C 81, the U.S. Coast Guard is authorized to establish aids to navigation. 14 U.S.C 83 prohibits establishment of aids to navigation without permission of the U.S. Coast Guard. 33 CFR 66.01-5 provides a means for private individuals to establish privately maintained aids to navigation through application to the U.S. Coast Guard.

Purpose: To obtain approval to establish a private aid to navigation, applicants must submit CG-2554 (Private Aids to Navigation Application). Information about the private aid to navigation (type, color, geographic position), as well as the applicant's contact information is stored in the U.S. Coast Guard's Integrated Aids to Navigation Information System (I-ATONIS). I-ATONIS is the U.S. Coast Guard's comprehensive database for managing information about aids to navigation. I-ATONIS has user access controls in place to govern who may view or access information.

Routine Uses: Collecting the applicant's contact information is important because it allows the U.S. Coast Guard to contact the applicant should there be a discrepancy or mishap involving the permitted private aid to navigation. Certain discrepancies create hazards to navigation and must be responded to and corrected or repaired. The contact information is available to U.S. Coast Guard aids to navigation personnel and contact is only initiated if the private aid to navigation becomes discrepant or in need of repair.

Disclosure: Provision of the applicant's contact information is mandatory, as it will allow the U.S. Coast Guard to contact the owner should there be a discrepancy or mishap with the permitted aid to navigation. Failure to provide the required contact information will lead to disapproval of the private aid to navigation application.

U.S. COAST GUARD
PRIVATE AIDS TO NAVIGATION APPLICATION
INSTRUCTIONS

1. The rules, regulations, and procedures pertaining to private aids to navigation are set forth in the excerpt of the Code of Federal Regulations; Title 33, Chapter 1, Part 66 on the following pages.

2. One copy of the application for private aids to navigation shall be forwarded via postal mail, electronic mail, or facsimile to the Commander of the Coast Guard District in which the aids will be located 30 days in advance of the proposed action. Sections of charts or sketches showing the work proposed should accompany each application.

3. When making application for private aids to navigation to mark structures and mooring buoys in navigable waters or to mark the excavating or depositing of material therein, evidence is required of the authorization obtained from the U.S. Army Corps of Engineers (USACE), Department of the Army, for such work, (Code of Federal Regulations; Title 33, Part 322.) and/or State Regulatory Agency.

4. The applicant shall complete all of Blocks 1, 2, 3, 4, 5, 9 and 10 for all new applications. When a private aid to navigation is being discontinued, Block 3 need not be completed. Block 6 shall be completed whenever authorization is required to be obtained from Corps of Engineers (See Instruction No. 3). Columns in Block 7 will be completed as follows:
   a. Unlighted buoy(s) - 7a, 7e, 7f, and 7j.
   b. Lighted buoy(s) - 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, and 7j.
   c. Daybeacon(s) - 7a, 7e, 7f (if applicable), 7h, 7i, and 7j.
   d. Light(s) on a structure - 7a, 7b, 7c, 7d, 7e, 7f (if applicable), 7g, 7h, 7i, and 7j.

5. When a private aid to navigation is being changed, Block 8 shall be used to describe the nature of the change.

6. The required information for each column includes the following:
   (7a) Proposed number or letter to be assigned to the private aid to navigation.
   (7b) Period of light (time in seconds for one complete cycle).
   (7c) Flash length in seconds. For complex or multiple flashes, explain in column (7j).
   (7d) Color of light.
   (7e) Position as determined by Global Positioning System (GPS), differential GPS, professional surveyor, by two or more horizontal angles, or bearing and distance from a prominent charted landmark. If a prominent charted landmark is not available, show latitude and longitude as precisely as the chart permits.
   (7f) Depth of water at buoy or structure (if marine site). All depths are measured from mean lower low water except on Great Lakes where depths are measured from low water datum.
   (7g) Candela, if known; otherwise, include the following information in column (7j); lens size, lamp voltage and amperage if electric, or details of other illuminant to be used.
   (7h) If lighted, the height of the light's optic above the water.
   (7i) Include details of structure (type, color).
   (7j) Used for the following specific information, plus any other useful details: a. buoys - size, shape, color, and reflective material used; b. structures - dayboard shape and color; c. sound signal on a buoy or structure - type and model, audible range, and characteristic (number of strokes or blasts, period and blast length).

7. This form may be used to cover more than one private aid to navigation in the same geographic area. Draw a line between each aid as indicated in example below. Attach separate sheet if additional space is required.

8. Attach a section of chart showing the proposed location of the private aid(s) to navigation.

9. a. After receipt of the approved form, the applicant will advise the District Commander by telephone, postal mail, electronic mail, or facsimile when the authorized work is actually accomplished.
   b. If the private aid(s) to navigation have not been installed within one year of the approval date, the approved application is automatically cancelled.
   c. Any discrepancy in the operation of the private aid(s) to navigation at any time shall be reported to the District Commander by telephone, postal mail, electronic mail, or facsimile in order that Notices to Mariners may be issued. A discrepancy exists whenever the private aid to navigation is not operating as described in the approved application, i.e., lack of signal, incorrect light characteristic, or improper color, shape, or position of shore structure or buoy. The correction of the discrepancy will also be reported by the same method.

10. All classes of private aids to navigation shall be maintained in proper condition. They are subject to inspection by the Coast Guard at any time and without prior notice to the maintainer.

EXAMPLE OF USE OF APPLICATION

FOR DISTRICT COMMANDERS ONLY		7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS									
LIGHT LIST NUMBER	NAME OF AID	NO. OR LTR (7a)	LIGHT			POSITION (7e)	DEPTH OF WATER (7f)	CANDELA (7g)	FOCAL PLANE HEIGHT (7h)	BUOY/STRUCTURE	REMARKS *(See instructions) (7j)*
			FLASH PERIOD (7b)	FLASH LENGTH (7c)	COLOR (7d)					TYPE, COLOR, AND HEIGHT ABOVE GROUND (7i)	
		1	4s	0.4s	Green	dd°mm'ss.sss"N ddd°mm'ss.sss"W	9 Ft			5' lighted buoy, Green	
		2				dd°mm'ss.sss"N ddd°mm'ss.sss"W	8 Ft			Nun buoy, Red	
		3				dd°mm'ss.sss"N ddd°mm'ss.sss"W	7 Ft			Single Pile	2' square dayboard, Green
		4	2.5s	0.5s	Red	dd°mm'ss.sss"N ddd°mm'ss.sss"W	9 Ft		14 Ft	Multi-Pile	3' triangular dayboard, Red

An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number.

The U.S. Coast Guard estimates the average burden for this report is 1 hour. You may submit any comments concerning the accuracy of this burden estimate or any suggestions for reducing the burden to: COMMANDANT (CG-NAV-1), U.S. COAST GUARD STOP 7418, 2703 MARTIN LUTHER KING JR AVE SE, WASHINGTON DC 20593-7418 or OFFICE OF MANAGEMENT AND BUDGET, PAPERWORK REDUCTION PROJECT (1625-0011), WASHINGTON, DC 20590-0001.

§ 66.01-1 Basic provisions.

(a) No person, public body, or instrumentality not under the control of the Commandant, exclusive of the Armed Forces, will establish and maintain, discontinue, change or transfer ownership of any aid to maritime navigation, without first obtaining permission to do so from the Commandant.

(b) For the purposes of this subpart, the term private aids to navigation includes all marine aids to navigation operated in the navigable waters of the United States other than those operated by the Federal Government (part 62 of this subchapter) or those operated in State waters for private aids to navigation (subpart 66.05).

(c) Coast Guard authorization of a private aid to navigation does not authorize any invasion of private rights, nor grant any exclusive privileges, nor does it obviate the necessity of complying with any other Federal, State or local laws or regulations.

(d) With the exception of radar beacons (racons) and shore based radar stations, operation of electronic aids to navigation as private aids will not be authorized.

§ 66.01-3 Delegation of authority to District Commanders.

(a) Under Section 888 of Pub. L. 107-296, 116 Stat. 2135, the Commandant delegates to the District Commanders within the confines of their respective districts (see Part 3 of this chapter for descriptions) the authority to grant permission to establish and maintain, discontinue, change or transfer ownership of private aids to maritime navigation, and otherwise administer the requirements of this subpart.

(b) The decisions of the District Commander may be appealed within 30 days from the date of decision. The decision of the Commandant in any case is final.

§ 66.01-5 Application procedure.

To establish and maintain, discontinue, change, or transfer ownership of a private aid to navigation, you must apply to the Commander of the Coast Guard District in which the aid is or will be located. You can find application form CG-2554 at http://www.uscg.mil/forms/cg/CG_2554.pdf. You must complete all parts of the form applicable to the aid concerned, and must forward the application to the District Commander. You must include the following information:

(a) The proposed position of the aid to navigation by two or more horizontal angles, bearings and distance from charted landmarks, or the latitude and longitude as determined by GPS or differential GPS. Attach a section of chart or sketch showing the proposed position.

(b) The name and address of the person at whose expense the aid will be maintained.

(c) The name and address of the person who will maintain the aid to navigation.

(d) The time and dates during which it is proposed to operate the aid.

(e) The necessity for the aid.

(f) For lights: The color, characteristic, range, effective intensity, height above water, and description of illuminating apparatus. Attach a copy of the manufacturer's data sheet to the application.

(g) For sound signals: Type (whistle, horn, bell, etc.) and characteristic.

(h) For buoys or daybeacons: Shape, color, number, or letter, depth of water in which located or height above water.

(i) For racons: Manufacturer and model number of racon, height above water of desired installation, and requested coding characteristic. Equipment must have FCC authorization.

§ 66.01-10 Characteristics.

The characteristics of a private aid to navigation must conform to those prescribed by the United States Aids to Navigation System set forth in subpart B of part 62 of this subchapter.

§ 66.01-11 Lights.

(a) Except for range and sector lights, each light approved as a private aid to navigation must:

(1) Have at least the effective intensity required by this subpart omnidirectionally in the horizontal plane, except at the seams of its lens-mold.

(2) Have at least 50% of the effective intensity required by this subpart within ±2° of the horizontal plane.

(3) Have a minimum effective intensity of at least 1 candela for a range of 1 nautical mile, 3 candelas for one of 2 nautical miles, 10 candelas for one of 3 nautical miles, and 54 candelas for one of 5 nautical miles. The District Commander may change the requirements for minimum intensity to account for local environmental conditions. For a flashing light this intensity is determined by the following formula:

$Ie=G/(0.2+t_2-t_1)$

Where:
Ie = Effective intensity
G = The integral of the instantaneous intensity of the flashed light with respect to time
t_1 = Time in seconds at the beginning of the flash
t_2 = Time in seconds at the end of the flash
t_2-t_1 is greater than or equal to 0.2 seconds.

(4) Unless the light is a prefocused lantern, have a means of verifying that the source of the light is at the focal point of the lens.

(5) Emit a color within the angle of 50% effective intensity with color coordinates lying within the boundaries defined by the corner coordinates in Table 66.01-11(5) of this part when plotted on the Standard Observer Diagram of the International Commission on Illumination (CIE).

Table 66.01-11(5)—Coordinates of Chromaticity

Color	Coordinates of chromaticity	
	x axis	y axis
White	0.500	0.382
	0.440	0.382
	0.285	0.264
	0.285	0.332
	0.453	0.440
	0.500	0.440
Green	0.305	0.689
	0.321	0.494
	0.228	0.351
	0.028	0.385
Red	0.735	0.265
	0.721	0.259
	0.645	0.335
	0.665	0.335
Yellow	0.618	0.382
	0.612	0.382
	0.555	0.435
	0.560	0.440

(6) Have a recommended interval for replacement of the source of light that ensures that the lantern meets the minimal required intensity stated in paragraph (a)(3) of this section in case of degradation of either the source of light or the lens.

(7) Have autonomy of at least 10 days if the light has a self-contained power system. Power production for the prospective position should exceed the load during the worst average month of insolation. The literature concerning the light must clearly state the operating limits and service intervals. Low-voltage disconnects used to protect the battery must operate so as to prevent sporadic operation at night.

(b) The manufacturer of each light approved as a private aid to navigation must certify compliance by means of an indelible plate or label affixed to the aid that meets the requirements of § 66.01-14.

§ 66.01-12 May I continue to use the private aid to navigation I am currently using?

If, after March 8, 2004, you modify, replace, or install any light that requires a new application as described in § 66.01-5, you must comply with the rules in this part.

§ 66.01-13 When must my newly manufactured equipment comply with these rules?

After March 8, 2004, equipment manufactured for use as a private aid to navigation must comply with the rules in this part.

§ 66.01-14 Label affixed by manufacturer.

(a) Each light, intended or used as a private aid to navigation authorized by this part, must bear a legible, indelible label (or labels) affixed by the manufacturer and containing the following information:

(1) Name of the manufacturer.

(2) Model number.

(3) Serial number.

(4) Words to this effect: "This equipment complies with requirements of the U.S. Coast Guard in 33 CFR part 66."

(b) This label must last the service life of the equipment.

(c) The manufacturer must provide the purchaser a data sheet containing the following information:
(1) Recommended service life based on the degradation of either the source of light or the lamp.
(2) Range in nautical miles.
(3) Effective intensity in candela.
(4) Size of lamp (incandescent only).
(5) Interval, in days or years, for replacement of dry-cell or rechargeable battery.

§ 66.01-15 Action by Coast Guard.

(a) The District Commander receiving the application will review it for completeness and will assign the aid one of the following classifications:

Class I: Aids to navigation on marine structures or other works which the owners are legally obligated to establish, maintain and operate as prescribed by the Coast Guard.

Class II: Aids to navigation exclusive of Class I located in waters used by general navigation.

Class III: Aids to navigation exclusive of Class I located in waters not ordinarily used by general navigation.

(b) Upon approval by the District Commander, a signed copy of the application will be returned to the applicant. Approval for the operation of radar beacons (racons) will be effective for an initial two year period, then subject to annual review without further submission required of the owner.

§ 66.01-20 Inspection.

All classes of private aids to navigation shall be maintained in proper operating condition. They are subject to inspection by the Coast Guard at any time and without prior notice.

§ 66.01-25 Discontinuance and removal.

(a) No person, public body or instrumentality shall change, move or discontinue any authorized private aid to navigation required by statute or regulation (Class I, § 66.01-15) without first obtaining permission to do so from the District Commander.

(b) Any authorized private aid to navigation not required by statute or regulation (Classes II and III, § 66.01-15) may be discontinued and removed by the owner after 30 days' notice to the District Commander to whom the original request for authorization for establishment of the aid was submitted.

(c) Private aids to navigation which have been authorized pursuant to this part shall be discontinued and removed without expense to the United States by the person, public body or instrumentality establishing or maintaining such aids when so directed by the District Commander.

§ 66.01-30 Corps of Engineers' approval.

(a) Before any private aid to navigation consisting of a fixed structure is placed in the navigable waters of the United States, authorization to erect such structure shall first be obtained from the District Engineer, U.S. Army Corps of Engineers in whose district the aid will be located.

(b) The application to establish any private aid to navigation consisting of a fixed structure shall show evidence of the required permit having been issued by the Corps of Engineers.

§ 66.01-40 Exemptions.

(a) Nothing in the preceding sections of this subpart shall be construed to interfere with or nullify the requirements of existing laws and regulations pertaining to the marking of structures, vessels and other obstructions sunken in waters subject to the jurisdiction of the United States (Part 64 of this subchapter), the marking of artificial islands and structures which are erected on or over the seabed and subsoil of the Outer Continental Shelf (Part 67 of this subchapter), or the lighting of bridges over navigable waters of the United States (Subchapter J of this subchapter).

(b) Persons marking bridges pursuant to Subchapter J of this title are exempted from the provisions of § 66.01-5.

§ 66.01-45 Penalties.

Any person, public body or instrumentality, excluding the armed forces, who shall establish, erect or maintain any aid to maritime navigation without first obtaining authority to do so from the Coast Guard, with the exception of those established in accordance with § 64.11 of this chapter, or who shall violate the regulations relative thereto issued in this part, is subject to the provisions of 14 U.S.C. 83.

§ 66.01-50 Protection of private aids to navigation.

Private aids to navigation lawfully maintained under these regulations are entitled to the same protection against interference or obstruction as is afforded by law to Coast Guard aids to navigation (Part 70 of this subchapter). If interference or obstruction occurs, a prompt report containing all the evidence available should be made to the Commander of the Coast Guard District in which the aids are located.

§ 66.01-55 Transfer of ownership.

(a) When any private aid to navigation authorized by the District Commander, or the essential real estate or facility with which the aid is associated, is sold or transferred, both parties to the transaction shall submit application (§66.01-5) to the Commander of the Coast Guard District in which the aid is located requesting authority to transfer responsibility for maintenance of the aid.

(b) The party relinquishing responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the discontinuance and the change of ownership of the aid sold or transferred.

(c) The party accepting responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the establishment and the change of ownership of the aid sold or transferred.

(d) In the event the new owner of the essential real estate or facility with which the aid is associated refuses to accept responsibility for maintenance of the aid, the former owner shall be required to remove the aid without expense to the United States. This requirement shall not apply in the case of any authorized private aid to navigation required by statute or regulation (Class I, § 66.01-15) which shall be maintained by the new owner until the conditions which made the aid necessary have been eliminated.

Attachment F

Notice to Navigation Interests

NOTICE TO NAVIGATION INTERESTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

OVERVIEW

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area is located at 33° 59' 40.59" North, 81° 02' 56.80" West, as shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and subject to permits and approvals from the U.S. Army Corps of Engineers (USACE), SCDHEC and other agencies.

The overall objective of this project is to place a physical barrier in the form of an engineered capping system over the impacted sediment within the Congaree River. The cap will consist of a geotextile fabric material overlain by articulated 8-inch thick concrete blocks (ACBs) connected together to form a mat. It is currently envisioned that the ACBs will be placed from approximately the 116-foot elevation line and will extend westward, out into the river from approximately 50 to 200 feet, depending on the location. The precise location, orientation, placement techniques and construction/deployment sequence will be at the discretion of the construction contractor and will likely be dictated by actual field conditions encountered during construction. With an average river flow elevation for the general project area over the last five years of approximately 116.5 foot, most of the ACBs will be placed below normal river flow elevations, except for the erosion prevention area on the boat ramp. The openings in the ACBs, also referred to as cores or cells, will be visible through the water, at low water levels. Even with the underlying geotextile material, it is anticipated that the capping system will settle a few inches into the soft sediment. It is also anticipated that the open cells within the ACB mats will fill with clean sediment [from the top] over time and result in a more natural looking surface.

The actual project area is relatively small in comparison to the overall width of the river and at least half of the river's width will be available for continued navigation or other activities during construction of the cap. The attached Figure 2 shows the planned restricted area and the area that will remain available for navigation during completion of project. The cap installation process is expected to take approximately seven months and will begin in the spring of 2018.

Navigation Signage, Lighting and Signals

Prior to initiation of sediment cap construction activities, warning signs will be placed upriver and downriver of the project area in the approximate locations shown on Figure 2. The final locations of the signs will be determined in the field and based on existing conditions. The signs will be located in areas that are readily visible from the water. The warning signs will be approximately 4 feet by 4 feet and state "Warning - River Construction Zone Ahead". The signs will be bolted to metal posts and attached to a weighted base and secured in-place with concrete blocks or boulders.

Information buoys (white with an orange band) will be placed approximately 20 feet away from the outboard of the construction area as an aid to alert river users to the presence of the rock dam. The buoys will be marked with a danger symbol that specifies the presence of the dam. The buoys will direct both downstream and upstream traffic away from the active construction zone. They will be relocated as necessary as the project progresses.

Marine-application lights will also be positioned above the top of the warning signs to help identify the perimeter of the construction area in the unlikely event that boating traffic is in the area during nighttime or low-light conditions. As part of the aids to navigation, solar powered, LED lights with signs will be placed on along the riverside perimeter of the construction area. The lights will have a standard flash rate of 60 flashes per minute (FPM) and will be visible for 1 mile, under clear conditions. At a minimum, 10 lights will be placed for each phase of construction. The operating period for lights is between sunset and sunrise.

Finally, “Restricted Area” signs will be positioned at regular intervals along outboard edge of the construction area to alert river users of the need to stay away from the active construction zone. No unauthorized access to river or adjacent landside support zone will be permitted.

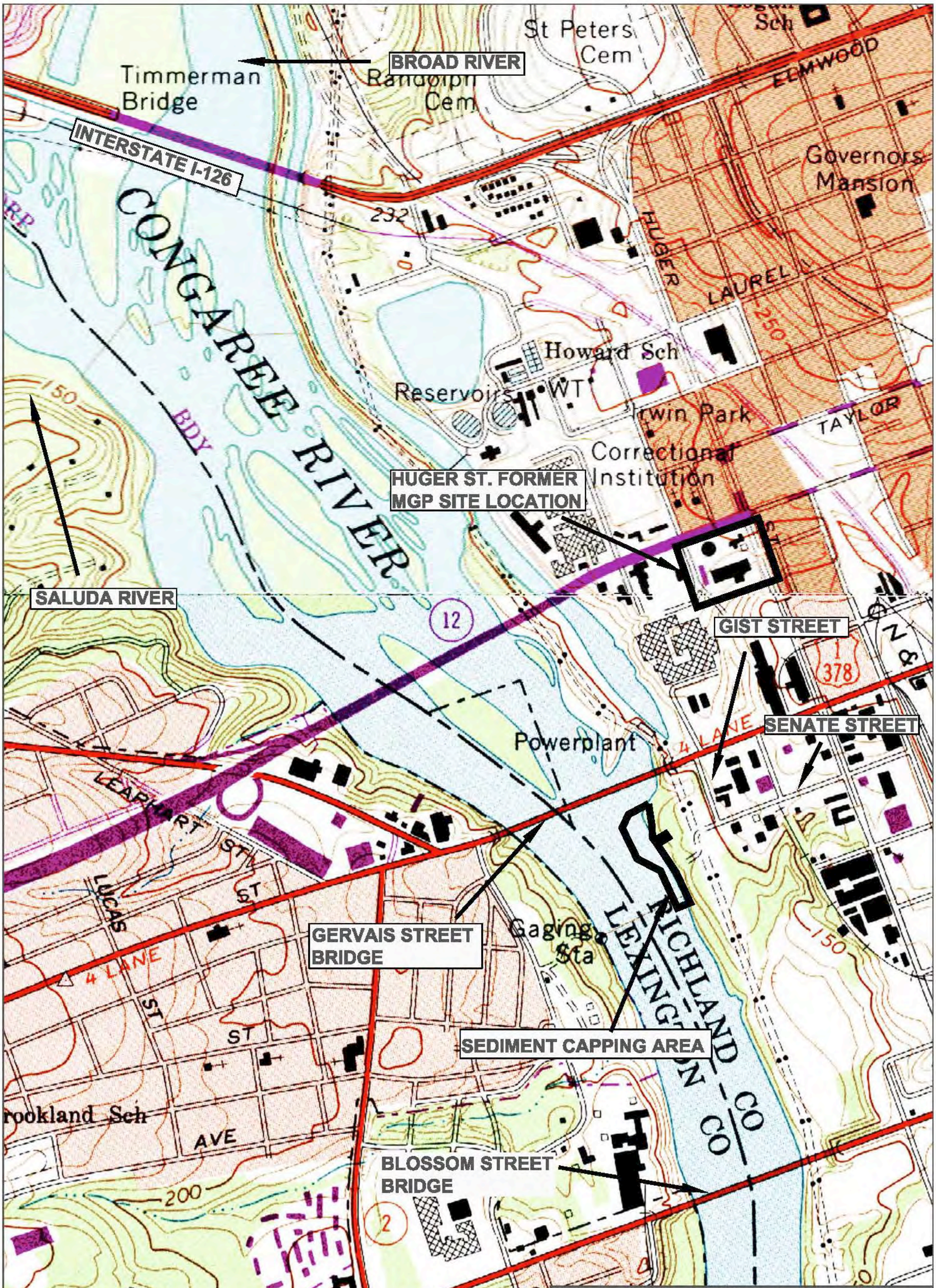


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

FIGURE 2

SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PRIVATE AIDS TO NAVIGATION
PROPOSED LOCATIONS FOR PHASE 2

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/17 FILE NAME: CONG462

APEX COMPANIES, LLC

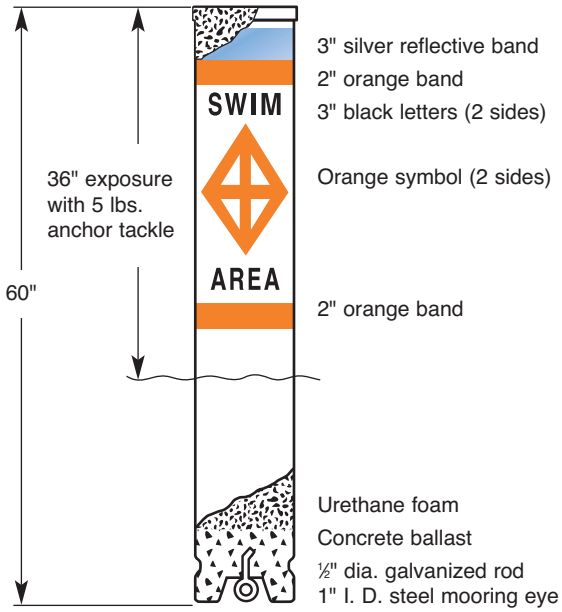
Attachment H

Example Buoy Specifications and Solar Powered Nautical Lights

Regulatory Buoys • ABS type – 9" Dia.

Approved and universally used by local, state and federal agencies to ensure water safety. Ideal for private applications.

UNSINKABLE — filled with urethane foam



Specify desired symbols and messages when ordering.

Submerged buoyancy	84 lbs.
Net weight	49 lbs.
Shipping weight	56 lbs.

Refer to installation suggestions on page 21.
See warranty information on back cover.

Model B1147R

Features

- Easy reconditioning of weather-worn buoys with excellent adhesion of restoration materials. See page 18.
- 9" diameter, white, ABS plastic exterior. Will not rust, chip or peel. Ultraviolet inhibited.
- Completely urethane foam filled. Virtually unsinkable.
- 3"-wide reflective band at top provides excellent nighttime visibility.
- Self-righting without tackle.
- Recessed cap allows buoy to stand upright.
- Heavy steel galvanized anchoring eye cast in an internal concrete ballast.
- Includes choice of standard symbols and messages.

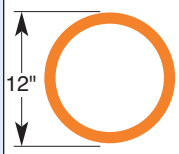
Available Options

- Pickup eye built into top.
- Stainless steel anchoring eye for salt water applications.
- Agency or name identification.
- Cone cap top.
- Special non-standard messages.
- Solar lights (see page 11).
- Available in yellow.
- Side mooring eyes for swim areas, float lines.

STANDARD INLAND WATERWAY SYMBOLS AND MESSAGES

Special messages are available. Request a quotation.

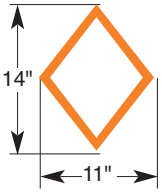
CONTROLLED AREA SYMBOL



2" band width

STANDARD MESSAGES
SLOW 5 MPH
SLOW NO WAKE
SKI AREA
NO SKI
SLOW 10 MPH
SPEED ZONE
NO WAKE IDLE SPEED

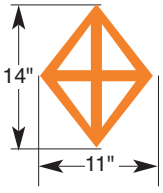
HAZARD WARNING SYMBOL



2" band width

STANDARD MESSAGES
ROCK
DANGER
RAPIDS
SHOAL
STUMP
SHALLOW AREA
HAZARD AREA
DANGER DAM

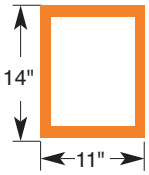
RESTRICTED AREA SYMBOL



2" band width

STANDARD MESSAGES
SWIM AREA
KEEP OUT
NO BOATS
BOATS KEEP OUT
CLOSED AREA
NO BOATING
DANGER DAM

INFORMATION SYMBOL



2" band width

STANDARD MESSAGES
REST ROOM 1 MILE
STATE PARK AHEAD
MARINA ENTRANCE
FISH ATTRACTOR

PERMAFLEX® CABLE

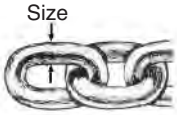
Lightweight
High strength
Safe to handle
Tough, durable, bright yellow, waterproof plastic covering is highly resistant to alkalis and salt

Covering O.D.	Part No.	Cable Dia.	Construction ①	Weight Lb./Ft.	Breaking Strength Lbs.	Standard Reel Size②	Reel Wt. Lbs.
5/32"	B1934	1/8"	7 x 7	.028	920	1000'	28
1/4"	B1936	3/16"	7 x 7	.065	3700	500'	37
5/16"	B1931	1/4"	7 x 7	.12	6100	500'	60
15/32"	B1933	3/8"	7 x 19	.28	14400	500'	180

Permaflex Cable – Galvanized steel wire rope coated & Impregnated with yellow polypropylene plastic.

CHAIN

Size



	Size	Part No.	Weight Lb./Ft.	Working Load Limit Lbs.	Standard Drum Size①
Proof Coil Heavy Duty	1/4"	B1828	.42	1300	400'
Steel Chain	3/8"	B1829	1.36	2650	200'
Hot Dipped Galv.	1/2"	B18210	2.3	4500	100'

NOTES: ① Chain may also be purchased by the foot. Subject to cut charge.

GALVANIZED HARDWARE

CABLE THIMBLES
Standard
Electro Galvanized

Heavy Duty
Hot Dipped Galvanized

Size	Part No.	Weight Lb./Ft.
3/16"	B2311	.03
1/4"	B2312	.04
5/16"	B2313	.05
1/2"	B2316	.15
1/4"	B2324	.08
5/16"	B2321	.11
1/2"	B2323	.47

CABLE CLAMPS
Standard
Electro Galvanized

Heavy Duty
Hot Dipped Galvanized

3/16"	B1831	.2
1/4"	B1832	.3
5/16"	B1833	.4
1/2"	B1835	.5
3/16"	B2331	.11
1/4"	B2332	.16
5/16"	B2333	.28
1/2"	B2335	.82

CONNECTING LINKS
Electro Galvanized

1/4"	B1891	.10
3/8"	B1892	.25
1/2"	B1893	.54

QUICK LINKS
Electro Galvanized

1/4"	B1801	.10
3/8"	B1803	.19
1/2"	B1804	.38

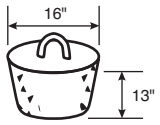
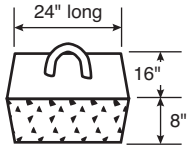
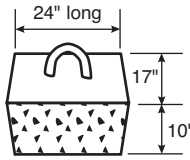
ANCHOR SHACKLES
Hot Dipped Galvanized

5/16"	B1900	.25
3/8"	B1901	.30
1/2"	B1902	.75

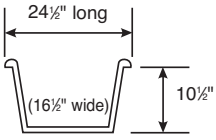
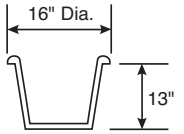
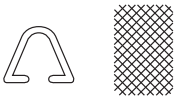
SWIVELS
Hot Dipped Galvanized

1/4"	B1921	.21
3/8"	B1922	.61
1/2"	B1923	.93

ANCHORS

ANCHORS CONCRETE	Avg. Wt. Lbs.	Under-water Wt. Lbs.
 B1842 ½" Round Steel Eye Hot Dipped Galvanized	90	54
 B21620 ½" Round Steel Eye Hot Dipped Galvanized	200	164
 B2152 ½" Round Steel Eye Hot Dipped Galvanized	300	180

ANCHOR KITS

	**B2161** Tough, high-density polyethylene anchor form. Cast up to 300 lb. concrete anchors.
	**B2163** Plastic anchor form for 90 lb. concrete anchors.
	**B2162** 1/2" Steel anchor eye and steel wire mesh.

Stainless steel hardware available.
Call for pricing.

Warning and Portage Signs

Bold black message on white reflective background with orange border. .080" aluminum base material. Excellent visibility, day and night.

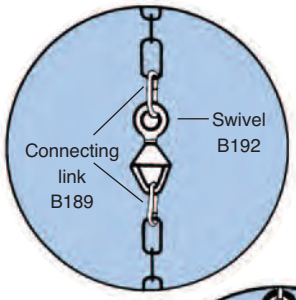
DAM	
SIZE (IN.)	PART NO.
24 x 24	B2011
30 x 30	B2021
36 x 36	B2031
48 x 48	B2211

THIN ICE	
24 x 24	B2013
30 x 30	B2023
36 x 36	B2033
48 x 48	B2213

SLOW NO WAKE	
SIZE (IN.)	PART NO.
24	B22258
30	B22259
36	B22260

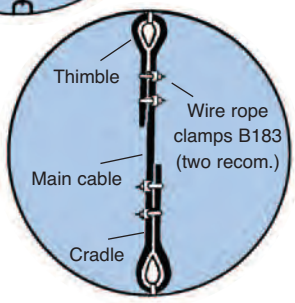
TAKE OUT		
SIZE (IN.)	PART NO.	RIGHT ARROW
24 x 24	B2012L	B2012R
30 x 30	B2022L	B2022R
36 x 36	B2032L	B2032R
48 x 48	B2212L	B2212R

Mooring Suggestions



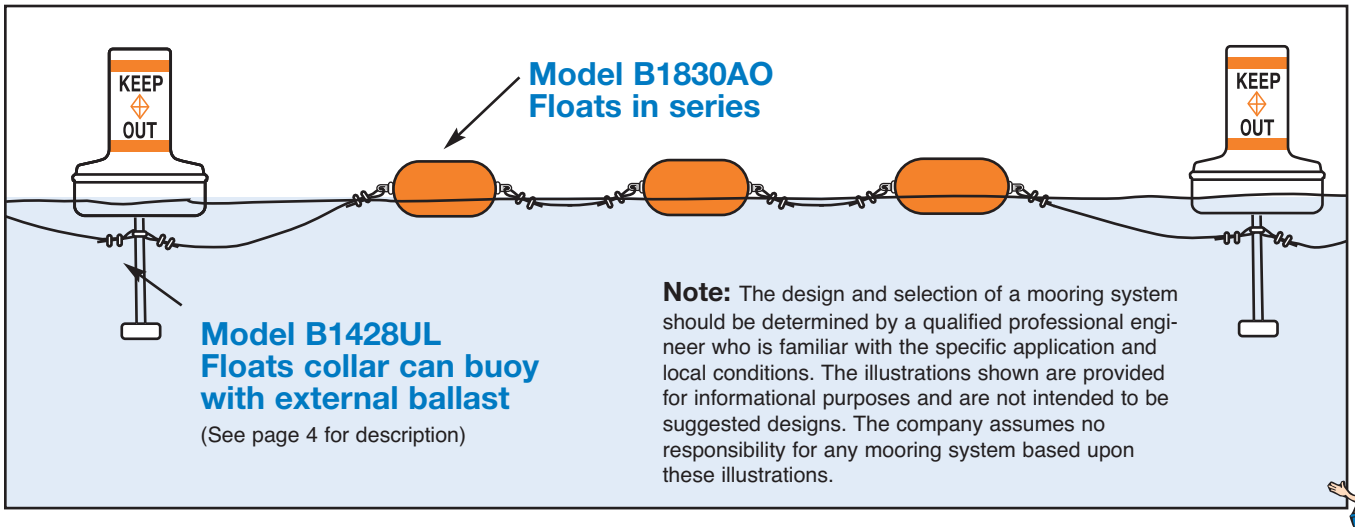
Use swivels to cut chain wear and increase buoy performance. Wind, wave, and current action causes buoys to rotate. This rotation, if severe, can cause chain or cable to twist, which will eventually submerge the buoy, increase chain wear, and increase the load on the anchor.

NOTE - The design and selection of a mooring system should be determined by a qualified professional engineer who is familiar with the specific application and local conditions. The illustrations shown are provided for informational purposes and are not intended to be suggested designs. The company assumes no responsibility for any mooring system based upon these illustrations.



Correct cable clamp assembly. Note from the sketch that the cradle is tightened against main cable. This is the correct assembly method to insure against the clamps, slipping while in service. Be sure to tighten nuts down, alternating from side to side frequently. Thimbles should be assembled so they are firmly trapped within the cable loop.

Typical Barrier Float System



Note: The design and selection of a mooring system should be determined by a qualified professional engineer who is familiar with the specific application and local conditions. The illustrations shown are provided for informational purposes and are not intended to be suggested designs. The company assumes no responsibility for any mooring system based upon these illustrations.

Attachment H

Recent Correspondence

-----Original Message-----
From: Megan.L.Cull@uscg.mil [mailto:Megan.L.Cull@uscg.mil]
Sent: Tuesday, December 24, 2013 12:28 PM
To: James Dunmyre
Cc: HQS-PF-fldr-CG-NAV; TIS-PF-NISWS
Subject: FW: ***For Action*** 2013-1153 - Inquiry Regarding Navigation

Greetings Sir -
We do not understand your question. Are you asking how the cofferdam should be marked while in place so that mariners are aware of it and act appropriately around it? What is the general location for the intended cofferdam? Coast Guard District offices oversee the aids to navigation system within their area of responsibility so they are probably the person you should discuss this with, but more information might help us discern that.

We hope this answers your inquiry and we exhort you to always navigate safely,

U.S. Coast Guard
Office of Navigation Systems
Washington, DC 20593-7851

1. Subject: Navigation
2. Name: James Dunmyre
3. Telephone number: 412-829-9650
4. Email Address: jdunmyre@apexcos.com
5. IP Address: 50.199.183.109
6. Comments or Questions:
I have a question in regards to potential temporary cofferdam construction and providing the correct information for a navigation plan while the cofferdam is constructed. I was unable to find any examples of plans online. I did although find the US aids to navigation but I was in search of an actual plan itself for example. Thanks

Mail Sent from Web Server: 12/23/2013 02:38:56

James Dunmyre

From: James Dunmyre

Sent: Friday, January 03, 2014 2:35 PM

To: 'andrew.m.engle@uscg.mil'

Subject: Columbia, South Carolina Project

Mr. Mark Engle,

Provided in this email is a link to the Army Corps Of Engineers, Public Notice for the project we discussed on Tuesday, December 31, 2013. I do believe we discussed that the Army Corps requested additional information regarding a navigation plan as a response to comments.

http://www.sac.usace.army.mil/Portals/43/docs/regulatory/publicnotices/SAC-2011-01356-6_Richland_congaree_river_remediaion.pdf

I will provide you with additional information in a separate email if required.

Thank You,

APEX
apexcos.com

James Dunmyre
Environmental Scientist
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085
O) 412-829-9850

MTR is now a subsidiary of Apex Companies, LLC. Click here to learn more about Apex.

Follow Apex on and Like us on

James Dunmyre

From: James Dunmyre
Sent: Monday, January 06, 2014 12:22 PM
To: 'andrew.m.engle@uscg.mil'
Subject: Additional information - Columbia South Carolina
Attachments: Summary to the Coast Guard.pdf

Mr. Engle,

Please find attached additional information pertaining to our project located on the Congaree River, Columbia, South Carolina. Included in the attachment is a brief summary of the project details and drawings for location and phase information.

If you require anything else please let me know.

APEX
apexcos.com

James Dunmyre
Environmental Scientist
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085
O) 412-829-9650

MTR is now a subsidiary of Apex Companies, LLC. Click here to learn more about Apex.

Follow Apex on and Like us on

APPENDIX P

TRAFFIC CONTROL PLAN

TRAFFIC CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

TRAFFIC CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach site operations scenario.

Since the capping project will be a relatively low impact activity, it is not expected to increase traffic significantly in the area surrounding the site. The majority of the project-related truck movements will be associated with transporting the capping materials to the site. The capping materials consist of articulated concrete blocks that are connected together to form an articulating mat. They are typically transported via flat-bed tractor trailer. It is likely that less than 10 deliveries of articulated mats will occur on a given day during completion of the project. The remaining truck movements will consist of bringing equipment on-site during mobilization or transporting equipment off-site during demobilization. These truck movements will be sporadic and infrequent. SCE&G intends to ensure that the necessary truck movements associated with the project are completed with as minimal of an impact to the surrounding area as practical. This Traffic Control Plan presents the proposed methodology for development of the truck routes into and away from the project area and for monitoring of driver compliance during completion of the project.

SITE OPERATIONS AND TRAFFIC PATTERNS

A site entrance at the corner of Senate and Gist Streets will be the sole entry and exit point for the site activities. Figure 2 shows the current site operations scenario, and the entry/exit gate at the corner of Senate and Gist Streets. The landside support zone will consist of a series of gravel roads and equipment/material lay down areas and site office trailers. Throughout completion of the project, only authorized remediation personnel will be allowed access to the work areas during the source removal activities and on-site traffic patterns will be restricted to the site roads. An off-site staging area for the sediment cap material trucks may be utilized if on-site storage space is not adequate to store a complete shipment of concrete mats. This off-site storage area may be located at either the SCE&G Huger Street site or another SCE&G owned location.

All site vehicles will maintain safe-operating speeds at all times. The site roads are anticipated to be wide enough to accommodate trucks passing each other in opposite directions. Spotters and/or flagmen will be utilized, as required, to maintain safe traffic flow on-site.

TRAFFIC CONTROL PLAN

As previously stated, project-related traffic is anticipated to be minimal and sporadic in nature. However, it will still be critical to adequately control the flow of tractor-trailer and tri-axle trucks into and out of the general site vicinity in order to minimize the impact on the surrounding community. The following specific routes were developed through consultation with local officials (police, fire department, public works, government personnel, etc.). All routes will be verified prior to commencement of the project and will be modified, if necessary, to account for changing traffic patterns or input from local residents/officials, etc. Each truck driver will be informed of the prescribed routes for site entry and exit and an effort will be made to utilize regular drivers who are familiar with these routes. All site-related vehicles will follow the specific routes and project oversight personnel will conduct periodic monitoring of truck movements to ensure compliance with the Traffic Control Plan. Any identified deviation from the prescribed route will be immediately corrected.

Incoming and Outgoing Traffic

General incoming and outgoing traffic patterns are presented on Figures 3 and 4, respectively. All incoming traffic will enter the site by turning right onto Senate Street from the southbound lanes of Huger Street and proceed straight into the site entrance. Similarly, outgoing traffic will exit the site entrance and proceed straight on Senate Street and make a right onto Huger Street to leave the general area. Staging of trucks on Senate or Gist Streets will be forbidden and strictly enforced throughout the project. Deliveries will be scheduled so that no backup occurs on Senate or Gist Streets and the off-site staging area will be utilized as an overflow lot in the unlikely scenario that too many trucks are scheduled.

As shown on Figure 3, if site-related traffic is entering the area by traveling eastbound over the Gervais Street Bridge, it will be directed to continue on Gervais Street, past the turn for Gist Street, and to make a right on to Huger Street and then a second right on to Senate Street so as to maintain a consistent traffic pattern into and away from the site.

These routes will ensure that trucks carry site-related materials do no cross oncoming lanes in order to enter or exit the site and that they do not pass in front of the condominiums that are located along Gist Street. Prescribed traffic patterns have been successfully utilized by SCE&G at many sites with significant numbers of truck movements, including the Huger Street remediation project that required approximately 27,000 truck movements to complete.

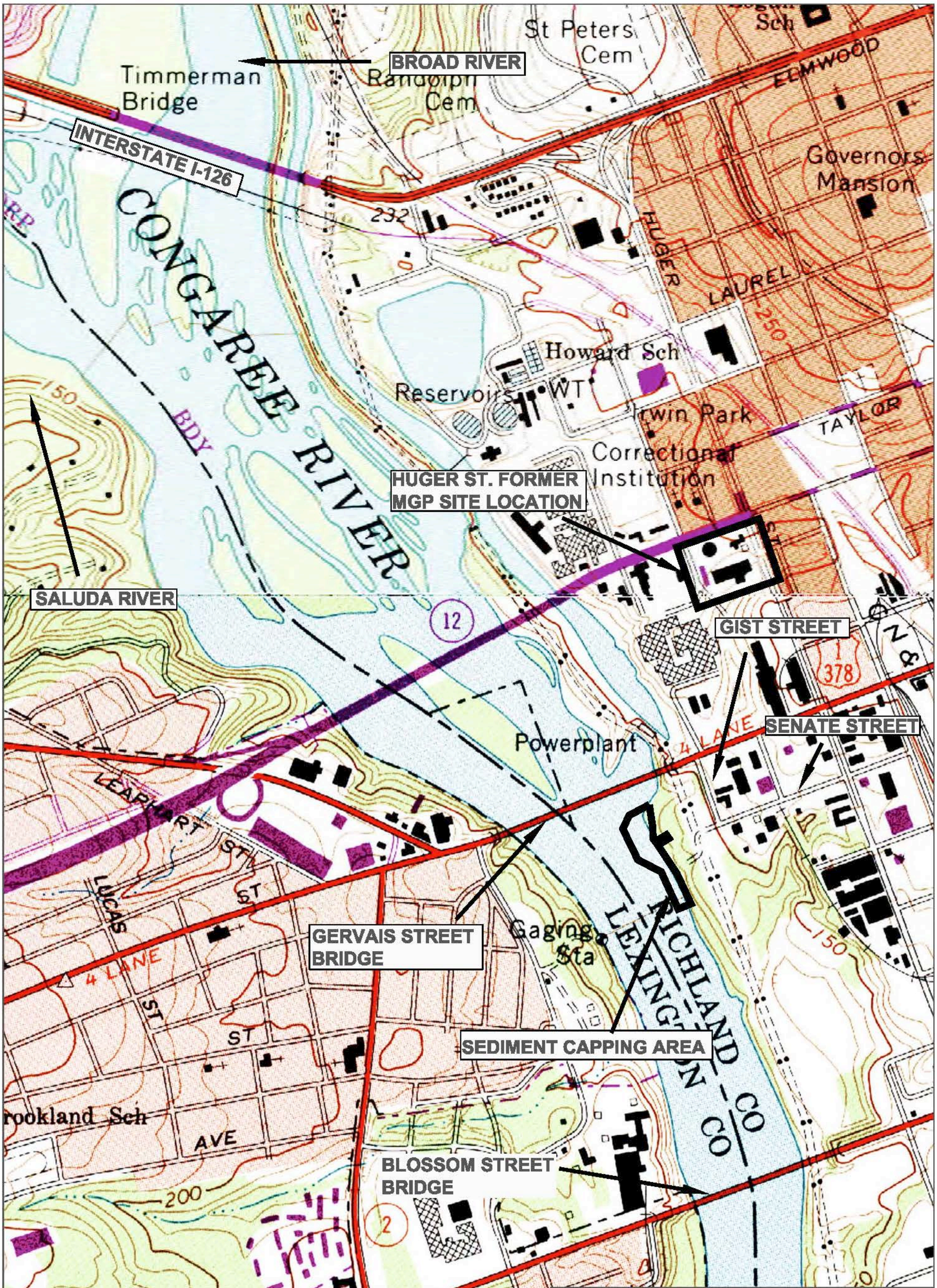


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

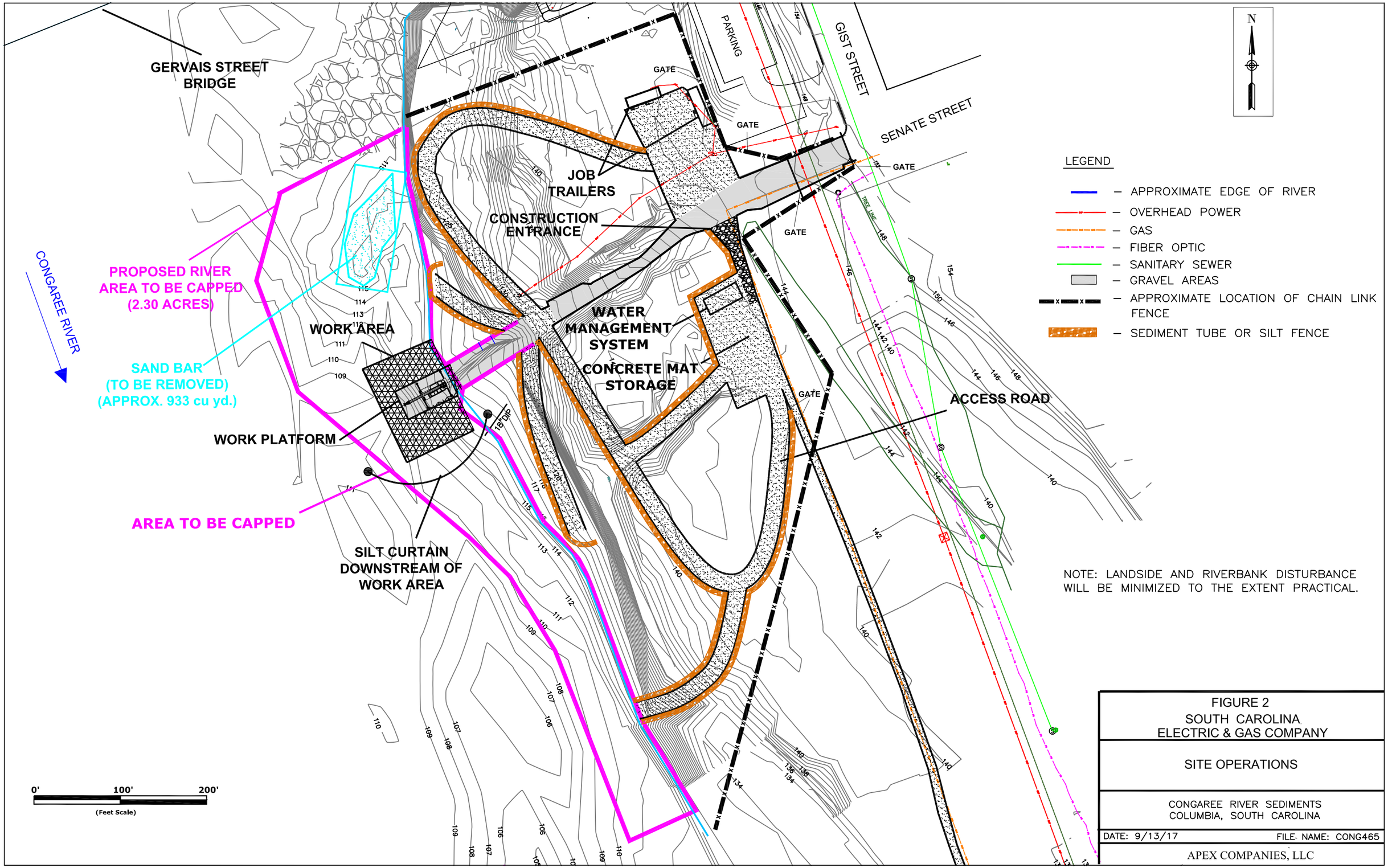


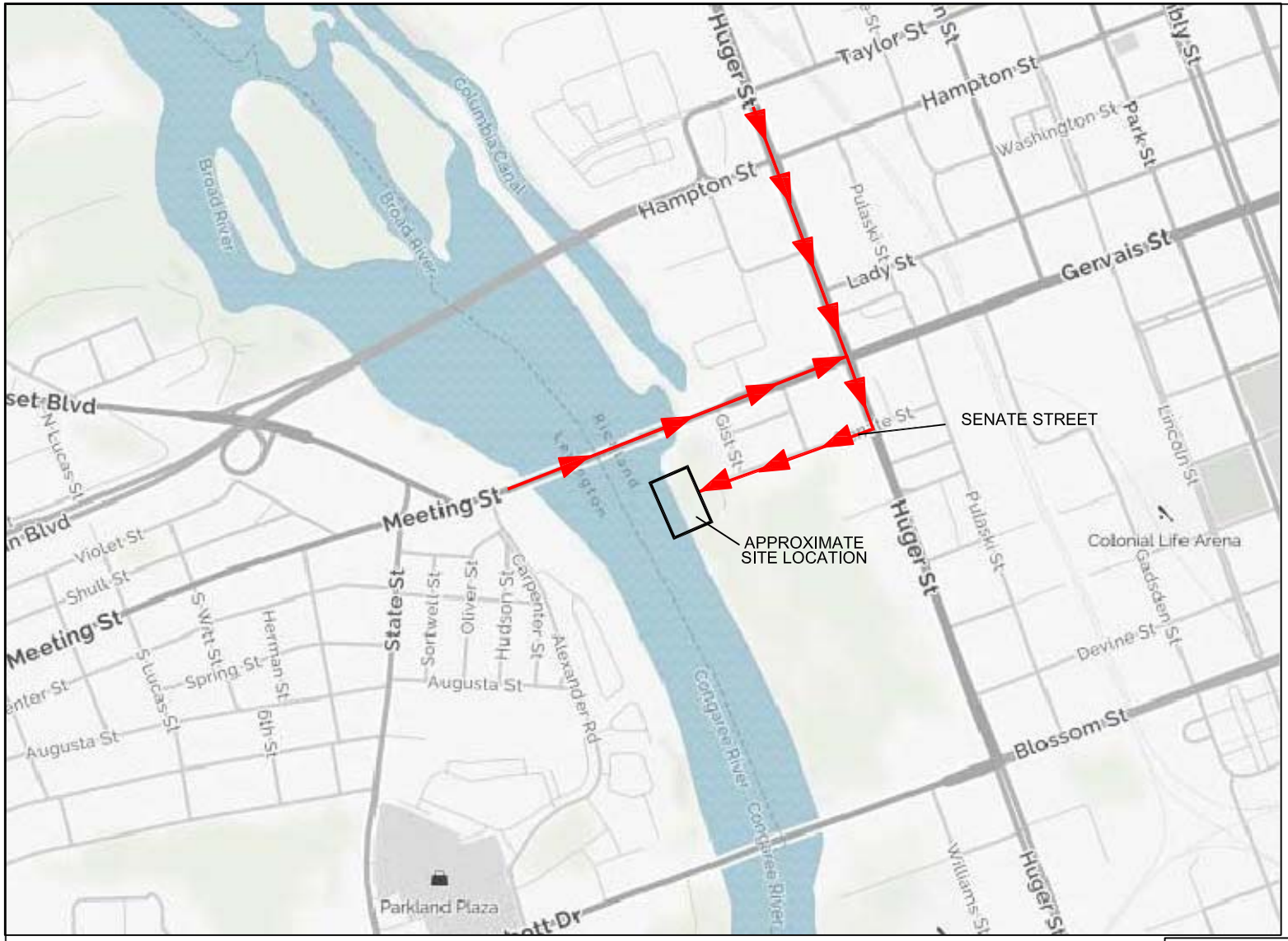
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/13/17 FILE NAME: CONG465

APEX COMPANIES, LLC



INCOMING TRUCK ROUTE

1. INCOMING TRAFFIC FROM HUGER STREET WILL TURN RIGHT ONTO SENATE STREET AND FOLLOW SENATE INTO THE SITE.
2. INCOMING TRAFFIC FROM MEETING STREET ONTO THE GERVAIS STREET BRIDGE WILL TURN RIGHT ONTO HUGER STREET THEN RIGHT ONTO SENATE AND FOLLOW SENATE INTO THE SITE.

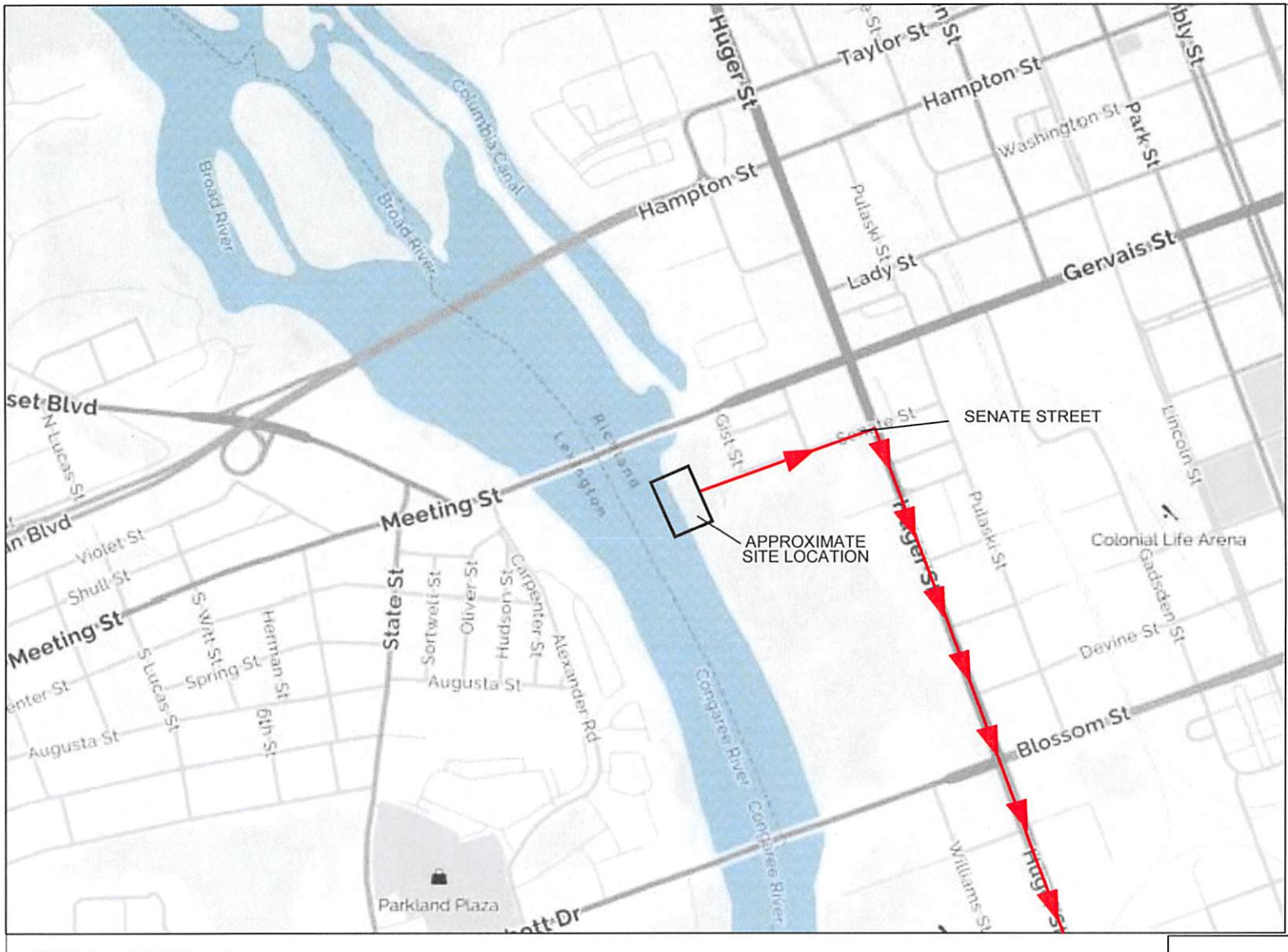
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

INCOMING ROUTE TO THE
PROJECT SITE

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/27/17 FILE NAME: CONG424

APEX COMPANIES, LLC



INCOMING TRUCK ROUTE

1. OUTGOING TRAFFIC WILL TRAVEL ON SENATE STREET AND TURN RIGHT ONTO HUGER STREET.

FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

OUTGOING ROUTE FROM THE
PROJECT SITE

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/27/17 FILE NAME: CONG423

APEX COMPANIES, LLC

APPENDIX Q

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2017

Prepared for:

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COMMUNITY AIR MONITORING AND
ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will greatly reduce the potential for human health exposure by serving to prevent direct contact with the TLM material in the near-shore, more-accessible areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach.

To ensure the safety of on-site workers and the local community, a comprehensive environmental site air-monitoring and odor/dust control program will be implemented during the project. SCE&G has successfully completed numerous former MGP remediation projects and has developed a reliable and effective system for eliminating the potential for remediation worker and/or community exposure to the chemicals of concern originating from the coal tar impacted material. Dust is also a typical concern with former MGP site remediation projects. However, for the Congaree River Sediment Project, dust emanating from impacted material is not expected be a concern since excavation operations will be limited to removal of the sand bar (Figure 2), which is not anticipated to be impacted, and will be very wet when removed. SCE&G will have dust control capabilities on-site and will utilize them throughout the project to control dust from site roads and on-site vehicle/equipment traffic.

The primary components of the air monitoring program include real-time work area and perimeter air monitoring (during intrusive activities) and implementation of dust and odor control measures, as needed. Since this is a sediment capping project, disturbance of the sediment and TLM is expected to be minimal, which limits the need for air monitoring. As currently planned, removal of the sand bar and limited excavation and grading to construct access points along the shoreline are the only activities where potential disturbance of TLM could occur. Air monitoring will be conducted during these activities and during any other intrusive activities that may have the potential to disturb the TLM. Placement of the engineered capping material or other site-related activities are not considered intrusive activities and air monitoring in the work area or at the site perimeter during these operations is not anticipated.

As stated above, there are two basic objectives of the air monitoring program:

- Protection of the on-site remediation worker; and
- Protection of the surrounding community.

This Plan describes the community air monitoring portion of the program in detail. The on-site remediation worker air monitoring program is described briefly in this document and the details are included in the Health and Safety Plan (HASP) for the project.

ON-SITE REMEDIATION WORKER AIR MONITORING

Based on regulatory requirements and SCE&G's commitment to health and safety, a HASP was prepared and will be implemented to protect the health and well-being of the on-site remediation workers. In summary, the HASP specifically addresses:

- The potential hazards associated with completing the work;
- The primary chemicals of concern that site workers may be exposed to; and
- The safety measures, precautions and personal protective equipment (PPE) to be used by the on-site workers.

A concern addressed by the HASP is the air-monitoring activities that will be completed during active excavation and material handling activities. Numerous procedures and techniques have been developed and will be implemented to minimize exposure to the on-site workers at the point of excavation and subsequently while handling and screening the TLM-impacted sediment.

It is important to note that air monitoring within the active work zones at other previously completed MGP projects has not identified sustained elevated air monitoring readings and SCE&G does not anticipate that this project will produce sustained elevated readings in the work zone. Furthermore, in the areas where intrusive activities are expected to occur during completion of this project, little to no TLM impacts were observed during the prior investigation/delineation phase of the project.

Figure 3 provides the currently planned site operations scenario, which includes the planned sand bar removal area. This will be the primary location for the work area air monitoring activities. During intrusive activities, periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation worker likely to have the highest exposure. These readings will be compared to the established action levels found in the HASP. Guidelines for specific project-related activities that require air monitoring and the subsequent frequency of air monitoring are also presented in the HASP.

Volatile organic compounds (VOCs) associated with the constituents found in the TLM and dust/particulates will be the primary focus of the air monitoring program for this project. A photo-ionization detector (PID) and a particulate (dust) meter will be the instruments used to collect the periodic real-time measurements in the breathing zone in locations where impacted material is being handled. Examples of the instruments typically utilized for similar projects are provided in Attachment A. If sustained VOC readings are identified using a PID, additional air monitoring using constituent-specific detector tubes, as specified in the HASP, will be conducted. Engineering controls such as the use of tarps or other such

means to encapsulate the impacted material and limit the potential for volatilization will be implemented should conditions warrant. Visual indications of dusty conditions will necessitate dust mitigation measures and water sprays will be utilized to control dust.

The remainder of this Plan describes the community air-monitoring program.

COMMUNITY AIR MONITORING & ODOR/DUST CONTROL PLAN

SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at other SCE&G MGP remediation sites, and it successfully confirmed the absence of elevated concentrations during completion of these projects.

This Community Air Monitoring and Odor/Dust Control Plan was developed to specifically identify measures that will be implemented to assure minimal impacts to the local residents and the surrounding community while completing the Congaree River Sediment Project. There are two primary elements of this plan that consist of:

- Conducting perimeter air-monitoring activities in the vicinity of Senate and Gist Streets during intrusive activities; and
- Implementing counter measures should the air monitoring activities warrant such mitigation activities.

SCE&G's objective for this plan is to measure air quality concentrations at the perimeter of the project area during intrusive activities to be protective of human health and confirm that there are no exceedances of any applicable air quality standards. The approach to achieving this objective is rather straight forward, as described below.

Perimeter Air Monitoring

Attachment B provides information on the predominant wind direction and wind speed for the Columbia Owens, SC weather station located approximately 3.5 miles southeast of the site. This weather station documents a predominant northeast to southwest wind direction. This approximate wind direction is also shown on Figure 3. With the prevailing wind direction blowing across the site from the northeast to the southwest, the downwind perimeter of the site would most often be the southeast corner, which is the Congaree River. Other than boaters utilizing this portion of the river on an infrequent basis, this perimeter location does not contain potential sensitive receptors. The primary location of potential sensitive receptors is the Senate and Gist Streets area and the Gervais Street Bridge. As a result, SCE&G has developed this perimeter air monitoring program to be protective of both the sensitive receptor areas and the downwind perimeter of the site, regardless of wind direction.

SCE&G will establish a number of air monitoring stations along the northern and eastern landside perimeter, as shown on Figure 3. These stations will house VOC and particulate air monitors whenever impacted material handling operations are being conducted, regardless of the predominant wind direction. A windsock or another device on-site will be used to determine the direction of the wind. Wind direction, weather conditions and perimeter monitoring locations will be noted in the field logbook. Two stations in

the Gist, Senate and Gervais Streets areas will be supplemented with one downwind station and one upwind (background station) that will be established on a daily basis (during impacted material handling). Implementation of this scenario will provide background data, downwind data and data directly adjacent to the Gervais Street Bridge and Senate and Gist Streets area.

During intrusive activities, the perimeter meters will conduct continuous real-time measurements of dust and organic compounds and will be set to record/log data at 15-minute intervals and to alarm at conservative action levels. The monitoring stations will be periodically inspected by site personnel and the data collected will be downloaded to the site computer and provided in the final report for the project. The data will also be available for review at any time.

For volatile organic vapors, the PIDs will have an audible alarm set at a 15-minute average concentration of 1 part per million (ppm). This conservative action level has been successfully utilized at other SCE&G sites. If the ambient air concentration of total organic vapors at the northern and eastern landside perimeter or the downwind perimeter of the work area exceeds 1 ppm above background for a 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level decreases (per instantaneous readings) below 1 ppm over background, work activities will resume with continued monitoring. If total organic vapor levels at the perimeter monitoring stations persist at levels in excess of 1 ppm over background, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions and monitoring continued until levels are reduced below 1 ppm and work activities can resume.

Similar to the VOC monitoring, the particulate monitoring will be performed at the perimeter locations during intrusive activities using real-time monitoring equipment (e.g., DataRam) capable of integrating readings over a period of 15 minutes (or less) and data logging the results. The monitors will be set to alarm at the conservative action level and will be periodically inspected by oversight personnel. In addition, fugitive dust migration will be visually assessed during work activities. If the perimeter particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be immediately employed. Work may continue with dust suppression techniques provided that downwind particulate levels do not exceed 150 $\mu g/m^3$ above the background level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped, and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 $\mu g/m^3$ of the background level and in preventing visible dust migration.

It is important to note that visual indications of dusty conditions will prompt dust control measures whether or not air monitoring is being conducted (i.e., non-intrusive activities are occurring) and/or no action levels are being exceeded. All loading and off-loading activities will be conducted with care to minimize the occurrence of particulate emissions. Also, water-resistant tarps will be used on all vehicles loaded at the site to minimize the production of particulates during transportation off-site. Site personnel will visually monitor for dust during equipment movement and windy conditions. Nuisance dust from truck movements (haul roads) may require management through the application of a water spray via a water truck. A

source of clean potable water will be obtained (most likely from a fire hydrant tap permit) and a water truck will be operated on-site to periodically dampen haul roads and other site areas exhibiting visible dust.

Air Monitor Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. A written record of all air monitoring equipment calibration and adjustment information will be maintained. Initially, the PID and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday when intrusive activities are scheduled to occur. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the field work. Calibration and/or zeroing will also be conducted during work hours, if a potential malfunction in the instrument is detected.

Odor Control

Odor control measures will be implemented, as needed, to ensure that site activities do not produce unsatisfactory odors at the site perimeter. Exposed impacted material, if encountered, will only be handled within the river excavation areas or within a properly lined staging area located a sufficient distance from the site perimeter. Plastic sheeting or tarps may be applied to cover impacted material and prevent or minimize fugitive odors. Additional control measures will be available on-site as a contingency measure during intrusive activities. These include the following two commercially available odor suppressant technologies, or equivalent:

- **Bio Solve® –** Bio Solve® is a biodegradable, water-based product that has the ability to encapsulate hydrocarbon VOC vapors. The product is mixed with water at a 3 to 5 percent concentration and can be applied with a variety of water application spray methods. Bio Solve® is not subject to breaches or drawdown (like some foam applications) that allow for re-volatilization, making it a preferred option in windy conditions or on sloped surfaces.
- **Odor Suppressant Foam –** Odor suppressant foam can provide immediate, localized control of odor emissions. The foam is produced by injection of air into a foam concentrate/water mixture using a pneumatic foam unit. The foam is applied via a hose to cover source areas, generally to a depth of 3 to 6 inches. Short-term foam (such as Rusmar AC-645) is recommended to control odors from active excavations and stockpiles. This foam may last between 12 to 16 hours but because it can degrade quickly in direct sunlight, frequent and liberal applications may be necessary. For longer-term odor suppression, such as over weekends, a long-term foam (such as Rusmar AC-904) should be used.

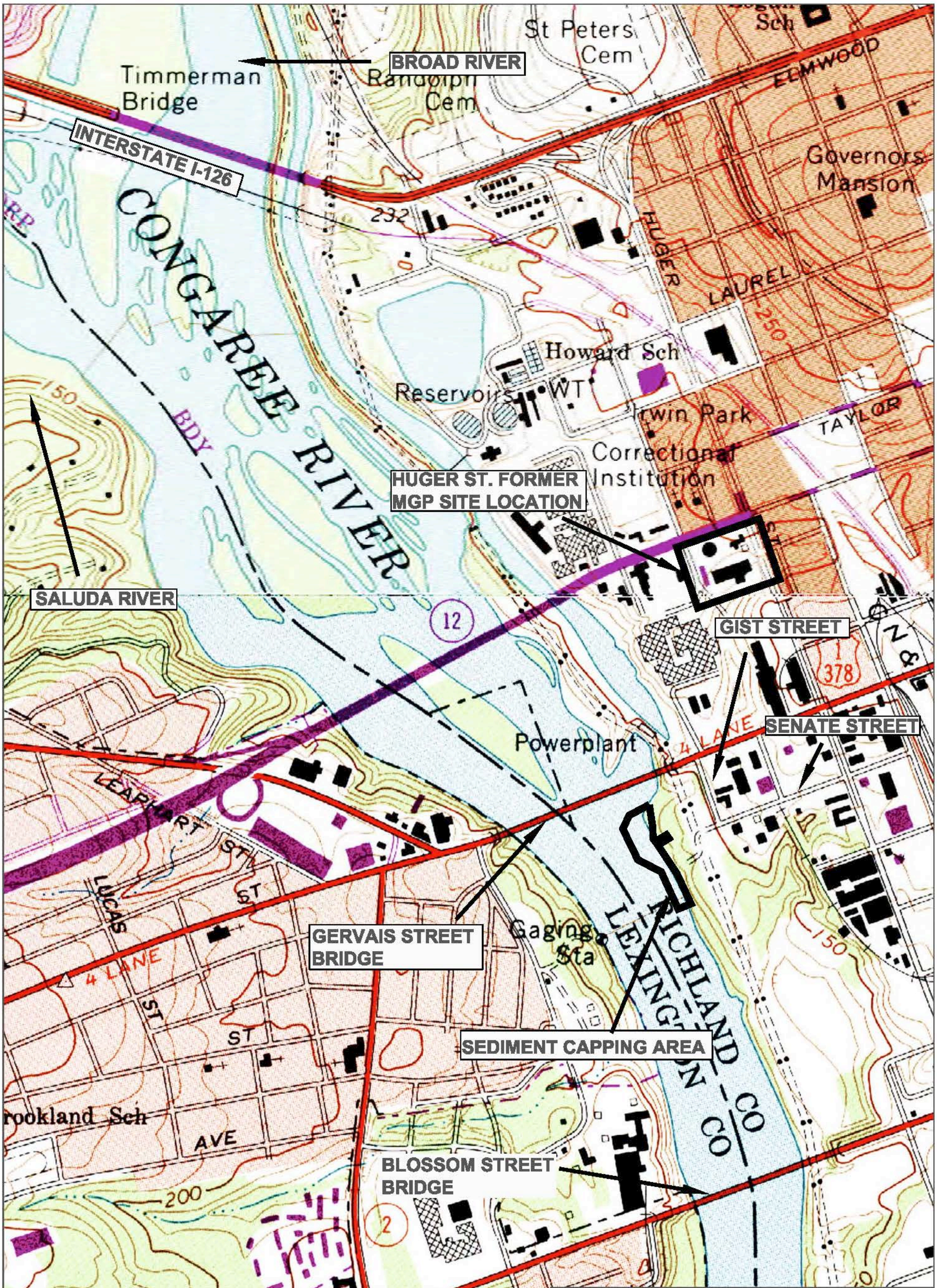


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

N

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

18"DIP

PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)

SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)

ACBs INSTALLED FOR EROSION CONTROL (APPROX. 6,000 sq ft)

CONGAREE RIVER

LEGEND

– APPROXIMATE EDGE OF RIVER

– APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.

– BATHYMETRIC LINE (FEET NAVD '88) – 2010

– ARTICULATED CONCRETE BLOCK MATS (ACBs)

0' 40' 80' 120' 160'

(Feet Scale)

FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION AND COMPONENTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 1/4/2017 FILE NAME: CONG404

APEX COMPANIES, LLC

GERVAIS STREET BRIDGE

CONGAREE RIVER

PROPOSED RIVER AREA TO BE CAPPED (2.30 ACRES)

SAND BAR (TO BE REMOVED) (APPROX. 933 cu yd.)

AREA TO BE CAPPED

WORK AREA

WORK PLATFORM

SILT CURTAIN DOWNSTREAM OF WORK AREA

JOB TRAILERS

CONSTRUCTION ENTRANCE

WATER MANAGEMENT SYSTEM

CONCRETE MAT STORAGE

PARKING

GIST STREET

SENATE STREET

ACCESS ROAD

GATE

18"DIP

TREE LINE

N

LEGEND

- APPROXIMATE EDGE OF RIVER
- OVERHEAD POWER
- GAS
- FIBER OPTIC
- SANITARY SEWER
- GRAVEL AREAS
- APPROXIMATE LOCATION OF CHAIN LINK FENCE
- SEDIMENT TUBE OR SILT FENCE
- RIPRAP AND GEOTEXTILE PLACEMENT (AS NEEDED IN DISTURBED AREAS)
- PREDOMINANT WIND DIRECTION
- AIR MONITORING STATION LOCATION

NOTE: LANDSIDE AND RIVERBANK DISTURBANCE WILL BE MINIMIZED TO THE EXTENT PRACTICAL.

0' 100' 200'
(Feet Scale)

FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN AND AIR MONITORING LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/11/17 FILE NAME: CONG464

APEX COMPANIES, LLC

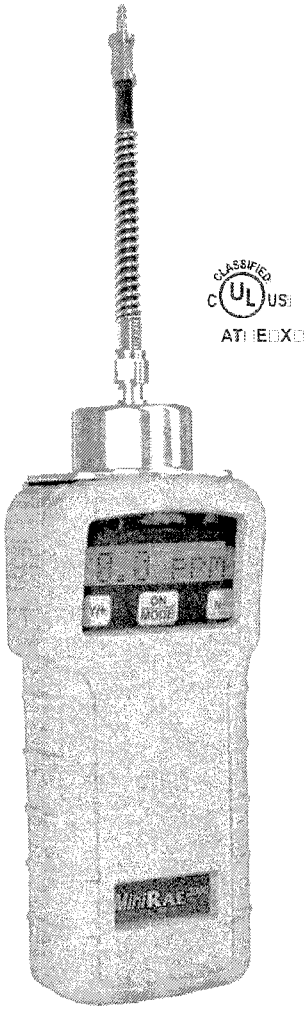
Attachment A

Air Monitoring Instrument Information

MiniRAE 2000

Portable Handheld VOC Monitor

The rugged MiniRAE 2000 is the smallest pumped handheld Volatile Organic Compound (VOC) monitor on the market. Its Photoionization Detector's (PID) extended range of 0-10,000 ppm makes it an ideal instrument for applications from environmental site surveying to HazMat/Homeland Security.



Key Features

Proven PID technology
The patented 3D sensor provides a 3-second response up to 10,000 ppm and sets a new standard for resistance to moisture and dirt.

Self-cleaning lamp and sensor
Our patented self-cleaning lamp and sensor minimize the need for maintenance and calibration.

The MiniRAE 2000 lamp and sensor can be taken apart in seconds for easy maintenance without any tools!

Measure more chemicals than with any other PID With over 100 Correction Factors built into the MiniRAE 2000 memory and the largest printed list of Correction Factors in the world (300+), RAE Systems offers the ability to accurately measure more ionizable chemicals than any other PID. When a gas is selected from the MiniRAE 2000's library, the alarm points are automatically loaded into the meter.

User friendly screens make it easy to use for simple applications and flexible enough for sophisticated operations.

Drop-in battery When work schedules require putting in more hours than the 10 hours supplied by the standard NiMH battery, the drop-in alkaline pack supplied with every MiniRAE 2000 lets you finish the job.

Rugged Rubber Boot The standard rubber boot helps assure that the MiniRAE 2000 survives the bumps and knocks of tough field use.

Strong, built-in sample pump draws up to 100 feet (30m) horizontally or vertically.

Tough flexible inlet probe

Large keys operable with 3 layers of gloves.

Easy-to-read display with backlight.

Stores up to 267 hours of data at one minute intervals for down-loading to PC (with the datalogging option).

3-year 10.6 eV lamp warranty

Applications

HazMat/Homeland Security
- Initial PPE (personal protective equipment) assessment
- Leak detection
- Perimeter establishment and maintenance
- Spill delineation
- Decontamination
- Remediation

Industrial Hygiene/Safety
- Confined Space Entry (CSE)
- Indoor Air Quality (IAQ)
- Worker exposure studies

Environmental
- Soil and water headspace analysis
- Leaking underground storage tanks
- Perimeter fence line monitoring
- Fugitive emissions (EPA Method 21)
- Vapor recovery breakthrough
- Landfill monitoring

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rev10_ 04.04

ISO 9001 CERTIFIED

RAE SYSTEMS

Specifications*

Default Sensor Settings**

Gas Monitor	Range (ppm)	Resolution (ppm)	Response Time (T90)
VOCs	0 - 999 ppm	0.1 ppm	< 3 sec
	100 - 10,000 ppm	1 ppm	< 3 sec

Detector Specifications

Size	8.2"L x 3.0"W x 2.0"H (21.8 x 7.62 x 5.0 cm)
Weight	20 oz with battery pack (553g) w/o rubber boot
Sensor	Photoionization sensor with standard 10.6 eV or optional 9.8eV or 11.7 eV UV lamp
Battery	• Rechargeable, external, field replaceable Nickel-Metal-Hydride (NiMH) battery pack • Alkaline battery holder (for 4 AA batteries)
Operating Period	10 hours continuous operation
Display	Large LCD, backlight activated manually, with alarms or darkness
Keypad	1 operation and 2 programming keys
Direct Readout	• VOCs as ppm by volume • High and low values • STEL and TWA (in hygiene mode) • Battery and shut down voltage
Alarms	90 dB buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms automatic reset or latching with manual override • Optional plug-in pen size vibration alarm • User adjustable alarm limits
Calibration	Two point field calibration of zero and standard reference gas. Calibration memory of 8 calibration gases, alarm limits, span values and calibration date
Datalogging	Optional 267 hours (at one minute intervals) with date/time. Header information includes monitor serial number, user ID, site ID, date and time
Sampling Pump	• Internal, integrated flow rate 400 cc/min • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto shut-off pump at low flow condition
Communication	Download data and upload instrument set-up from PC through RS-232 link to serial port
Temperature	14° to 104°F (-10° to 40°C)
Humidity	0% to 95% relative humidity (non-condensing)
EM/RFI	Highly resistant to EMI /RFI. Compliant with EMC Directive 89/336/EEC
IP-rating	IP-55: protected against dust, protected against low pressure jets of water from all directions
Hazardous Area Approval	• US and Canada: UL and cUL, Classified for use in Class I, Division 1, Groups A, B, C and D hazardous locations • Europe: ATEX II IG EEx ia IIC T4
Attachment	Durable bright yellow rubber boot w/belt clip & wrist strap
Warranty	Lifetime on non-consumable components (per RAE Systems Standard Warranty), 1 year for 10.6.V PID lamp, 1 year for pump and battery

MiniRAE 2000 and Accessories

Monitor only includes:

- 10.6eV, 9.8eV or 11.7eV as specified
- RAE Systems UV lamp: 10.6eV, 9.8eV or 11.7eV as specified
- 5-inch Flex-I-Probe
- External filter
- Rubber boot with belt clip
- Alkaline battery adapter
- Tool kit
- Lamp cleaning kit
- Nickel-Metal-Hydride battery
- 120/230 V AC/DC wall adapter (if specified)
- Operation and maintenance manual

Monitor with accessories kit adds:

- Hard transport case with pre-cut foam
- 5 porous metal filters and O-rings
- Organic vapor zeroing adapter
- Gas outlet port and tubing

Optional calibration kit adds:

- 10 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

Datalogging monitor adds:

- ProRAE Suite software package for Windows 98, NT, 2000 and XP
- Computer interface cable

Optional Guaranteed Cost of Ownership Program:

- 4-year repair and replacement guarantee
- Annual maintenance service

* On going projects to enhance our products means that these specifications are subject to change

** Performance based on isobutylene calibration

MiniRAE 2000

ATEX

ISO 9001 CERTIFIED

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rev10_ 04.04

Product Overview

All these applications in one small unit

- Indoor air quality monitoring
- Walk-through surveys
- Personal exposure monitoring
- Time & motion studies
- Workplace & plant monitoring
- Fixed-point continuous monitoring
- Remediation personal surveillance
- Remote alarming
- Mobile monitoring in vehicles & aircraft
- Toxicology & epidemiology studies
- Emergency response
- Testing air filtration efficiency

*personal*DataRAM™ Series

Measures airborne particulate concentration in real time

- *p*DR-1000AN
  For passive air sampling applications
- *p*DR-1200
  For active air sampling applications

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

*p*DR-1000AN
Hand-held and fixed-point, real-time aerosol monitor/datalogger

Measure airborne particulate concentration in real-time

The *personal*DataRAM (*p*DR-1000AN) measures mass concentrations of dust, smoke, mists, and fumes in real time, and sounds an audible alarm whenever the user-defined level is exceeded. Conventional filter-based monitoring methods cannot indicate dangerous, real-time dust levels. In contrast, the *p*DR-1000AN alerts you to a problem within seconds, allowing you to take immediate action. With the datalogging enabled, the instrument automatically tags and time stamps the data collected, and stores it for subsequent retrieval, printing, or graphing through a computer.

Highest performance of any real-time personal particulate monitor

With a measurement range from 0.001 to 400 mg/m^3 (auto-ranging), and an optical feedback stabilized sensing system, the *p*DR-1000AN sets the standard for sensitivity, long-term stability and reliability.

The palm-sized *p*DR-1000AN weighs only 18 oz (0.5 kg) for easy portability and attachment to a belt or a shoulder strap. The absence of any moving parts, such as pumps, motors and valves, and the use of low-power semiconductors housed in a ruggedized case ensures long life and dependable operation.

High correlation with gravimetric measurement

The *p*DR-1000AN is a light-scattering photometer (i.e., nephelometer) incorporating a pulsed, high output, near-infrared light emitting diode source, a silicon detector/hybrid preamplifier, and collimating optics and a source reference feedback PIN silicon detector. The intensity of the light scattered over the forward angle of 50^0 to 90^0 by airborne particles passing through the sensing chamber is linearly proportional to their concentration. This optical configuration produces optimal response to particles in the size range of 0.1-10 µm, achieving high correlation with standard gravimetric measurements of the respirable and thoracic fractions.

Simple zeroing and calibration

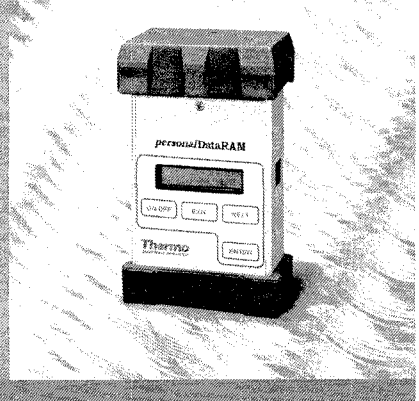
The *p*DR-1000AN arrives practically ready to use after the easy zeroing step. The unit comes gravimetrically calibrated in mg/m^3 (NIST traceable) using standard SAE Fine test dust (ISO Fine). Zeroing with particle-free air is accomplished quickly and effectively under field conditions using the zeroing kit included with the instrument. Internal firmware controls an automatic calibration check. To maximize efficiency in the field, gravimetric calibration can be performed by comparison with a filter sampler and programming of the calibration constant.

Standard Accessories

- Universal voltage power supply
- PC communications software
- Zeroing kit
- Belt clip kit
- Instruction manual
- Carrying case
- Signal output cables

Optional Accessories

- Rechargeable battery pack (NiMH)
- Active sampling kit (converts *p*DR-1000AN to *p*DR-1200)
- Portable pump unit
- Shoulder strap
- Remote alarm interface
- Wall mounting bracket



*p*DR-1200
Active aerosol monitor/datalogger, plus aerodynamic sizing

Designed for active particulate monitoring applications

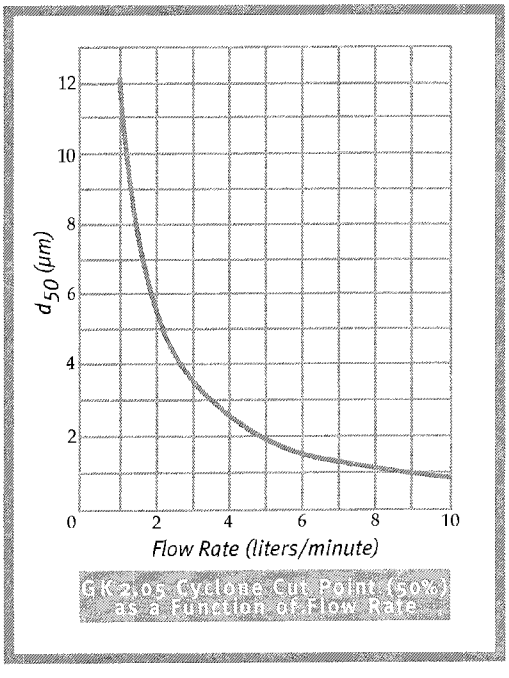
The *personal*DataRam™ (model *p*DR-1200) performs active sampling applications and aerosol sizing. The *p*DR-1200 requires a vacuum pump module to perform particle size selective measurements under field conditions. The separate pump (not included) is required for active sampling and aerosol sizing. With optional inlet accessories, the *p*DR-1200 is excellent for ambient air measurements under variable wind and high humidity conditions. It is ideal for respirable, thoracic, and PM2.5 monitoring, as well as continuous emission and test chamber monitoring. With an isokinetic sampling set, the pDR-1200 can be used for stack and duct extractive sampling monitoring. Membrane filters can be used to capture particles for particles for subsequent laboratory analysis.

Aerodynamic particle sizing

The *p*DR-1200 incorporates an optimally designed metal cyclone (BGI Model GK 2.05) or the optional low flow cyclone (BGI Model Triplex SCC1.062-CUST) especially selected for PM2.5 collection at 1.5 LPM. By operating the pump at specific sampling flow rates, the *p*DR-1200 cyclone preseparator provides precisely defined particle size cuts.

Primary calibration and particle samples by filter collection

An integral filter holder directly downstream of the photometric sensing stage accepts 37 mm filters. The calibration constant of the *p*DR-1200 is simply adjusted to coincide with the filter-determined concentration. Primary gravimetric calibration of the instrument concentration readout is easily accomplished under actual field conditions by means of this integral filter. Use membrane filters for chemical analysis or concurrent gravimetric measurements.

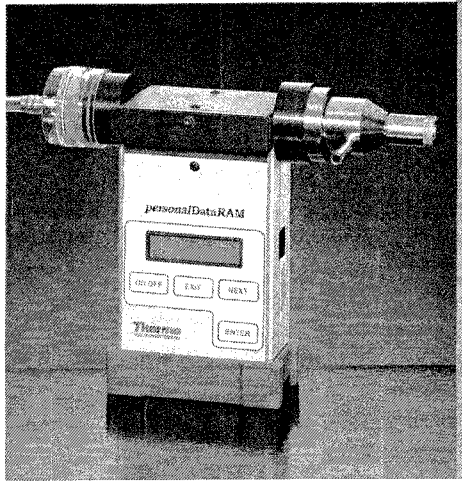


GK 2.05 Cyclone Cut Point (50%) as a Function of Flow Rate

*p*DR-PU Attachable Pump Module

This optional accessory is designed for use with the *personal*DataRAM Model *p*DR-1200. It incorporates a dual-chamber diaphragm pump, a volumetric flow sensing, and control unit. The pump module operates from either an optional, rechargeable NiMH battery pack or from AC line current using the power supply/charger supplied with the *personal*DataRAM. The *p*DR-PU is designed as a modular unit that can be used in various combinations.

- Flow rate (user adjustable): 1 to 4 liters/minute
- Maximum pressure drop: 10 in H2O (25 mbar)
- Precision of constant flow rate control: ±2%
- Power: 9 VDC, 200 mA at 4 liters/minute (approximate)
- Dimensions: 4 in (100 mm) H x 3.6 in (90 mm) W x 1.8 in (45 mm) D
- Weight: 1 lb (0.45 kg)



personalDataRAM™ ***Series***

At last,
a compact,
versatile,
real-time
aerosol monitor

Specifications

Concentration Measurement Range (auto-ranging)
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm sg = 2.5, as aerosolized)
0.001 to 400 mg/m^3

Scattering Coefficient Range
1.5 x 10^{-6} to 0.6 m^{-1}(approx) @ lambda = 880 nm

Precision/Repeatability Over 30 Days (2-sigma at constant temperature and full battery voltage)

- ±2% of reading or ±0.005 mg/m^3, whichever is larger, for 1 second averaging time
- ±0.5 of reading or ±0.0015 mg/m^3, whichever is larger, for 10 second averaging time
- ±0.2% of reading or ±0.0005 mg/m^3, whichever is larger, for 60 second averaging time

Accuracy
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm, sg = 2.5, as aerosolized)
±5% of reading ±precision

Resolution
0.1% of reading or 0.001 mg/m^3, whichever is larger

Particle Size Range of Maximum Response
0.1 to 10 µm

Flow Rate Range (model *p*DR-1200)
1-10 liters/min (external pump required)

Aerodynamic Particle Sizing Range
1.0 to 10 µm (*p*DR-1200 only)

Concentration Display Updating Interval
1 second

Concentration Display Averaging Time (user selectable)
1 to 60 seconds

Alarm Level Adjustment Range (user selectable)
Selectable over entire measurement range

Alarm Averaging Time (user selectable)
Real-time (1 to 60 seconds) or STEL (15 minutes)

Datalogging Averaging Periods (user selectable)
1 second to 4 hours

Total Number of Data Points That Can Be Logged in Memory
More than 13,300

Number of Data Tags (data sets)
99 (maximum)

Logged Data

- Each data point: average concentration, time/date, and data point number
- Run summary: overall average and maximum concentrations, time/data of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration, and time/date of occurrence, averaging (logging) period, calibration factor, and tag number

Analog Signal Output
0 to 5 V and 4 to 20 mA, with selectable full scale ranges between 0.1 and 400 mg/m^3

Power

- Internal battery 9 V alkaline, 20 hour run time (typical)
- Internal battery 9 V lithium, 40 hour run time (typical)
- AC source universal voltage adapter (included) 100-250 volts, 50-60 Hz (CE marked)
- Optional battery pack rechargeable NiMH, 72 hour run time typical (*p*DR-BP)

Readout Display
LCD 16 characters (4 mm height) x 2 lines

Serial Interface
RS232, 4800 baud

Computer Requirements
PC compatible, 486 or higher, Windows 95® or higher

Storage Environment
-20°C to 70°C (-4°F to 158°F)

Operating Environment
-10°C to 50°C (14°F to 122°F), 10 to 95% RH, non-condensing

Dimensions (max external)
153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D (*p*DR-1000AN)
160 mm (6.3 in) H x 205 mm (8.1 in) W x 60 mm (2.4in) D (*p*DR-1200 including cyclone and filter holder)

Weight
0.5 kg (18 oz) (*p*DR-1000AN)
0.68 kg (24 oz) (*p*DR-1200)

Approvals

- Intrinsic safety approval by US Mine Safety & Health Administration (MSHA) coal-mining environments containing methane gas (the *p*DR-PU pump is not approved by MSHA)
- US FCC Rules (Part 15)
- CE certified

Lit_PDREID_06/05

Thermo Electron Corporation
Environmental Instruments
27 Forge Parkway
Franklin MA USA 02038
www.thermo.com/eh
1.866.282.0430
+1.508.520.0430
+1.508.520.1460 fax

Attachment B

Predominant Wind Direction Information

FIGURE 1

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

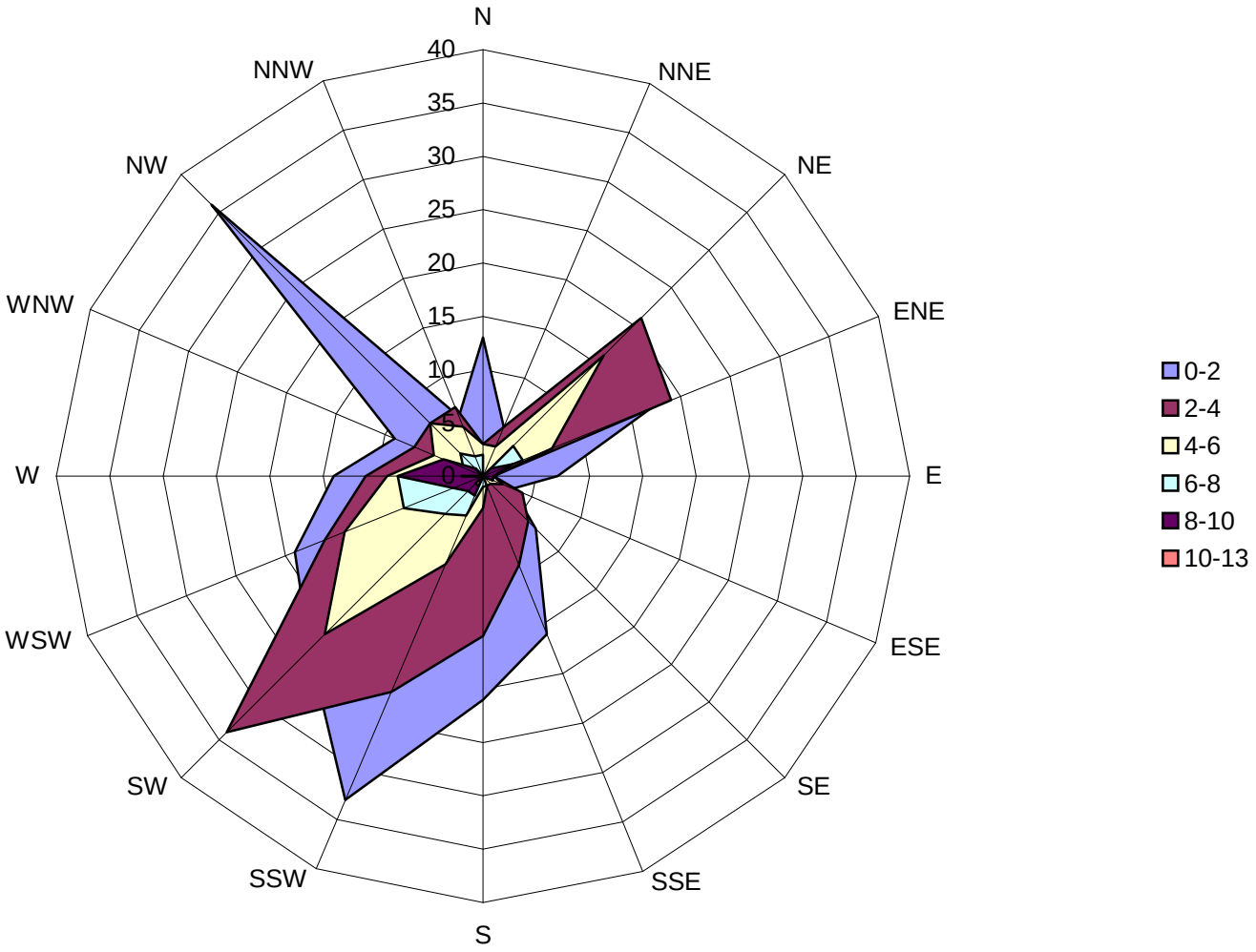
LOCATION OF THE PROJECT AREA WITH RESPECT TO THE WEATHER STATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

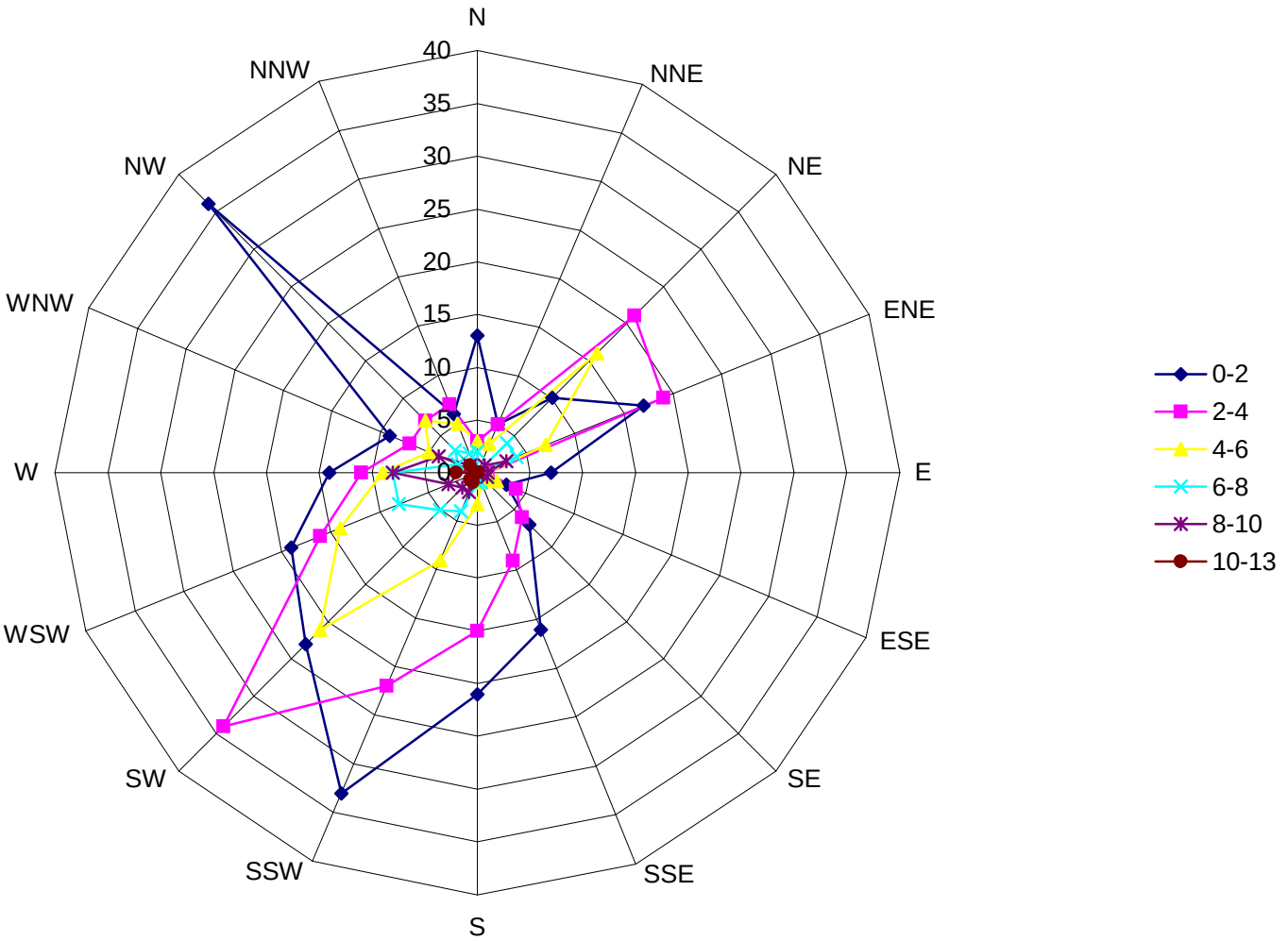
DATE: 05/05/2014 FILE NAME: WEATHER STATION

APEX COMPANIES, LLC

Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



APPENDIX R

POST-CONSTRUCTION MONITORING/MITIGATION PLAN

POST-CONSTRUCTION MONITORING/MITIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

October 2017

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

POST-CONSTRUCTION MONITORING/MITIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area (Figure 1). The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The primary objective is to limit or prevent human exposure to the TLM impacted sediments within the project area. This will be accomplished through the placement of an engineered cap (i.e., geotextile and articulated concrete blocks [ACB mats]) over the entire project area. The physical barrier of the cap will prevent direct contact with the TLM material in the near-shore areas. The secondary objective of the project is to prevent re-suspension and potential downstream migration of the impacted sediment. Figure 2 illustrates the planned capping approach.

After the cap is in place, periodic monitoring of the capped area and mitigation of any identified issues will be an important component to ensure the long-term effectiveness of the cap implementation. This Plan provides the details of the post-construction monitoring activities.

SCHEDULE

Periodic monitoring of the capped area (Figure 3) will be conducted at six-month intervals for the first year following completion of the installation. Similar inspections will be completed on a yearly basis for a period of five years following the first year of semi-annual inspections. Inspections will also be conducted following large storm events that result in significant flooding of the project area. The purpose of these inspections will be to quickly identify any damage to the cap. Flooding events that result in an increase of the river elevation to approximately 125 feet, as measured at the Congaree River gage located across the river from the project area, will trigger such inspections. When possible, inspections will be conducted during low river levels in order to maximize visibility of the cap and access to the project area.

Periodic Monitoring and Inspection Activities

The capped area will be subject to a general inspection and more specific data collection activities in order to verify that it remains intact and functional. The general inspection will include wading and/or floating over the area in a canoe in order to visually verify the integrity of the cap and document any areas that require attention such as erosion, undermining, etc. Deposition of river born natural debris such as sediment, trees and other natural objects will serve to re-establish the aquatic habitat in the capped area.

These items will be left in place on the cap unless they are deemed to potentially pose a threat to the cap's integrity.

Specific areas of interest will include the cap extension area that extends up the landside area and ties into the asphalt roadway. This area may present erosion issues if significant runoff down the asphalt road occurs on a regular basis. The areas where the easternmost portion of the cap ties into the riverbank may also be susceptible to erosion or undermining. Finally, the underwater portion of the cap may be subject to new and varying hydraulic forces due to the changing nature of the Congaree River in the project area. These areas will receive special attention during the general inspection process.

The data gathering portion of the inspection will include checking the same general points located along the edges and the interior of the cap over multiple inspection events and collecting data at each point. For illustrative purposes, example points are shown on Figure 3. Actual points will be determined utilizing the as-built construction diagram of the completed cap and will be selected based on providing spatial coverage over the capped area and also gathering data at specific points of interest (i.e., corners, etc.). Data collected during each event will be compared to historical data from previous events and the as-built to determine if the cap is changing, moving or being altered by river forces, etc. The data collected will include:

- Elevation of the top of the concrete block capping material at each prescribed point;
- Thickness of accumulated sediment on top of the cap and within the block cells, if any; and
- General condition of the capping material at each point.

Mitigation Activities

Defects or areas that require maintenance will be addressed as soon as possible. Any issues identified with the cap that require mobilization of construction equipment to repair will be brought to the attention of SCDHEC prior to repair completion. Erosion and/or undermining areas will be repaired and the cause of the erosion will be addressed, if practical, to reduce the potential for similar issues to develop in the future.

Reporting

A summary report will be developed within 60-days of an inspection event and will be transmitted to SCDHEC. The report will include:

1. Reason for inspection (i.e., post-flood event, semi-annual or annual inspection);
2. Photographic documentation of the project area;
3. Photographic documentation of any identified issues and the subsequent completed maintenance activities;
4. General condition of the cap, and the cap elevation and sediment thickness data obtained;
5. Any completed repair or maintenance activities;
6. Areas that may require additional work to repair; and
7. The planned date of the next inspection.

ATTACHMENTS

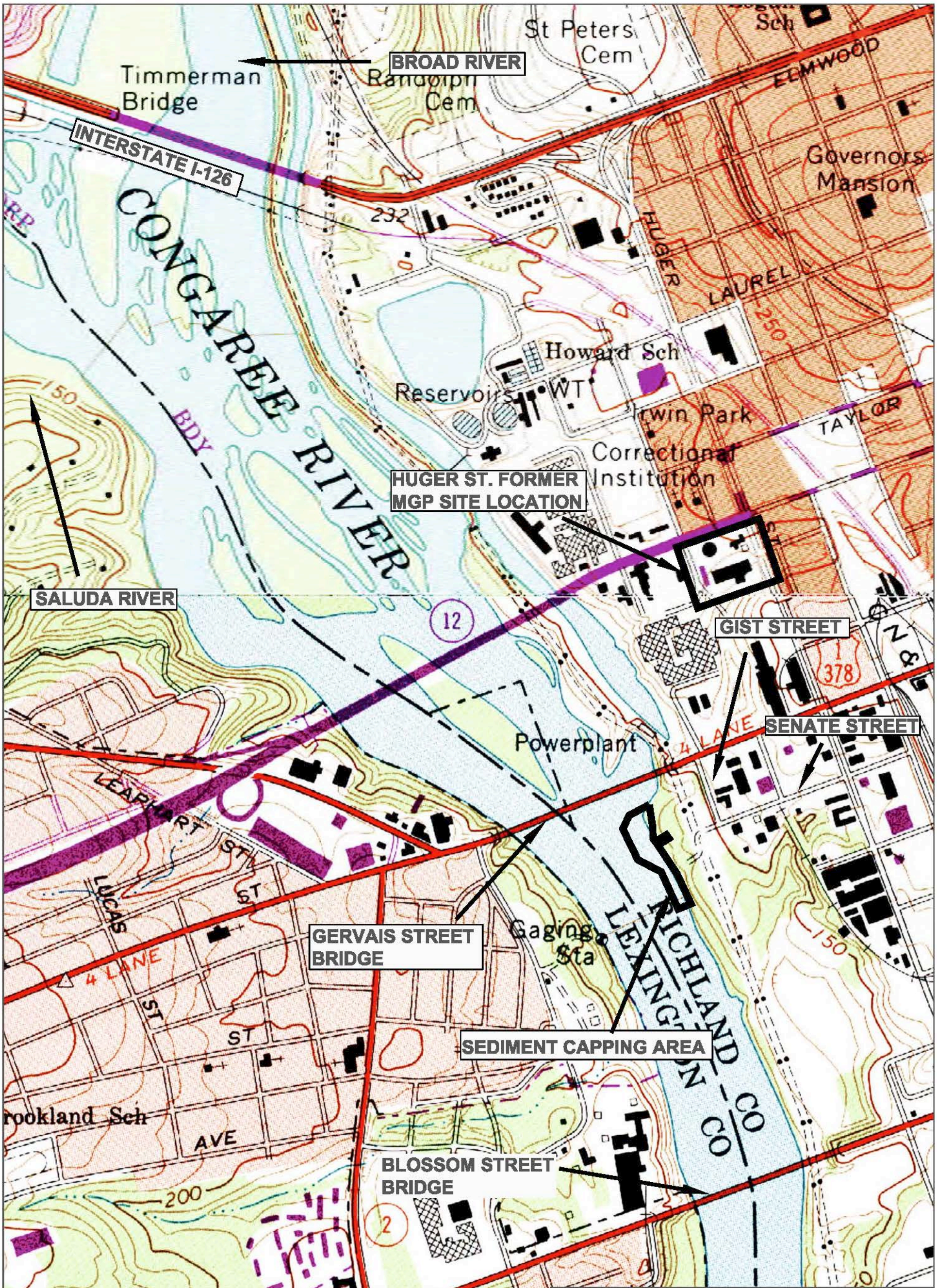


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP - PHASE 2
MODIFIED REMOVAL ACTION (MRA) SEDIMENT CAPPING

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/6/17 FILE NAME: CONG402

APEX COMPANIES, LLC

GERVAIS STREET BRIDGE

GIST STREET

PARKING

SENATE STREET EXTENSION

CONCRETE APRON FIELD FIT

18"DIP

CONGAREE RIVER

LEGEND

- — APPROXIMATE EDGE OF RIVER
- — APPROXIMATE EXTENT OF PROPOSED AREA TO BE CAPPED.
- — BATHYMETRIC LINE (FEET NAVD '88) – 2010
- — ARTICULATED CONCRETE BLOCK MATS (ACBs)

40' 80' 120'

(Feet Scale)

FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SEDIMENT CAP LOCATION
AND DESIGN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/8/2017 FILE NAME: CONG461

APEX COMPANIES, LLC

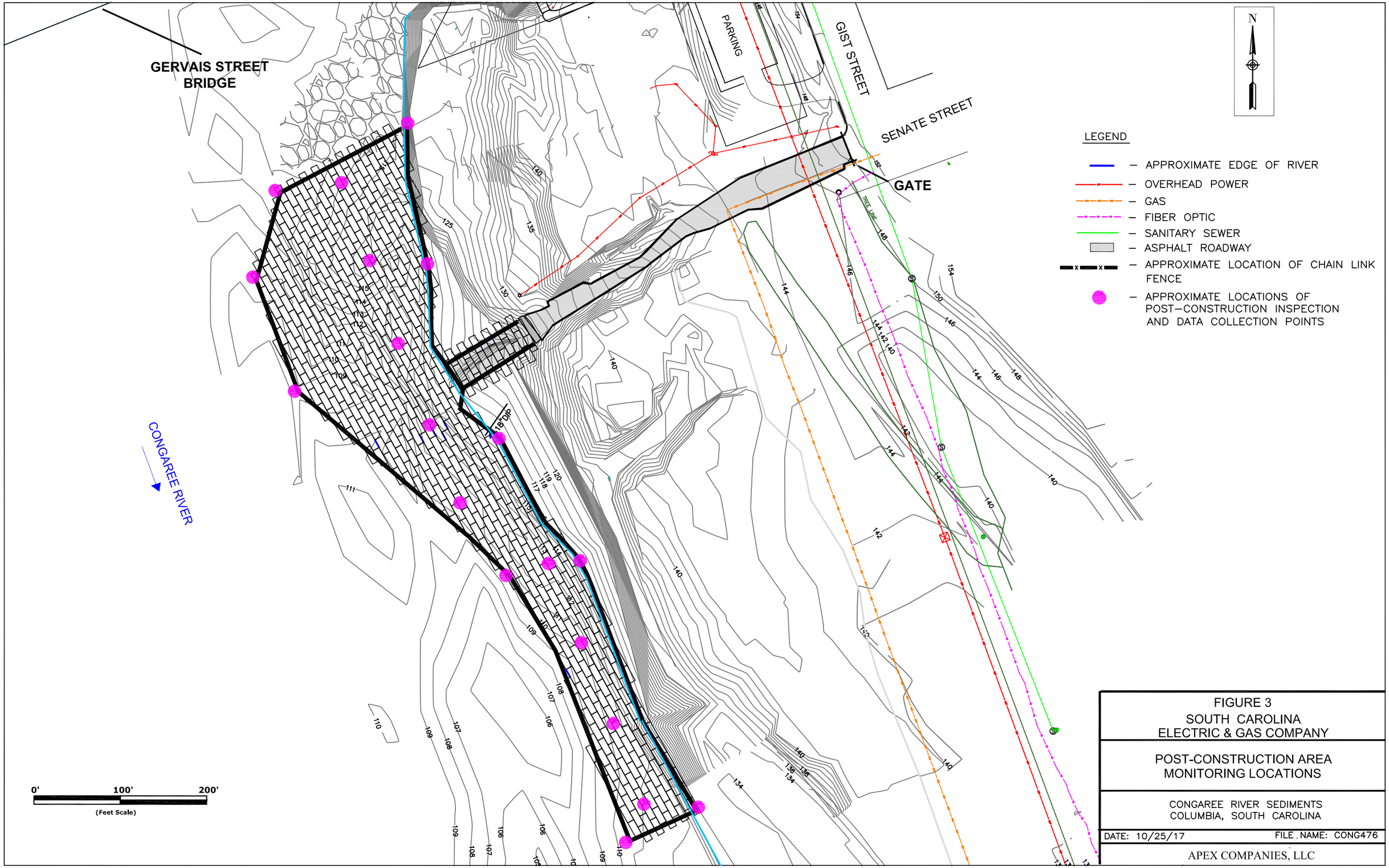


FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

POST-CONSTRUCTION AREA
MONITORING LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/25/17 FILE NAME: CONG476

APEX COMPANIES, LLC

APPENDIX S

SURFACE WATER - SAMPLING ANALYSIS PLAN (SW-SAP)

SURFACE WATER - SAMPLING ANALYSIS PLAN (SW-SAP)

CONGAREE RIVER PROJECT
COLUMBIA, SOUTH CAROLINA

June 2017

Prepared for:

South Carolina Electric & Gas Company
220 Operation Way
Cayce, South Carolina 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

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FIGURES

APPENDICES

1.0 INTRODUCTION

This Draft Surface Water - Sampling and Analysis Plan (SW-SAP) is being submitted on behalf of South Carolina Electric & Gas Company (SCE&G) as requested by the South Carolina Department of Health and Environmental Control (SCDHEC) in a letter dated April 7, 2017 (Appendix A). This Draft SW-SAP will provide for the future routine collection of surface water analytical data in support of the sediment remediation project located in a portion of the Congaree River in Columbia, South Carolina as shown on Figure 1.

1.1 Brief Project History/Summary

SCE&G and SCDHEC have been working on the Congaree River Project since the discovery of a tar-like material (TLM) in June of 2010. Based on the delineation work previously completed and available in the administrative record, the extent of TLM has been well defined. The TLM is commingled with sediment primarily within an area of the river just south of the Gervais Street Bridge, adjacent to the eastern shoreline as shown on Figure 2. The TLM in the river is thought to have been the result of past operations of the former Huger Street Manufactured Gas Plant (MGP) site located at 1409 Huger St. Columbia, South Carolina (Figure 3). The former MGP site was operated by predecessor companies to SCE&G from approximately 1905 thru the mid 1950's. SCDHEC's Administrative Record contains additional details on the environmental history of the site.

1.2 Regulatory Framework

The SCDHEC and SCE&G have executed a Responsible Party Voluntary Cleanup Contract (VCC) #02-5295-RP for the former MGP site located at 1409 Huger St. Columbia South Carolina. After discovery of the TLM in the river in June of 2010, the existing VCC Huger St site was extended to cover the Congaree River Project area. The Huger St. VCC was executed by the Department on August 19, 2002 and all the activities contemplated within this SW-SAP are intended to be consistent with the VCC.

1.3 Overview of the Draft SW-SAP

On March 7, 2017, SCDHEC approved an internally developed work plan (Appendix B) for collecting surface water samples within the Congaree River Project area. The SCDHEC Work Plan was implemented in April 2017 and is now considered as a "baseline report" for monitoring surface water conditions in the project area. Additional information regarding the work plan and the baseline findings (all virtually non-detect concentrations) are discussed in more detail in the following section. Therefore, this Draft SW-SAP is, by design, intended to replicate the initial work completed by SCDHEC and provide a uniform monitoring program moving forward. The proposed sampling locations are intended to replicate many of SCDHEC's locations, while maintaining a forward-looking approach that also accounts for the currently envisioned sediment capping project to be completed in the near future.

1.4 Objectives

The objectives of the SW-SAP are to:

- Collect sufficient data to fulfill the data requirements of the SCDHEC Site Assessment Program Level QAPP;

- Discuss the proposed sampling program locations, frequency and contingencies;
- Discuss procedures, approaches and techniques that will be used to complete the field work; and
- Safely complete the proposed field work.

2.0 BACKGROUND INFORMATION AND BASELINE SAMPLING EVENT

2.1 Surface Water Hydrology

The Congaree River is formed by the confluence of the Broad and Lower Saluda Rivers approximately 6,000 feet above the project area near the Timmerman/State Route 126 Bridge (Figure 1). The flow of the Lower Saluda River is largely influenced by the Saluda River Hydroelectric Dam, which is constructed on Lake Murray and located approximately 12 miles northwest of the site. The Broad River is located to the north east of the project area, with multiple dams constructed upriver from the Gervais Street Bridge. The flow of the Broad River is less regulated (or controlled) than the Lower Saluda and is more runoff dependent. The Lower Saluda is considered a South Carolina Scenic River from approximately 1 mile below the Lake Murray Dam to the confluence with the Broad River, or the beginning of the Congaree River.

Within the project area, the unnamed tributary that extends from the 72-inch culvert pipe located near the intersection of Gist and Gervais Streets (Figure 2) provides a discharge point for stormwater runoff from the City of Columbia. This stormwater conveyance services a large area northeast of the site and exhibits varying flows that are strongly dependent on recent precipitation amounts. Minimal flow is observed during extended dry periods, which suggests some groundwater infiltration into the stormwater system.

A United States Geologic Survey (USGS) river gage is located directly across the river from the project area. According to the USGS, the drainage area for the Congaree River at this gage location is 7,850 square miles and the gage height is 113.02 feet, based on NGVD ’29 (or 112.25 based on NGVD ’88). From the available data, the mean daily discharge rate varies from approximately 5,000 cubic feet to 16,000 cubic feet. The USGS gage height is a key component in the overall approach for this sampling program.

2.2 SCDHEC Work Plan

In March 2017, SCDHEC finalized a work plan to collect surface water samples “to determine the surface water quality in the Congaree River as it relates to the coal tar deposits from former manufacturing gas plant operations”. The sampling had a two-fold objective which included determining whether there was a release to the environment and establish baseline conditions. Appendix B contains a copy of the work plan.

The work plan describes collecting 13 surface water samples and shows the proposed sampling locations (Appendix B). However, a total of 14 samples were collected (Appendix C). The surface water samples were collected at upstream and downstream locations as well as within the area targeted for remediation as well as tributaries discharging into the Congaree River. The length of the Congaree River sampled was about 2,000 feet starting near the Gervais Street and proceeding downstream on approximate 200-

foot intervals to near an unnamed tributary. The surface water within 15 to 25 feet from the eastern Congaree River shoreline was sampled. A sample from a tributary running through Memorial Park, which is upstream of a tributary discharging to the Congaree River near the Gervais Street bridge, was also sampled. One duplicate sample was also collected. The surface water samples were collected on March 21, 2017.

The collection, handling, and other elements associated with the sampling were performed in accordance to the SDHEC Site Assessment Level Quality Assurance Project Plan (QAPP) as shown in Appendix B.

2.3 Findings of the Baseline Event April 2017

As discussed above, a total of 14 surface water samples and one duplicate sample were collected as shown in Appendix C. The samples were analyzed for volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) via Methods 8260B and 8270D, respectively. Shealy Environmental Services, Inc. (Shealy) located in West Columbia, South Carolina performed the analyses.

The SCDHEC provided the analytical findings to SCANA in a letter dated April 7, 2017. In this letter, the SCDHEC indicated “with the exception of one detection of bis(2-ethylhexyl)phthalate, all other samples yielded no detections. This detection is a common laboratory contaminant and is suspected to be a false detection”. SCDHEC also indicated that the analytical results for the duplicate sample collected from the same location were non-detect. The surface water sample analytical results are provided in Appendix C.

3.0 BACKGROUND/BASELINE SAMPLING EVENT

3.1 Proposed Sampling Locations and Rationale

A total of nine surface water sampling locations are proposed along the Congaree, Saluda, and Broad Rivers, and tributaries discharging to the Congaree River. [The project area is located just below the confluence of the Broad and Saluda Rivers, which join to form the Congaree River.] The sampling locations are described on Table 1, shown on Figure 3, and include:

- **SW-01 through SW-03 and SW-08**: Monitoring surface water quality at upstream locations to establish surface water quality prior to entering the project area;
- **SW-04 and SW-05**: Monitoring surface water quality in the project area;
- **SW-06 and SW-07**: Monitoring surface water quality downstream of the project area; and
- **SW-09**: Monitoring surface water quality at a tributary to the west of the Congaree River to assess other potential contributions.

Sampling locations SW-04 through SW-07 are intended to be located near the SCDHEC surface water sampling locations (Table 1 and Figure 3).

3.2 Sampling Procedures

In general, and where possible, the interval at about 0.5 to 1.0 foot above the river or tributary bottom will be targeted for sampling. To facilitate sampling this interval, two different sampling procedures are described based on surface water depth encountered at the time of sampling. For locations within the river, sampling will proceed in an upstream manner. All samples will be collected by sampling personnel wading into the river or tributary.

3.2.1 Shallow Surface Water Sampling Procedures

Shallow surface water (as defined in this plan as less than 1.0 foot) sampling procedures will be utilized at locations where collecting the sample by submerging the sample bottle, or transfer container, directly into the water, if feasible. The shallow surface water sample will be collected by orienting the sample bottle or transfer container opening in an upstream manner. It is likely this sampling procedure will be utilized at the tributary sampling locations.

3.2.2 Deeper Surface Water Sampling Procedures

Deeper surface water sampling procedures will be utilized at locations where the surface water is approximately 1 to 4 feet deep and prohibits submerging the sample bottle, or transfer container, directly into the water to collect the sample. For the deeper surface water, a Van Dorn sampling device will be used as described below. It is likely this sampling procedure may be utilized in the Congaree, Saluda, and Broad Rivers.

Similar to SCDHEC's Surface Water Sampling Plan, surface water samples in the project area will be collected about 15 to 25 feet from the shoreline, perhaps further if favorable river conditions are encountered at the time of the sampling event. If the water is very shallow, the samples will be collected in a manner described in Section 3.2.1. In the event the surface water is deeper, a Van Dorn sampler (or similar) will be used to collect the surface water sample.

At the deeper sampling locations, the water column height will be measured. The Van Dorn sampler (or similar) will be lowered to a distance of about 0.5 feet above the river or tributary bottom. A weighted "messenger" will be sent down the rope or wire supporting the sampler, triggering a mechanism that will close the gaskets sealing the water sample inside. The sampler will then be raised and contents transferred into the appropriate sample containers.

Care will be taken when collecting the sample to minimize sediment disturbance and if disturbed, sufficient time will be permitted to allow the sediment to clear.

3.2.3 Documentation

At each sampling location, a description of the surface water will be made, water depth measured, clarity of water, method sampled (shallow or deeper), and any other pertinent information noted.

3.3 Laboratory Analyses

The surface water samples will be analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and specific, site-related, polynuclear aromatic hydrocarbons (PAHs). This parameter list is recommended since these constituents represent the same parameters analyzed in sediment samples collected during

the delineation activities. In addition, focusing the list to BTEX and PAHs is supported by the SCDHEC analytical results which did not indicate the presence of other constituents that could be of interest.

The list of parameters, analytical methods, and project reporting limits for the SW-SAP are shown on Table 2. Consistent with the SCDHEC Work Plan, Shealy Environmental Services, Inc. (Shealy) located in West Columbia, South Carolina will perform the analyses.

3.4 Sampling Frequency

Initially, the surface water samples will be collected semi-annually, tentatively scheduled for March and September of each year. Assuming concurrence with this plan in timely manner, the first sampling event will occur in September 2017, the next event would occur in March of 2018, prior to initiating cap installation activities, and the September 2018 event would be completed after the cap was installed. Obviously, the precise sampling schedule is tentative and must be flexible to accommodate changing river conditions or cap installation activities. A project schedule with target dates is provided in Section 5.0.

Depending upon the sampling results obtained from the events described above, and with concurrence from SCDHEC, the sampling frequency may be reduced to an annual event that would likely correspond with the annual cap inspections.

3.4.1 River Levels

The intent of the surface water sampling is to safely monitor surface water quality under “base flow” conditions and characterize or document any contribution the TLM may have on the water column. Therefore, it is important to minimize or eliminate runoff scenarios where contributions from the urban settings may adversely influence the analytical results. Also, since the project area is extremely susceptible to rising river levels due to regional precipitation events, safety of the sampling personnel is paramount.

The National Weather Service (NWS) Advanced Hydrologic Prediction Service in conjunction with the USGS river gage will be utilized to assess future river level heights in the Congaree River to determine when conditions are suitable for sampling. Generally, at water level heights below 4 feet as measured at the river gage, sample locations along the rivers may be safely accessed. Reproducibility of the sample location will be a function of the river level heights at the time sampling. In the event that river level heights are projected to be above 4 feet for a period of time near the planned sampling date, the sampling event will be postponed until river conditions are suitable.

3.4.2 Alternate Sampling Locations

While conducting the monitoring events, alternate sampling locations may be necessary due to access constraints, change in tributary or river conditions, etc. If field conditions are encountered that require an alternate sampling location, the sample will be collected as close to the proposed location as conditions allow and any deviation from the plan will be documented.

3.5 Decontamination, Materials Management

3.5.1 Decontamination

Dedicated equipment (i.e., transfer bottles) and materials will be used where appropriate. All non-dedicated and/or non-disposable equipment will be decontaminated prior to and/or after use, as well as between each surface water sampling location. Equipment and materials will be decontaminated with a tap water and Liquinox® (or Alconox) wash or wipe followed by a tap and distilled water rinse. Additional distilled water rinses, acetone rinse and air drying will be utilized as necessary.

3.5.2 Materials Management

Waste materials anticipated to be generated through the completion of the surface water sampling activities will be minimal, but may include:

- Decontamination fluids;
- Spent personal protective equipment (PPE); and
- Miscellaneous field supplies (paper towels, plastic sheeting, etc.) generated from the sampling.

Investigation-derived wastes (IDW) will be segregated as appropriate and staged in a designated staging area for subsequent management and disposal. General refuse will be disposed of appropriately.

3.6 Surveying

The coordinates of the proposed surface water sampling locations shown on Figure 3 will be established prior to the initial sampling and entered into a hand-held GPS unit. The hand-held GPS unit will then be used to locate the sampling locations in the field.

Depending on river level heights at the time of sampling, the surface water sampling locations in the river may or may not be exactly replicated. Under these conditions, the sample will be collected as close to the proposed location as possible. To facilitate future surface water sampling along the river, physical markers (e.g., flagging) may be established where feasible.

Sampling locations in the tributary will be generally located near culvert locations and therefore, easier to replicate the sample location. At these locations, a description and sampling distance from the culvert (inlet or outlet) will be documented to facilitate future sampling and to augment locating with the hand-held GPS unit.

3.7 Health and Safety Plan

A Health and Safety Plan (HASP) was developed by SCE&G (MTR, June 2010) for the delineation work within the Congaree River that was completed during the initial phases of the project in 2010 through 2014. This HASP was updated/amended twice, once in July 2015 and again in January 2017. Since the activities contemplated for the scope of work described in this document are similar to those in the existing HASP, the existing HASP shall be suitable for this project.

4.0 REPORT

A Semi-Annual Assessment Report (Report) will be developed that discusses the field techniques used to collect the samples and will present the analytical results in tabular format. The Report will be submitted semi-annually, approximately 90 days after each sampling event. Figures will include maps showing the sampling locations and detected analytical results. Any other relevant information observed during the sampling event or any proposed changes to the plan will included in the Report.

5.0 SCHEDULE FOR SW-SAP

The tentative schedule assumes the following timeline:

SW-SAP – Review and Approval

Duration	Tentative Date	Description
1 day	June 30, 2017	Submittal of the Work Plan to SCDHEC
45 days	August 18, 2017	SCDHEC Review, Comment and Approval of SW-SAP

First Semi-Annual Sampling Event

1 day	September 13, 2017	First Event – Field Work
15 Days	October 4, 2017	Receipt of Analytical Data
60 Days	December 1, 2017	Submittal of the First Semi-Annual Assessment Report

Second Semi-Annual Sampling Event

1 day	March 26, 2018	Second Event – Field Work
15 Days	April 16, 2018	Receipt of Analytical Data
60 Days	June 16, 2018	Submittal of the Second Semi-Annual Assessment Report

Third Semi-Annual Sampling Event

1 day	September 26, 2018	Third Event – Field Work
15 Days	October 16, 2018	Receipt of Analytical Data
60 Days	December 16, 2018	Submittal of the Third Semi-Annual Assessment Report

In the event the first three semi-annual sampling events indicate no detections of constituents of interest, a request may be submitted to SCDHEC to reduce the sampling program to one annual event, likely to be completed in June of each subsequent year.

All dates and durations are estimated and subject to change.

TABLES

TABLE 1

SURFACE WATER SAMPLING LOCATIONS

Congaree River Project
Columbia, South Carolina

SCE&G Sampling Location	SCDHEC Sampling Location (Baseline)	Description
SW-01	CR-SW-14	Area upstream of Tributary "1", located in Memorial Park
SW-02	--	Unnamed Tributary "1" Outfall
SW-03	--	Just upstream of the confluence of the Broad River and Congaree River
SW-04	CR-SW-13	Just south of the Alluvial Fan and coinciding with SCDHEC sample location
SW-05	CR-SW-06	Approximately 200 feet downstream of SW-04 and coinciding with SCDHEC sample location
SW-06	CR-SW-08	Approximately 200 feet downstream of SW-05 and coinciding with SCDHEC sample location
SW-07	CR-SW-10	Approximately 200 feet downstream of SW-06 and coinciding with SCDHEC sample location
SW-08	--	Just upstream of the confluence of the Saluda River and Congaree River
SW-09	--	Tributary located west of the Congaree River

TABLE 2

SURFACE WATER SAMPLING PARAMETERS AND METHODS

Congaree River Project
Columbia, South Carolina

Constituent	Analytical Method	Reporting Limit (µg/L)
Volatile Organic Compounds		
Benzene	8260B	5
Ethylbenzene	8260B	5
Toluene	8260B	5
Xylenes, Total	8260B	5
PAH Constituents		
Acenaphthene	8270D	10
Acenaphthylene	8270D	10
Anthracene	8270D	10
Benzo(a)anthracene	8270D	10
Benzo(a)pyrene	8270D	10
Benzo(b)fluoranthene	8270D	10
Benzo(g,h,i)perylene	8270D	10
Benzo(k)fluoranthene	8270D	10
Chrysene	8270D	10
Dibenzo(a,h)anthracene	8270D	10
Fluoranthene	8270D	10
Fluorene	8270D	10
Indeno(1,2,3-cd)pyrene	8270D	10
Naphthalene	8270D	10
Phenanthrene	8270D	10
Pyrene	8270D	10

Notes:

1. Quality assurance/quality control (QA/QC) samples included one trip blank per sample delivery group (VOCs only) and one blind field duplicate.

FIGURES

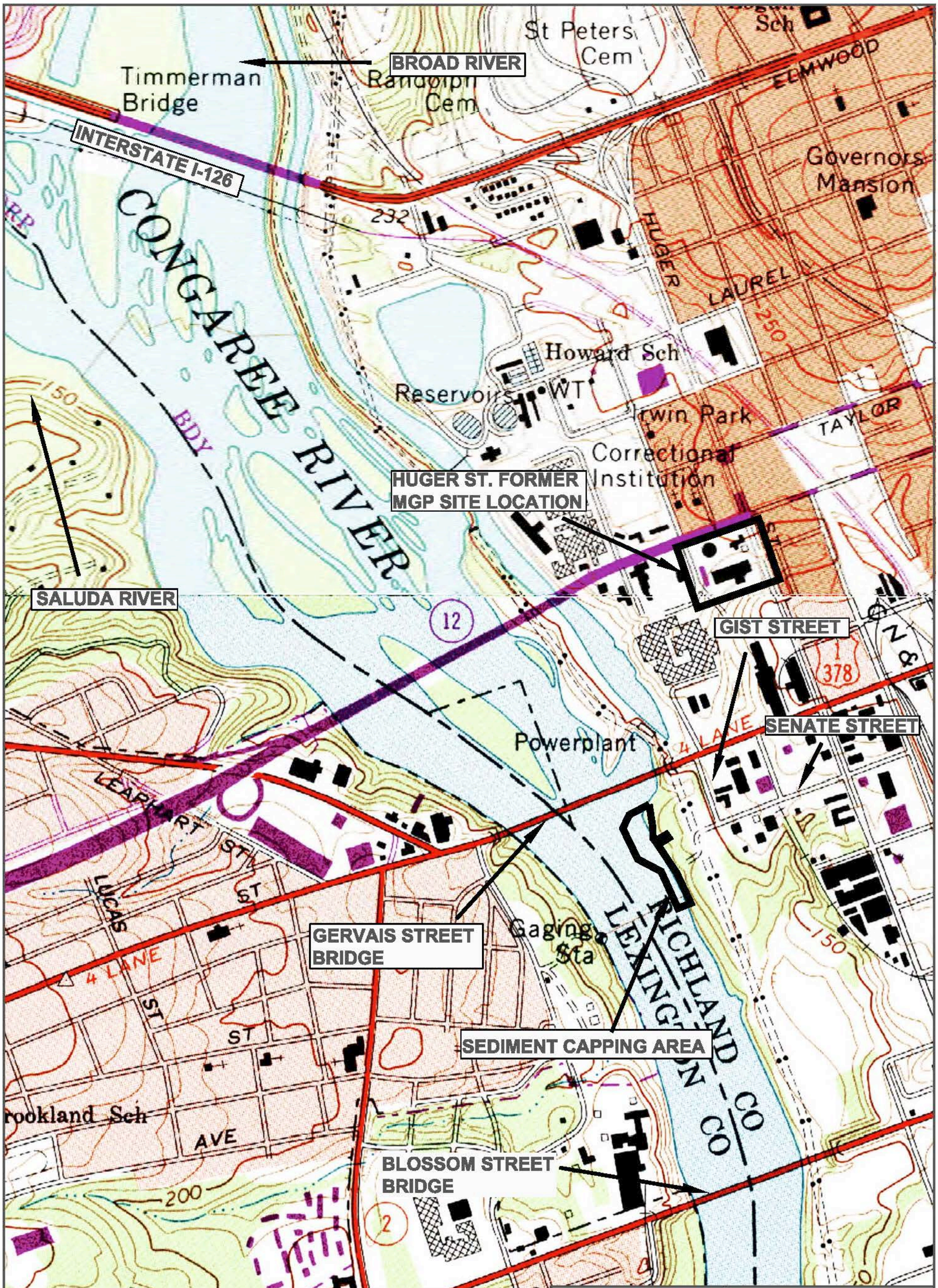


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 06/29/17 FILE NAME: CONG446

APEX COMPANIES, LLC

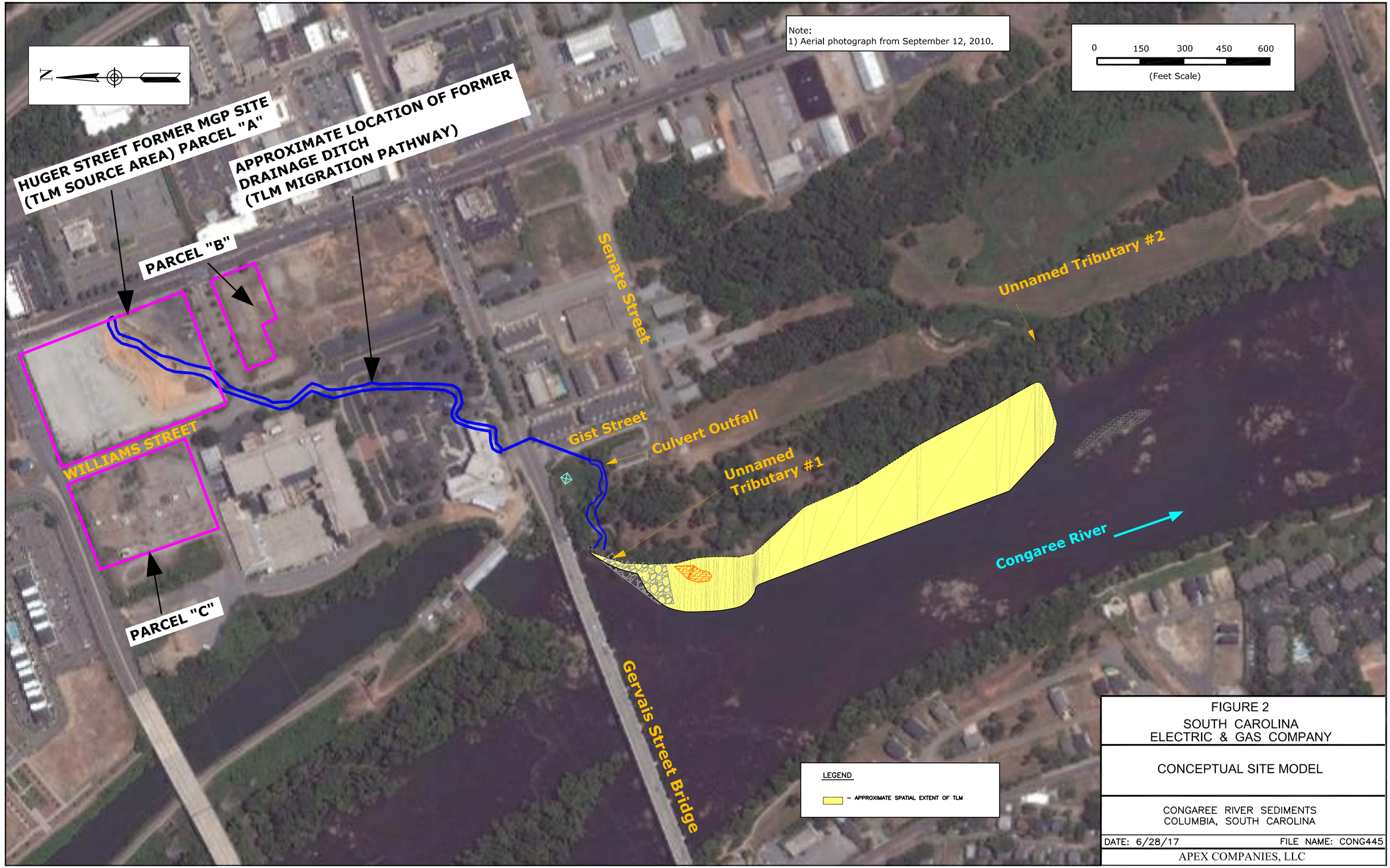


FIGURE 2

SOUTH CAROLINA
ELECTRIC & GAS COMPANY

CONCEPTUAL SITE MODEL

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/28/17 FILE NAME: CONG445

APEX COMPANIES, LLC

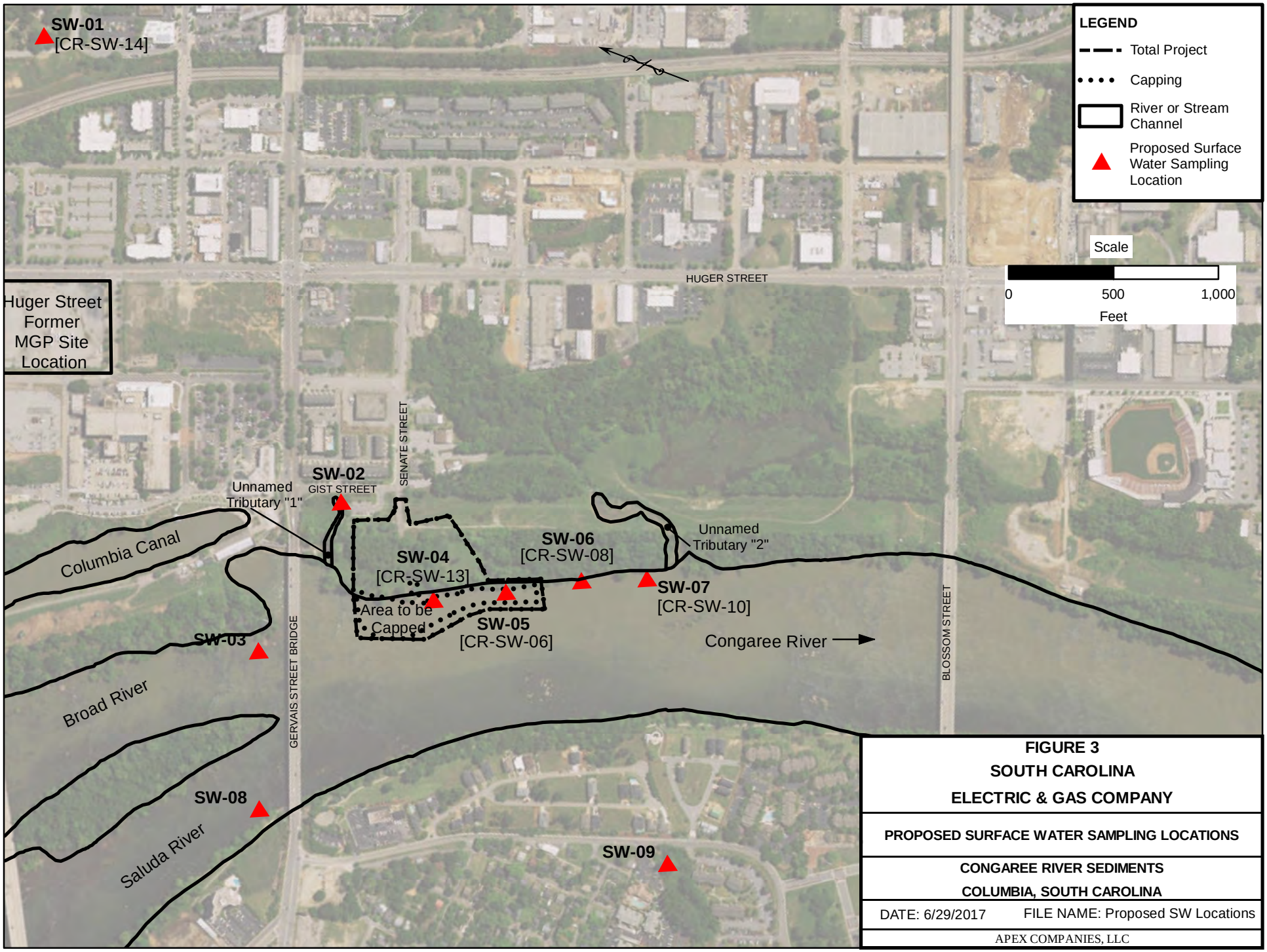


FIGURE 3

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROPOSED SURFACE WATER SAMPLING LOCATIONS

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 6/29/2017 FILE NAME: Proposed SW Locations

APEX COMPANIES, LLC

APPENDIX A

APRIL 7, 2017 SCDHEC LETTER

dhec
Healthy People. Healthy Communities.

April 7, 2017

Mr. Robert Apple
Environmental Division
South Carolina Electric and Gas Company
4077 Haywood Rd
Mills River NC 28759

RE: Surface Water Monitoring Results
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Apple,

The State Voluntary Cleanup Program with the assistance of the Site Assessment Section collected surface water samples on March 21, 2017, on the eastern side of the Congaree River from approximately the Gervais Street Bridge to the Blossom Street Bridge. Samples were collected in approximately 200 foot intervals around 15-25 feet from the river's edge. Additional samples were collected from tributaries flowing into the river and a background sample was collected upgradient of the Fleet Maintenance MGP Site in a stream running through Memorial Park.

Sampling results were received by the Department on April 4, 2017. With the exception of one detection of bis(2-Ethylhexyl)phthalate, all other samples yielded no detections. This detection is a common laboratory contaminant and is suspected to be a false detection. Additionally, a duplicate sample was collected at this location at the same time as the original sample and laboratory results were non-detect for all constituents for the duplicate sample.

The Department requests that South Carolina Electric and Gas submit a work plan that proposes a schedule and locations for regular surface water sampling in the Congaree River. This plan should be submitted to the Department by July 1, 2017.

If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

Greg Cassidy

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Harry Mathis, Midlands EA Region

APPENDIX B

SCDHEC SURFACE WATER SAMPLING PLAN DATED MARCH 7, 2017

SECTION A: Project Planning Elements		
A1. Title (*Project Name*):	SCE&G Huger Street MGP	
Project Location:	Congaree River between Gervais and Blossom Streets, Columbia SC	
Originating Organization:	SCDHEC State Voluntary Cleanup Section	
SCDHEC Section Managers	Lucas Berresford, Section Manager Jonathan McInnis, Section Manager	
Section Manager's Signature		Date: 03/07/17
Section Manager's Signature		Date: 03/07/17
Project Manager's Name, Position, and Organization:	Greg Cassidy, Project Manager, State Remediation, SCDHEC	
Project Manager's Signature:		Date: 03/07/17
Project Manager's Name, Position, and Organization	Jason Williams, Project Manager, Site Assessment, SCDHEC	
Project Manager's Signature:		Date: 03/07/17

A2. Table of Contents	

	Figure 1 – Proposed Sample Locations 9	
A3. Distribution List	Sampling Team, Waste Assessment	
A4. Project Personnel	**Organization**	**Responsibilities**
Jason Williams	SCDHEC	Site Assessment Project Manager and Site Safety Officer
Greg Cassidy	SCDHEC	State Voluntary Cleanup Project Manager
Dana Cook	SCDHEC	Sampling
Ben Bair	SCDHEC	Sampling
Tim Kadar	SCDHEC	Sampling
Robert Cole	SCDHEC	Sampling
Karen Seaber	SCDHEC	Sampling
Comments:		
Organization Chart: Refer to SCDHEC Site Assessment Program Level QAPP		
A5. Background:	The purpose of this investigation is to determine the surface water quality in the Congaree River as it relates to the coal tar deposits from former manufactured gas plant operations.	
A6. Project Description:	Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) both of which have been adopted by South Carolina as law, the Site Assessment Section and State Voluntary Cleanup Section, South Carolina Department of Health & Environmental Control will collect samples at the above listed site. For this study, the surface water pathway will be evaluated by sample collection and evaluation. Sampling for this site will include the collection of twelve (12) surface water samples. Two surface water sampling locations in the Congaree River will be sampled near the top of the water column and near the bottom of the water column. The samples collected will be used to determine if there has been a release to the environment. This will serve as a baseline sampling event for a long term monitoring plan for the Congaree River project. Sampling at the site will be conducted during the week of March 13, 2017.	
Decision(s) to be made based on data:	The information gathered from this investigation will be used to determine if coal tar in the river bed is having an adverse effect to surface water and serve as the baseline for future monitoring events.	
Applicable regulatory information, actions levels, etc.	Refer to SCDHEC Site Assessment Program Level QAPP	
Field Study Date:	March 21, 2017	

Projected Lab Completion Date:	April 21, 2017
Final Report Completion Date:	May 21, 2017

A7. Quality Objectives and Criteria

All water samples collected in this study will be analyzed for the following:
VOCs
SVOCs

MS/MSD samples will be collected based on the number of samples.. A water temp blank will be prepared for each day in the field for the respective media and one preservative blank will also be collected.

Refer to SCDHEC Site Assessment Program Level QAPP.

A8. Special Training/Certifications

Refer to SCDHEC Site Assessment Program Level QAPP

A9. Documents and Records

Refer to SCDHEC Site Assessment Program Level QAPP.

All field observations, measurements and sampling activities supporting the field investigation will be recorded and documented according to the SESD *Operating Procedure for Logbooks*, SESDPROC-010-R3 and the SCDHEC SOP&QA Manual.

SECTION B: Data Generation and Acquisition

B1. Sampling Design

Refer to SCDHEC Site Assessment Program Level QAPP.

Sample Number	Sample Media	Analyses	Location/Rationale
CR-SW-01	Surface Water	VOA SVOA	Location: Taken from outfall from Under Gervais Street.
CR-SW-02	Surface Water	VOA SVOA	Location: At the outfall of the stream that runs from the outfall to the Congaree river.

CR-SW-03	Surface Water	VOA SVOA	Location: Taken from an area upgradient of the Gervais street bridge. Rationale: This point is to set a background concentration in an area that does not have coal tar in the sediment.
CR-SW-04	Surface Water	VOA SVOA	Location: Taken from off the sandbar where coal tar deposits have been previously identified. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-05	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-04. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-06	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-05 . Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-07	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-06. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-08	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-07. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-09	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-08. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-10	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-09. Rationale: To determine water quality and potential impacts from coal tar.
CR-SW-11	Surface Water	VOA SVOA	Location: Taken approximately 200 feet downstream of CR-SW-010. Rationale: To determine water quality and potential impacts from coal tar.

CR-SW-12			Location: Taken approximately 200 feet downstream of CR-SW-11. Rationale: To determine water quality and potential impacts from coal tar
CR-SW-13			Location: Taken approximately 200 feet downstream of CR-SW-12. Rationale: To determine water quality and potential impacts from coal tar.

Volume, Holding Time, and Preservation Requirements. See SCDHEC Site Assessment Program Level QAPP

Maps or Diagrams with sample locations: See Attached

B2. Sampling Methods, General Procedures

Refer to SCDHEC Site Assessment Program Level QAPP.

B3. Sampling Handling and Custody

All samples will be handled and custody maintained in accordance with the SCDHEC Site Assessment Program Level QAPP

B4. Analytical Methods

SESD:	Suggested references are found at http://epa.gov/region4/sesd/asbsop/asb-loqam.pdf
CLP:	Suggested references are found at www.epa.gov/superfund/programs/clp.
Other:	Level 3 QA/QC will be used.

B5. Quality Control

Field:	Refer to SCDHEC Site Assessment Program Level QAPP
Laboratory:	Refer to SCDHEC Site Assessment Program Level QAPP and selected CLP QA/QC

B6. Instrument/Equipment Testing, Inspection and Maintenance

Refer to SCDHEC Site Assessment Program Level QAPP

B7. Instrument/Equipment Calibration and Frequency

Refer to SCDHEC Site Assessment Program Level QAPP

B8. Inspection/Acceptance for Supplies and Consumables

Refer to SCDHEC Site Assessment Program Level QAPP.

B9. Non-direct Measurements:

Refer to SCDHEC Site Assessment Program Level QAPP

B10. Data Management

The project manager will be responsible for ensuring that all requirements for data management are met. All data generated for this field investigation, whether hand-recorded or obtained using an electronic data logger will be recorded, stored and managed according to the following procedures:

SESD Operating Procedure for Control of Records, SESDPROC-002-R3.
SESD Operating Procedures for Logbooks, SESDPROC-010-R3.

Refer to SCDHEC Site Assessment Program Level QAPP

SECTION C: Assessment/Oversight

C1. Assessments and Response Actions

Assessments will be conducted during the field investigation according to the *SESD Operating Procedure for Project Planning*, SESDPROC-016-R1 to ensure the QAPP is being implemented as approved. The Project Manager is responsible for all corrective actions while in the field.

Refer to SCDHEC Site Assessment Program Level QAPP.

C2. Reports to Management

The SCDHEC Project Manager (PM), Greg Cassidy, will be responsible for notifying the appropriate SCDHEC Program Manager if any circumstances arise during the field investigation that may adversely impact the quality of the data collected. SCDHEC PM will prepare said report and send to Program Manager for review.

SECTION D: Data Validation and Usability

D1. Data Review, Verification, and Validation

Refer to SCDHEC Site Assessment Program Level QAPP

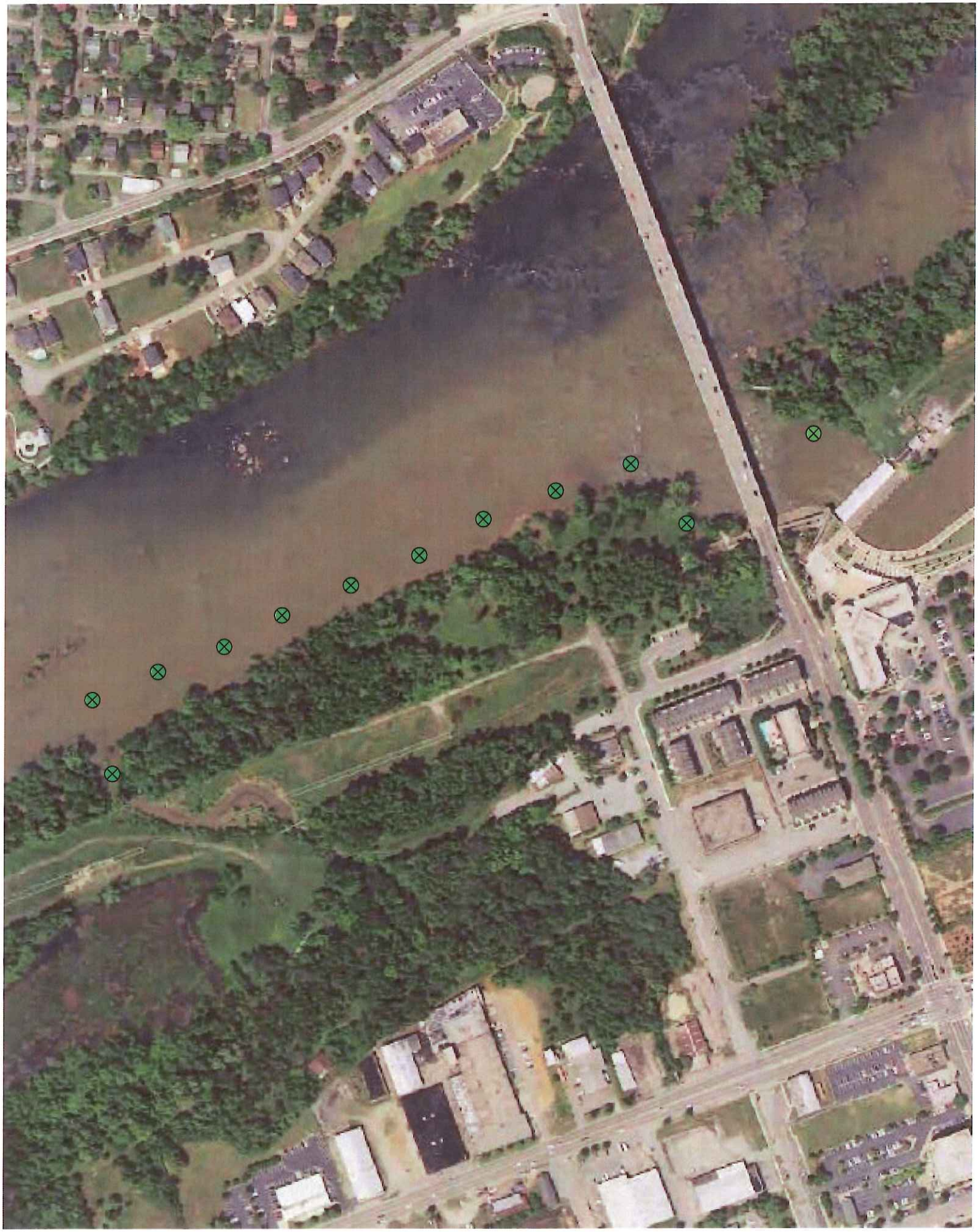
D2. Verification and Validation Methods

Refer to SCDHEC Site Assessment Program Level QAPP

D3. Reconciliation with User Requirements

Refer to SCDHEC Site Assessment Program Level QAPP.

**Footnotes: This Quality Assurance Project Plan (QAPP) has been prepared and approved according to the EPA *Requirements for Quality Assurance Project Plans (EPA QA/R5 EPA/240/B-01/003)*, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March 2001(USEPA, 2001). This document will be used to ensure that the environmental data collected for this project are of the type and quality for the intended purposes.



APPENDIX C

SCDHEC SURFACE WATER ANALYTICAL RESULTS – APRIL 2017

SHEALY ENVIRONMENTAL SERVICES, INC.

Report of Analysis

NuEarth Solutions, LLC
2041 Industrial Blvd.
Lexington, SC 29072
Attention: Jono Rabley

Project Name: **SCDHEC - SCEG Fleet Maintenance Site**

Project Number: **52561**

Lot Number: **SC21057**

Date Completed: **04/04/2017**

Kelly M. Nance
Project Manager

The following non-paginated documents are considered part of this report: Chain of Custody Record and Sample Receipt Checklist.

Case Narrative
NuEarth Solutions, LLC
Lot Number: SC21057

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved NELAC standards, the Shealy Environmental Services, Inc. ("Shealy") Quality Assurance Management Plan (QAMP), standard operating procedures (SOPs), and Shealy policies. Any exceptions to the NELAC standards, the QAMP, SOPs or policies are qualified on the results page or discussed below.

If you have any questions regarding this report please contact the Shealy Project Manager listed on the cover page.

Semivolatiles
The LCS associated with prep batch 38153 had 3,3'-dichlorobenzidine recovered below the acceptance limits. This demonstrates a low bias on analytical results. Samples -013, -014 and -016 were re-extracted and re-analyzed outside of the holding time for confirmation. All compounds were ND in both runs.

The MS/MSD associated with sample -004 had compounds recovered outside of the acceptance limits and RPDs exceeded method control limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Sample Summary
NuEarth Solutions, LLC
Lot Number: SC21057

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	CR-SW-01	Aqueous	03/21/2017 1050	03/21/2017
002	CR-SW-02	Aqueous	03/21/2017 1030	03/21/2017
003	CR-SW-03	Aqueous	03/21/2017 1215	03/21/2017
004	CR-SW-04	Aqueous	03/21/2017 1015	03/21/2017
005	CR-SW-05	Aqueous	03/21/2017 1202	03/21/2017
006	CR-SW-06	Aqueous	03/21/2017 1155	03/21/2017
007	CR-SW-07	Aqueous	03/21/2017 1105	03/21/2017
008	CR-SW-08	Aqueous	03/21/2017 1057	03/21/2017
009	CR-SW-09	Aqueous	03/21/2017 1050	03/21/2017
010	CR-SW-10	Aqueous	03/21/2017 1040	03/21/2017
011	CR-SW-11	Aqueous	03/21/2017 1030	03/21/2017
012	CR-SW-12	Aqueous	03/21/2017 1040	03/21/2017
013	CR-SW-13	Aqueous	03/21/2017 1230	03/21/2017
014	CR-SW-14	Aqueous	03/21/2017 1415	03/21/2017
015	Trip Blank	Aqueous	03/21/2017	03/21/2017
016	CR-SW-05 DUP	Aqueous	03/21/2017 1202	03/21/2017

(16 samples)

Executive Summary
NuEarth Solutions, LLC
Lot Number: SC21057

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
005	CR-SW-05	Aqueous	bis(2-Ethylhexyl)phthalate	8270D	150		ug/L	23

(1 detection)

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-001**

Description: **CR-SW-01** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2229	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-001**

Description: **CR-SW-01** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2229	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		95	70-130
Bromofluorobenzene		94	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
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J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-001**

Description: **CR-SW-01** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1659	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
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H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-001**

Description: **CR-SW-01** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1659	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		76	37-129
2-Fluorophenol		55	24-127
Nitrobenzene-d5		86	38-127
Phenol-d5		75	28-128
Terphenyl-d14		79	10-148
2,4,6-Tribromophenol		73	41-144

PQL = Practical quantitation limit
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ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-002**

Description: **CR-SW-02** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2252	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-002**

Description: **CR-SW-02** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2252	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		94	70-130
Bromofluorobenzene		94	70-130
Toluene-d8		102	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
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Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-002**

Description: **CR-SW-02** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1723	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
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Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-002**

Description: **CR-SW-02** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1723	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		76	37-129
2-Fluorophenol		65	24-127
Nitrobenzene-d5		84	38-127
Phenol-d5		78	28-128
Terphenyl-d14		79	10-148
2,4,6-Tribromophenol		73	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-003**

Description: **CR-SW-03** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1215**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2315	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-003**

Description: **CR-SW-03** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1215**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2315	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		96	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		102	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-003**

Description: **CR-SW-03** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1215**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1748	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-003**

Description: **CR-SW-03** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1215**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1748	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		78	37-129
2-Fluorophenol		45	24-127
Nitrobenzene-d5		85	38-127
Phenol-d5		69	28-128
Terphenyl-d14		83	10-148
2,4,6-Tribromophenol		74	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-004**

Description: **CR-SW-04** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1015**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2339	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-004**

Description: **CR-SW-04** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1015**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/22/2017 2339	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		95	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-004**

Description: **CR-SW-04** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1015**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1812	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-004**

Description: **CR-SW-04** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1015**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1812	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		78	37-129
2-Fluorophenol		57	24-127
Nitrobenzene-d5		86	38-127
Phenol-d5		72	28-128
Terphenyl-d14		85	10-148
2,4,6-Tribromophenol		72	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-005**

Description: **CR-SW-05** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0002	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-005**

Description: **CR-SW-05** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0002	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		96	70-130
Bromofluorobenzene		95	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-005**

Description: **CR-SW-05** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1924	RBH	03/23/2017 1235	37862
2	3520C	8270D	5	04/03/2017 0942	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	**117-81-7**	**8270D**	**150**		**20**	**ug/L**	**2**
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-005**

Description: **CR-SW-05** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1924	RBH	03/23/2017 1235	37862
2	3520C	8270D	5	04/03/2017 0942	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
2-Fluorobiphenyl		73	37-129		74	37-129
2-Fluorophenol		51	24-127		35	24-127
Nitrobenzene-d5		84	38-127		54	38-127
Phenol-d5		72	28-128		47	28-128
Terphenyl-d14		78	10-148		72	10-148
2,4,6-Tribromophenol		73	41-144		82	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-006**

Description: **CR-SW-06** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1155**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0025	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-006**

Description: **CR-SW-06** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1155**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0025	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		99	70-130
Bromofluorobenzene		95	70-130
Toluene-d8		103	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-006**

Description: **CR-SW-06** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1155**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1948	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-006**

Description: **CR-SW-06** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1155**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 1948	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		71	37-129
2-Fluorophenol		49	24-127
Nitrobenzene-d5		81	38-127
Phenol-d5		63	28-128
Terphenyl-d14		57	10-148
2,4,6-Tribromophenol		65	41-144

PQL = Practical quantitation limit
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ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-007**

Description: **CR-SW-07** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1105**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0048	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-007**

Description: **CR-SW-07** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1105**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0048	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		95	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		100	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-007**

Description: **CR-SW-07** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1105**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2012	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-007**

Description: **CR-SW-07** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1105**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2012	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		68	37-129
2-Fluorophenol		44	24-127
Nitrobenzene-d5		78	38-127
Phenol-d5		54	28-128
Terphenyl-d14		55	10-148
2,4,6-Tribromophenol		66	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-008**

Description: **CR-SW-08** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1057**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0111	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-008**

Description: **CR-SW-08** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1057**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0111	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		96	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-008**

Description: **CR-SW-08** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1057**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2036	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-008**

Description: **CR-SW-08** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1057**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2036	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		74	37-129
2-Fluorophenol		50	24-127
Nitrobenzene-d5		83	38-127
Phenol-d5		65	28-128
Terphenyl-d14		83	10-148
2,4,6-Tribromophenol		66	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-009**

Description: **CR-SW-09** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0134	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-009**

Description: **CR-SW-09** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0134	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		94	70-130
Bromofluorobenzene		91	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-009**

Description: **CR-SW-09** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2101	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-009**

Description: **CR-SW-09** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1050**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2101	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		70	37-129
2-Fluorophenol		51	24-127
Nitrobenzene-d5		82	38-127
Phenol-d5		67	28-128
Terphenyl-d14		84	10-148
2,4,6-Tribromophenol		66	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-010**

Description: **CR-SW-10** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0157	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-010**

Description: **CR-SW-10** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0157	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		97	70-130
Bromofluorobenzene		95	70-130
Toluene-d8		102	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-010**

Description: **CR-SW-10** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2125	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-010**

Description: **CR-SW-10** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2125	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		69	37-129
2-Fluorophenol		53	24-127
Nitrobenzene-d5		82	38-127
Phenol-d5		61	28-128
Terphenyl-d14		62	10-148
2,4,6-Tribromophenol		64	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-011**

Description: **CR-SW-11** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0221	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-011**

Description: **CR-SW-11** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0221	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		95	70-130
Bromofluorobenzene		95	70-130
Toluene-d8		102	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-011**

Description: **CR-SW-11** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2149	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-011**

Description: **CR-SW-11** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1030**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2149	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		73	37-129
2-Fluorophenol		55	24-127
Nitrobenzene-d5		82	38-127
Phenol-d5		66	28-128
Terphenyl-d14		84	10-148
2,4,6-Tribromophenol		70	41-144

PQL = Practical quantitation limit
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J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-012**

Description: **CR-SW-12** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0244	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-012**

Description: **CR-SW-12** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0244	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		96	70-130
Bromofluorobenzene		92	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-012**

Description: **CR-SW-12** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2213	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-012**

Description: **CR-SW-12** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1040**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2213	RBH	03/23/2017 1235	37862

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		69	37-129
2-Fluorophenol		50	24-127
Nitrobenzene-d5		79	38-127
Phenol-d5		56	28-128
Terphenyl-d14		75	10-148
2,4,6-Tribromophenol		64	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-013**

Description: **CR-SW-13** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1230**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0307	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-013**

Description: **CR-SW-13** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1230**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0307	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		97	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		104	70-130

PQL = Practical quantitation limit
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J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-013**

Description: **CR-SW-13** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1230**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2325	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-013**

Description: **CR-SW-13** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1230**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2325	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		71	37-129
2-Fluorophenol		49	24-127
Nitrobenzene-d5		79	38-127
Phenol-d5		63	28-128
Terphenyl-d14		73	10-148
2,4,6-Tribromophenol		64	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-014**

Description: **CR-SW-14** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1415**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0330	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-014**

Description: **CR-SW-14** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1415**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0330	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		97	70-130
Bromofluorobenzene		94	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-014**

Description: **CR-SW-14** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1415**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2349	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-014**

Description: **CR-SW-14** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1415**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/30/2017 2349	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		71	37-129
2-Fluorophenol		51	24-127
Nitrobenzene-d5		83	38-127
Phenol-d5		64	28-128
Terphenyl-d14		82	10-148
2,4,6-Tribromophenol		62	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-015**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **03/21/2017**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0353	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-015**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **03/21/2017**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0353	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		96	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		100	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-016**

Description: **CR-SW-05 DUP** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0417	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Acetone	67-64-1	8260B	ND		20	ug/L	1
Benzene	71-43-2	8260B	ND		1.0	ug/L	1
Bromodichloromethane	75-27-4	8260B	ND		1.0	ug/L	1
Bromoform	75-25-2	8260B	ND		1.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260B	ND		2.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260B	ND		10	ug/L	1
Carbon disulfide	75-15-0	8260B	ND		1.0	ug/L	1
Carbon tetrachloride	56-23-5	8260B	ND		1.0	ug/L	1
Chlorobenzene	108-90-7	8260B	ND		1.0	ug/L	1
Chloroethane	75-00-3	8260B	ND		2.0	ug/L	1
Chloroform	67-66-3	8260B	ND		1.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260B	ND		1.0	ug/L	1
Cyclohexane	110-82-7	8260B	ND		1.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260B	ND		1.0	ug/L	1
Dibromochloromethane	124-48-1	8260B	ND		1.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260B	ND		1.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260B	ND		1.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260B	ND		1.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260B	ND		1.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260B	ND		2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260B	ND		1.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260B	ND		1.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260B	ND		1.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		1.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260B	ND		1.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260B	ND		1.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260B	ND		1.0	ug/L	1
Ethylbenzene	100-41-4	8260B	ND		1.0	ug/L	1
2-Hexanone	591-78-6	8260B	ND		10	ug/L	1
Isopropylbenzene	98-82-8	8260B	ND		1.0	ug/L	1
Methyl acetate	79-20-9	8260B	ND		1.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260B	ND		1.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260B	ND		10	ug/L	1
Methylcyclohexane	108-87-2	8260B	ND		5.0	ug/L	1
Methylene chloride	75-09-2	8260B	ND		1.0	ug/L	1
Styrene	100-42-5	8260B	ND		1.0	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260B	ND		1.0	ug/L	1
Tetrachloroethene	127-18-4	8260B	ND		1.0	ug/L	1
Toluene	108-88-3	8260B	ND		1.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260B	ND		1.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260B	ND		1.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260B	ND		1.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260B	ND		1.0	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Volatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-016**

Description: **CR-SW-05 DUP** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260B	1	03/23/2017 0417	ECP		37834

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Trichloroethene	79-01-6	8260B	ND		1.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260B	ND		1.0	ug/L	1
Vinyl chloride	75-01-4	8260B	ND		1.0	ug/L	1
Xylenes (total)	1330-20-7	8260B	ND		1.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		93	70-130
Bromofluorobenzene		94	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-016**

Description: **CR-SW-05 DUP** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/31/2017 0014	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,1'-Biphenyl	92-52-4	8270D	ND		4.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		4.0	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		4.0	ug/L	1
2,4-Dichlorophenol	120-83-2	8270D	ND		8.0	ug/L	1
2,4-Dimethylphenol	105-67-9	8270D	ND		4.0	ug/L	1
2,4-Dinitrophenol	51-28-5	8270D	ND		20	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		8.0	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270D	ND		8.0	ug/L	1
2-Chloronaphthalene	91-58-7	8270D	ND		4.0	ug/L	1
2-Chlorophenol	95-57-8	8270D	ND		4.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270D	ND		0.80	ug/L	1
2-Methylphenol	95-48-7	8270D	ND		4.0	ug/L	1
2-Nitroaniline	88-74-4	8270D	ND		8.0	ug/L	1
2-Nitrophenol	88-75-5	8270D	ND		4.0	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270D	ND		4.0	ug/L	1
3+4-Methylphenol	106-44-5	8270D	ND		4.0	ug/L	1
3-Nitroaniline	99-09-2	8270D	ND		8.0	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270D	ND		20	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270D	ND		4.0	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270D	ND		4.0	ug/L	1
4-Chloroaniline	106-47-8	8270D	ND		8.0	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270D	ND		4.0	ug/L	1
4-Nitroaniline	100-01-6	8270D	ND		8.0	ug/L	1
4-Nitrophenol	100-02-7	8270D	ND		20	ug/L	1
Acenaphthene	83-32-9	8270D	ND		0.80	ug/L	1
Acenaphthylene	208-96-8	8270D	ND		0.80	ug/L	1
Acetophenone	98-86-2	8270D	ND		4.0	ug/L	1
Anthracene	120-12-7	8270D	ND		0.80	ug/L	1
Atrazine	1912-24-9	8270D	ND		4.0	ug/L	1
Benzaldehyde	100-52-7	8270D	ND		8.0	ug/L	1
Benzo(a)anthracene	56-55-3	8270D	ND		0.80	ug/L	1
Benzo(a)pyrene	50-32-8	8270D	ND		0.80	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270D	ND		0.80	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270D	ND		0.80	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270D	ND		0.80	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270D	ND		4.0	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270D	ND		4.0	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270D	ND		4.0	ug/L	1
Butyl benzyl phthalate	85-68-7	8270D	ND		4.0	ug/L	1
Caprolactam	105-60-2	8270D	ND		8.0	ug/L	1
Carbazole	86-74-8	8270D	ND		4.0	ug/L	1
Chrysene	218-01-9	8270D	ND		0.80	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270D	ND		0.80	ug/L	1

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Semivolatile Organic Compounds by GC/MS

Client: **NuEarth Solutions, LLC** Laboratory ID: **SC21057-016**

Description: **CR-SW-05 DUP** Matrix: **Aqueous**

Date Sampled: **03/21/2017 1202**

Date Received: **03/21/2017**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270D	1	03/31/2017 0014	RBH	03/27/2017 1811	38153

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Dibenzofuran	132-64-9	8270D	ND		4.0	ug/L	1
Diethylphthalate	84-66-2	8270D	ND		4.0	ug/L	1
Dimethyl phthalate	131-11-3	8270D	ND		4.0	ug/L	1
Di-n-butyl phthalate	84-74-2	8270D	ND		4.0	ug/L	1
Di-n-octylphthalate	117-84-0	8270D	ND		4.0	ug/L	1
Fluoranthene	206-44-0	8270D	ND		0.80	ug/L	1
Fluorene	86-73-7	8270D	ND		0.80	ug/L	1
Hexachlorobenzene	118-74-1	8270D	ND		4.0	ug/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		4.0	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270D	ND		20	ug/L	1
Hexachloroethane	67-72-1	8270D	ND		4.0	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270D	ND		0.80	ug/L	1
Isophorone	78-59-1	8270D	ND		4.0	ug/L	1
Naphthalene	91-20-3	8270D	ND		0.80	ug/L	1
Nitrobenzene	98-95-3	8270D	ND		4.0	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270D	ND		4.0	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270D	ND		4.0	ug/L	1
Pentachlorophenol	87-86-5	8270D	ND		20	ug/L	1
Phenanthrene	85-01-8	8270D	ND		0.80	ug/L	1
Phenol	108-95-2	8270D	ND		4.0	ug/L	1
Pyrene	129-00-0	8270D	ND		0.80	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		69	37-129
2-Fluorophenol		46	24-127
Nitrobenzene-d5		79	38-127
Phenol-d5		65	28-128
Terphenyl-d14		81	10-148
2,4,6-Tribromophenol		65	41-144

PQL = Practical quantitation limit
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
H = Out of holding time
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

QC Summary

Volatile Organic Compounds by GC/MS - MB

Sample ID: SQ37834-001
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Acetone	ND		1	20	ug/L	03/22/2017 2151
Benzene	ND		1	1.0	ug/L	03/22/2017 2151
Bromodichloromethane	ND		1	1.0	ug/L	03/22/2017 2151
Bromoform	ND		1	1.0	ug/L	03/22/2017 2151
Bromomethane (Methyl bromide)	ND		1	2.0	ug/L	03/22/2017 2151
2-Butanone (MEK)	ND		1	10	ug/L	03/22/2017 2151
Carbon disulfide	ND		1	1.0	ug/L	03/22/2017 2151
Carbon tetrachloride	ND		1	1.0	ug/L	03/22/2017 2151
Chlorobenzene	ND		1	1.0	ug/L	03/22/2017 2151
Chloroethane	ND		1	2.0	ug/L	03/22/2017 2151
Chloroform	ND		1	1.0	ug/L	03/22/2017 2151
Chloromethane (Methyl chloride)	ND		1	1.0	ug/L	03/22/2017 2151
Cyclohexane	ND		1	1.0	ug/L	03/22/2017 2151
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	1.0	ug/L	03/22/2017 2151
Dibromochloromethane	ND		1	1.0	ug/L	03/22/2017 2151
1,2-Dibromoethane (EDB)	ND		1	1.0	ug/L	03/22/2017 2151
1,2-Dichlorobenzene	ND		1	1.0	ug/L	03/22/2017 2151
1,3-Dichlorobenzene	ND		1	1.0	ug/L	03/22/2017 2151
1,4-Dichlorobenzene	ND		1	1.0	ug/L	03/22/2017 2151
Dichlorodifluoromethane	ND		1	2.0	ug/L	03/22/2017 2151
1,1-Dichloroethane	ND		1	1.0	ug/L	03/22/2017 2151
1,2-Dichloroethane	ND		1	1.0	ug/L	03/22/2017 2151
1,1-Dichloroethene	ND		1	1.0	ug/L	03/22/2017 2151
cis-1,2-Dichloroethene	ND		1	1.0	ug/L	03/22/2017 2151
trans-1,2-Dichloroethene	ND		1	1.0	ug/L	03/22/2017 2151
1,2-Dichloropropane	ND		1	1.0	ug/L	03/22/2017 2151
cis-1,3-Dichloropropene	ND		1	1.0	ug/L	03/22/2017 2151
trans-1,3-Dichloropropene	ND		1	1.0	ug/L	03/22/2017 2151
Ethylbenzene	ND		1	1.0	ug/L	03/22/2017 2151
2-Hexanone	ND		1	10	ug/L	03/22/2017 2151
Isopropylbenzene	ND		1	1.0	ug/L	03/22/2017 2151
Methyl acetate	ND		1	1.0	ug/L	03/22/2017 2151
Methyl tertiary butyl ether (MTBE)	ND		1	1.0	ug/L	03/22/2017 2151
4-Methyl-2-pentanone	ND		1	10	ug/L	03/22/2017 2151
Methylcyclohexane	ND		1	5.0	ug/L	03/22/2017 2151
Methylene chloride	ND		1	1.0	ug/L	03/22/2017 2151
Styrene	ND		1	1.0	ug/L	03/22/2017 2151
1,1,2,2-Tetrachloroethane	ND		1	1.0	ug/L	03/22/2017 2151
Tetrachloroethene	ND		1	1.0	ug/L	03/22/2017 2151
Toluene	ND		1	1.0	ug/L	03/22/2017 2151
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	ug/L	03/22/2017 2151
1,2,4-Trichlorobenzene	ND		1	1.0	ug/L	03/22/2017 2151
1,1,1-Trichloroethane	ND		1	1.0	ug/L	03/22/2017 2151
1,1,2-Trichloroethane	ND		1	1.0	ug/L	03/22/2017 2151

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: SQ37834-001
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Trichloroethene	ND		1	1.0	ug/L	03/22/2017 2151
Trichlorofluoromethane	ND		1	1.0	ug/L	03/22/2017 2151
Vinyl chloride	ND		1	1.0	ug/L	03/22/2017 2151
Xylenes (total)	ND		1	1.0	ug/L	03/22/2017 2151

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		96	70-130
1,2-Dichloroethane-d4		97	70-130
Toluene-d8		103	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: SQ37834-002
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Acetone	100	62		1	62	60-140	03/22/2017 2051
Benzene	50	46		1	92	70-130	03/22/2017 2051
Bromodichloromethane	50	49		1	97	70-130	03/22/2017 2051
Bromoform	50	44		1	87	70-130	03/22/2017 2051
Bromomethane (Methyl bromide)	50	45		1	90	60-140	03/22/2017 2051
2-Butanone (MEK)	100	83		1	83	60-140	03/22/2017 2051
Carbon disulfide	50	43		1	87	60-140	03/22/2017 2051
Carbon tetrachloride	50	49		1	97	70-130	03/22/2017 2051
Chlorobenzene	50	46		1	91	70-130	03/22/2017 2051
Chloroethane	50	44		1	87	60-140	03/22/2017 2051
Chloroform	50	43		1	86	70-130	03/22/2017 2051
Chloromethane (Methyl chloride)	50	39		1	79	60-140	03/22/2017 2051
Cyclohexane	50	42		1	85	70-130	03/22/2017 2051
1,2-Dibromo-3-chloropropane (DBCP)	50	44		1	88	70-130	03/22/2017 2051
Dibromochloromethane	50	50		1	101	70-130	03/22/2017 2051
1,2-Dibromoethane (EDB)	50	47		1	94	70-130	03/22/2017 2051
1,2-Dichlorobenzene	50	46		1	92	70-130	03/22/2017 2051
1,3-Dichlorobenzene	50	47		1	94	70-130	03/22/2017 2051
1,4-Dichlorobenzene	50	45		1	90	70-130	03/22/2017 2051
Dichlorodifluoromethane	50	46		1	92	60-140	03/22/2017 2051
1,1-Dichloroethane	50	44		1	88	70-130	03/22/2017 2051
1,2-Dichloroethane	50	45		1	89	70-130	03/22/2017 2051
1,1-Dichloroethene	50	45		1	90	70-130	03/22/2017 2051
cis-1,2-Dichloroethene	50	45		1	90	70-130	03/22/2017 2051
trans-1,2-Dichloroethene	50	46		1	91	70-130	03/22/2017 2051
1,2-Dichloropropane	50	49		1	98	70-130	03/22/2017 2051
cis-1,3-Dichloropropene	50	52		1	105	70-130	03/22/2017 2051
trans-1,3-Dichloropropene	50	50		1	100	70-130	03/22/2017 2051
Ethylbenzene	50	47		1	93	70-130	03/22/2017 2051
2-Hexanone	100	95		1	95	60-140	03/22/2017 2051
Isopropylbenzene	50	49		1	98	70-130	03/22/2017 2051
Methyl acetate	50	43		1	86	15-128	03/22/2017 2051
Methyl tertiary butyl ether (MTBE)	50	40		1	80	70-130	03/22/2017 2051
4-Methyl-2-pentanone	100	99		1	99	60-140	03/22/2017 2051
Methylcyclohexane	50	49		1	98	70-130	03/22/2017 2051
Methylene chloride	50	42		1	84	70-130	03/22/2017 2051
Styrene	50	51		1	103	70-130	03/22/2017 2051
1,1,2,2-Tetrachloroethane	50	46		1	91	60-140	03/22/2017 2051
Tetrachloroethene	50	48		1	95	70-130	03/22/2017 2051
Toluene	50	48		1	97	70-130	03/22/2017 2051
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	43		1	86	70-130	03/22/2017 2051
1,2,4-Trichlorobenzene	50	50		1	100	70-130	03/22/2017 2051
1,1,1-Trichloroethane	50	43		1	87	70-130	03/22/2017 2051
1,1,2-Trichloroethane	50	46		1	92	70-130	03/22/2017 2051

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: SQ37834-002
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Trichloroethene	50	48		1	96	70-130	03/22/2017 2051
Trichlorofluoromethane	50	44		1	89	70-130	03/22/2017 2051
Vinyl chloride	50	40		1	81	70-130	03/22/2017 2051
Xylenes (total)	100	95		1	95	70-130	03/22/2017 2051

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		95	70-130
1,2-Dichloroethane-d4		93	70-130
Toluene-d8		101	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - Duplicate

Sample ID: SC21057-001DU
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Result (ug/L)	Q	Dil	% RPD	% RPD Limit	Analysis Date
Acetone	ND	ND		1	0.00	20	03/23/2017 0612
Benzene	ND	ND		1	0.00	20	03/23/2017 0612
Bromodichloromethane	ND	ND		1	0.00	20	03/23/2017 0612
Bromoform	ND	ND		1	0.00	20	03/23/2017 0612
Bromomethane (Methyl bromide)	ND	ND		1	0.00	20	03/23/2017 0612
2-Butanone (MEK)	ND	ND		1	0.00	20	03/23/2017 0612
Carbon disulfide	ND	ND		1	0.00	20	03/23/2017 0612
Carbon tetrachloride	ND	ND		1	0.00	20	03/23/2017 0612
Chlorobenzene	ND	ND		1	0.00	20	03/23/2017 0612
Chloroethane	ND	ND		1	0.00	20	03/23/2017 0612
Chloroform	ND	ND		1	0.00	20	03/23/2017 0612
Chloromethane (Methyl chloride)	ND	ND		1	0.00	20	03/23/2017 0612
Cyclohexane	ND	ND		1	0.00	20	03/23/2017 0612
1,2-Dibromo-3-chloropropane (DBCP)	ND	ND		1	0.00	20	03/23/2017 0612
Dibromochloromethane	ND	ND		1	0.00	20	03/23/2017 0612
1,2-Dibromoethane (EDB)	ND	ND		1	0.00	20	03/23/2017 0612
1,4-Dichlorobenzene	ND	ND		1	0.00	20	03/23/2017 0612
1,3-Dichlorobenzene	ND	ND		1	0.00	20	03/23/2017 0612
1,2-Dichlorobenzene	ND	ND		1	0.00	20	03/23/2017 0612
Dichlorodifluoromethane	ND	ND		1	0.00	20	03/23/2017 0612
1,2-Dichloroethane	ND	ND		1	0.00	20	03/23/2017 0612
1,1-Dichloroethane	ND	ND		1	0.00	20	03/23/2017 0612
trans-1,2-Dichloroethene	ND	ND		1	0.00	20	03/23/2017 0612
cis-1,2-Dichloroethene	ND	ND		1	0.00	20	03/23/2017 0612
1,1-Dichloroethene	ND	ND		1	0.00	20	03/23/2017 0612
1,2-Dichloropropane	ND	ND		1	0.00	20	03/23/2017 0612
trans-1,3-Dichloropropene	ND	ND		1	0.00	20	03/23/2017 0612
cis-1,3-Dichloropropene	ND	ND		1	0.00	20	03/23/2017 0612
Ethylbenzene	ND	ND		1	0.00	20	03/23/2017 0612
2-Hexanone	ND	ND		1	0.00	20	03/23/2017 0612
Isopropylbenzene	ND	ND		1	0.00	20	03/23/2017 0612
Methyl acetate	ND	ND		1	0.00	20	03/23/2017 0612
Methyl tertiary butyl ether (MTBE)	ND	ND		1	0.00	20	03/23/2017 0612
4-Methyl-2-pentanone	ND	ND		1	0.00	20	03/23/2017 0612
Methylcyclohexane	ND	ND		1	0.00	20	03/23/2017 0612
Methylene chloride	ND	ND		1	0.00	20	03/23/2017 0612
Styrene	ND	ND		1	0.00	20	03/23/2017 0612
1,1,2,2-Tetrachloroethane	ND	ND		1	0.00	20	03/23/2017 0612
Tetrachloroethene	ND	ND		1	0.00	20	03/23/2017 0612
Toluene	ND	ND		1	0.00	20	03/23/2017 0612
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND		1	0.00	20	03/23/2017 0612
1,2,4-Trichlorobenzene	ND	ND		1	0.00	20	03/23/2017 0612
1,1,2-Trichloroethane	ND	ND		1	0.00	20	03/23/2017 0612
1,1,1-Trichloroethane	ND	ND		1	0.00	20	03/23/2017 0612

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - Duplicate

Sample ID: SC21057-001DU
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Result (ug/L)	Q	Dil	% RPD	% RPD Limit	Analysis Date
Trichloroethene	ND	ND		1	0.00	20	03/23/2017 0612
Trichlorofluoromethane	ND	ND		1	0.00	20	03/23/2017 0612
Vinyl chloride	ND	ND		1	0.00	20	03/23/2017 0612
Xylenes (total)	ND	ND		1	0.00	20	03/23/2017 0612

Surrogate	Q	% Rec	Acceptance Limit
1,2-Dichloroethane-d4		94	70-130
Bromofluorobenzene		93	70-130
Toluene-d8		100	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: SC21057-002MS
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Acetone	ND	100	76		1	76	60-140	03/23/2017 0636
Benzene	ND	50	50		1	100	72-127	03/23/2017 0636
Bromodichloromethane	ND	50	51		1	103	71-143	03/23/2017 0636
Bromoform	ND	50	43		1	86	65-131	03/23/2017 0636
Bromomethane (Methyl bromide)	ND	50	48		1	97	36-168	03/23/2017 0636
2-Butanone (MEK)	ND	100	88		1	88	60-140	03/23/2017 0636
Carbon disulfide	ND	50	45		1	91	60-140	03/23/2017 0636
Carbon tetrachloride	ND	50	54		1	109	37-166	03/23/2017 0636
Chlorobenzene	ND	50	50		1	99	78-129	03/23/2017 0636
Chloroethane	ND	50	49		1	97	60-140	03/23/2017 0636
Chloroform	ND	50	47		1	94	63-123	03/23/2017 0636
Chloromethane (Methyl chloride)	ND	50	46		1	92	20-158	03/23/2017 0636
Cyclohexane	ND	50	48		1	97	70-130	03/23/2017 0636
1,2-Dibromo-3-chloropropane (DBCP)	ND	50	45		1	91	70-130	03/23/2017 0636
Dibromochloromethane	ND	50	51		1	102	74-134	03/23/2017 0636
1,2-Dibromoethane (EDB)	ND	50	50		1	101	70-130	03/23/2017 0636
1,4-Dichlorobenzene	ND	50	47		1	94	70-130	03/23/2017 0636
1,3-Dichlorobenzene	ND	50	48		1	96	70-130	03/23/2017 0636
1,2-Dichlorobenzene	ND	50	48		1	97	70-130	03/23/2017 0636
Dichlorodifluoromethane	ND	50	51		1	101	10-158	03/23/2017 0636
1,2-Dichloroethane	ND	50	48		1	96	59-143	03/23/2017 0636
1,1-Dichloroethane	ND	50	49		1	98	69-132	03/23/2017 0636
trans-1,2-Dichloroethene	ND	50	50		1	101	67-141	03/23/2017 0636
cis-1,2-Dichloroethene	ND	50	49		1	99	70-130	03/23/2017 0636
1,1-Dichloroethene	ND	50	51		1	103	50-132	03/23/2017 0636
1,2-Dichloropropane	ND	50	53		1	105	71-126	03/23/2017 0636
trans-1,3-Dichloropropene	ND	50	51		1	102	73-131	03/23/2017 0636
cis-1,3-Dichloropropene	ND	50	53		1	107	69-130	03/23/2017 0636
Ethylbenzene	ND	50	51		1	101	79-132	03/23/2017 0636
2-Hexanone	ND	100	98		1	98	60-140	03/23/2017 0636
Isopropylbenzene	ND	50	53		1	107	70-130	03/23/2017 0636
Methyl acetate	ND	50	41		1	82	15-128	03/23/2017 0636
Methyl tertiary butyl ether (MTBE)	ND	50	44		1	88	60-140	03/23/2017 0636
4-Methyl-2-pentanone	ND	100	100		1	105	60-140	03/23/2017 0636
Methylcyclohexane	ND	50	54		1	107	70-130	03/23/2017 0636
Methylene chloride	ND	50	46		1	93	69-129	03/23/2017 0636
Styrene	ND	50	54		1	107	70-130	03/23/2017 0636
1,1,2,2-Tetrachloroethane	ND	50	48		1	96	60-155	03/23/2017 0636
Tetrachloroethene	ND	50	51		1	102	70-130	03/23/2017 0636
Toluene	ND	50	53		1	105	75-125	03/23/2017 0636
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	50	48		1	96	70-130	03/23/2017 0636
1,2,4-Trichlorobenzene	ND	50	52		1	104	70-130	03/23/2017 0636
1,1,2-Trichloroethane	ND	50	48		1	96	77-132	03/23/2017 0636
1,1,1-Trichloroethane	ND	50	49		1	98	77-132	03/23/2017 0636

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: SC21057-002MS
Batch: 37834
Analytical Method: 8260B
Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Trichloroethene	ND	50	52		1	104	73-124	03/23/2017 0636
Trichlorofluoromethane	ND	50	50		1	99	41-173	03/23/2017 0636
Vinyl chloride	ND	50	45		1	90	29-159	03/23/2017 0636
Xylenes (total)	ND	100	100		1	103	70-130	03/23/2017 0636

Surrogate	Q	% Rec	Acceptance Limit
1,2-Dichloroethane-d4		94	70-130
Bromofluorobenzene		98	70-130
Toluene-d8		103	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: SQ37862-001
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
1,1'-Biphenyl	ND		1	4.0	ug/L	03/30/2017 1434
2,4,5-Trichlorophenol	ND		1	4.0	ug/L	03/30/2017 1434
2,4,6-Trichlorophenol	ND		1	4.0	ug/L	03/30/2017 1434
2,4-Dichlorophenol	ND		1	8.0	ug/L	03/30/2017 1434
2,4-Dimethylphenol	ND		1	4.0	ug/L	03/30/2017 1434
2,4-Dinitrophenol	ND		1	20	ug/L	03/30/2017 1434
2,4-Dinitrotoluene	ND		1	8.0	ug/L	03/30/2017 1434
2,6-Dinitrotoluene	ND		1	8.0	ug/L	03/30/2017 1434
2-Chloronaphthalene	ND		1	4.0	ug/L	03/30/2017 1434
2-Chlorophenol	ND		1	4.0	ug/L	03/30/2017 1434
2-Methylnaphthalene	ND		1	0.80	ug/L	03/30/2017 1434
2-Methylphenol	ND		1	4.0	ug/L	03/30/2017 1434
2-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 1434
2-Nitrophenol	ND		1	4.0	ug/L	03/30/2017 1434
3+4-Methylphenol	ND		1	4.0	ug/L	03/30/2017 1434
3,3'-Dichlorobenzidine	ND		1	4.0	ug/L	03/30/2017 1434
3-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 1434
4,6-Dinitro-2-methylphenol	ND		1	20	ug/L	03/30/2017 1434
4-Bromophenyl phenyl ether	ND		1	4.0	ug/L	03/30/2017 1434
4-Chloro-3-methyl phenol	ND		1	4.0	ug/L	03/30/2017 1434
4-Chloroaniline	ND		1	8.0	ug/L	03/30/2017 1434
4-Chlorophenyl phenyl ether	ND		1	4.0	ug/L	03/30/2017 1434
4-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 1434
4-Nitrophenol	ND		1	20	ug/L	03/30/2017 1434
Acenaphthene	ND		1	0.80	ug/L	03/30/2017 1434
Acenaphthylene	ND		1	0.80	ug/L	03/30/2017 1434
Acetophenone	ND		1	4.0	ug/L	03/30/2017 1434
Anthracene	ND		1	0.80	ug/L	03/30/2017 1434
Atrazine	ND		1	4.0	ug/L	03/30/2017 1434
Benzaldehyde	ND		1	8.0	ug/L	03/30/2017 1434
Benzo(a)anthracene	ND		1	0.80	ug/L	03/30/2017 1434
Benzo(a)pyrene	ND		1	0.80	ug/L	03/30/2017 1434
Benzo(b)fluoranthene	ND		1	0.80	ug/L	03/30/2017 1434
Benzo(g,h,i)perylene	ND		1	0.80	ug/L	03/30/2017 1434
Benzo(k)fluoranthene	ND		1	0.80	ug/L	03/30/2017 1434
bis (2-Chloro-1-methylethyl) ether	ND		1	4.0	ug/L	03/30/2017 1434
bis(2-Chloroethoxy)methane	ND		1	4.0	ug/L	03/30/2017 1434
bis(2-Chloroethyl)ether	ND		1	4.0	ug/L	03/30/2017 1434
bis(2-Ethylhexyl)phthalate	ND		1	4.0	ug/L	03/30/2017 1434
Butyl benzyl phthalate	ND		1	4.0	ug/L	03/30/2017 1434
Caprolactam	ND		1	8.0	ug/L	03/30/2017 1434
Carbazole	ND		1	4.0	ug/L	03/30/2017 1434
Chrysene	ND		1	0.80	ug/L	03/30/2017 1434
Di-n-butyl phthalate	ND		1	4.0	ug/L	03/30/2017 1434

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: SQ37862-001
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Di-n-octylphthalate	ND		1	4.0	ug/L	03/30/2017 1434
Dibenzo(a,h)anthracene	ND		1	0.80	ug/L	03/30/2017 1434
Dibenzofuran	ND		1	4.0	ug/L	03/30/2017 1434
Diethylphthalate	ND		1	4.0	ug/L	03/30/2017 1434
Dimethyl phthalate	ND		1	4.0	ug/L	03/30/2017 1434
Fluoranthene	ND		1	0.80	ug/L	03/30/2017 1434
Fluorene	ND		1	0.80	ug/L	03/30/2017 1434
Hexachlorobenzene	ND		1	4.0	ug/L	03/30/2017 1434
Hexachlorobutadiene	ND		1	4.0	ug/L	03/30/2017 1434
Hexachlorocyclopentadiene	ND		1	20	ug/L	03/30/2017 1434
Hexachloroethane	ND		1	4.0	ug/L	03/30/2017 1434
Indeno(1,2,3-c,d)pyrene	ND		1	0.80	ug/L	03/30/2017 1434
Isophorone	ND		1	4.0	ug/L	03/30/2017 1434
N-Nitrosodi-n-propylamine	ND		1	4.0	ug/L	03/30/2017 1434
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	4.0	ug/L	03/30/2017 1434
Naphthalene	ND		1	0.80	ug/L	03/30/2017 1434
Nitrobenzene	ND		1	4.0	ug/L	03/30/2017 1434
Pentachlorophenol	ND		1	20	ug/L	03/30/2017 1434
Phenanthrene	ND		1	0.80	ug/L	03/30/2017 1434
Phenol	ND		1	4.0	ug/L	03/30/2017 1434
Pyrene	ND		1	0.80	ug/L	03/30/2017 1434

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		68	41-144
2-Fluorobiphenyl		79	37-129
2-Fluorophenol		59	24-127
Nitrobenzene-d5		90	38-127
Phenol-d5		73	28-128
Terphenyl-d14		94	10-148

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
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+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: SQ37862-002
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
1,1'-Biphenyl	40	33		1	82	30-130	03/30/2017 1522
2,4,5-Trichlorophenol	40	33		1	82	30-130	03/30/2017 1522
2,4,6-Trichlorophenol	40	30		1	75	30-130	03/30/2017 1522
2,4-Dichlorophenol	40	29		1	73	30-130	03/30/2017 1522
2,4-Dimethylphenol	40	33		1	83	30-130	03/30/2017 1522
2,4-Dinitrophenol	80	56		1	71	11-126	03/30/2017 1522
2,4-Dinitrotoluene	40	37		1	93	30-130	03/30/2017 1522
2,6-Dinitrotoluene	40	37		1	93	30-130	03/30/2017 1522
2-Chloronaphthalene	40	32		1	79	30-130	03/30/2017 1522
2-Chlorophenol	40	32		1	80	30-130	03/30/2017 1522
2-Methylnaphthalene	40	30		1	76	40-132	03/30/2017 1522
2-Methylphenol	40	45		1	111	30-130	03/30/2017 1522
2-Nitroaniline	40	39		1	98	30-130	03/30/2017 1522
2-Nitrophenol	40	34		1	84	30-130	03/30/2017 1522
3+4-Methylphenol	40	45		1	112	30-130	03/30/2017 1522
3,3'-Dichlorobenzidine	40	25		1	61	30-130	03/30/2017 1522
3-Nitroaniline	40	31		1	78	30-130	03/30/2017 1522
4,6-Dinitro-2-methylphenol	40	35		1	88	30-130	03/30/2017 1522
4-Bromophenyl phenyl ether	40	33		1	83	30-130	03/30/2017 1522
4-Chloro-3-methyl phenol	40	35		1	87	30-130	03/30/2017 1522
4-Chloroaniline	40	27		1	67	12-157	03/30/2017 1522
4-Chlorophenyl phenyl ether	40	31		1	78	30-130	03/30/2017 1522
4-Nitroaniline	40	38		1	94	30-130	03/30/2017 1522
4-Nitrophenol	80	71		1	88	30-130	03/30/2017 1522
Acenaphthene	40	36		1	90	30-130	03/30/2017 1522
Acenaphthylene	40	37		1	92	30-130	03/30/2017 1522
Acetophenone	40	43		1	107	30-130	03/30/2017 1522
Anthracene	40	35		1	89	30-130	03/30/2017 1522
Atrazine	40	36		1	89	30-130	03/30/2017 1522
Benzaldehyde	40	29		1	72	30-130	03/30/2017 1522
Benzo(a)anthracene	40	36		1	90	30-130	03/30/2017 1522
Benzo(a)pyrene	40	34		1	84	30-130	03/30/2017 1522
Benzo(b)fluoranthene	40	37		1	92	30-130	03/30/2017 1522
Benzo(g,h,i)perylene	40	42		1	105	30-130	03/30/2017 1522
Benzo(k)fluoranthene	40	35		1	88	30-130	03/30/2017 1522
bis (2-Chloro-1-methylethyl) ether	40	42		1	105	30-130	03/30/2017 1522
bis(2-Chloroethoxy)methane	40	36		1	90	30-130	03/30/2017 1522
bis(2-Chloroethyl)ether	40	40		1	99	30-130	03/30/2017 1522
bis(2-Ethylhexyl)phthalate	40	46		1	114	30-130	03/30/2017 1522
Butyl benzyl phthalate	40	45		1	113	30-130	03/30/2017 1522
Caprolactam	40	37		1	91	30-130	03/30/2017 1522
Carbazole	40	37		1	92	30-130	03/30/2017 1522
Chrysene	40	36		1	90	30-130	03/30/2017 1522
Di-n-butyl phthalate	40	42		1	106	30-130	03/30/2017 1522

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
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+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: SQ37862-002
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Di-n-octylphthalate	40	46		1	114	30-130	03/30/2017 1522
Dibenzo(a,h)anthracene	40	32		1	79	30-130	03/30/2017 1522
Dibenzofuran	40	35		1	88	30-130	03/30/2017 1522
Diethylphthalate	40	40		1	100	30-130	03/30/2017 1522
Dimethyl phthalate	40	37		1	93	30-130	03/30/2017 1522
Fluoranthene	40	36		1	91	30-130	03/30/2017 1522
Fluorene	40	34		1	85	30-130	03/30/2017 1522
Hexachlorobenzene	40	34		1	85	30-130	03/30/2017 1522
Hexachlorobutadiene	40	25		1	62	24-110	03/30/2017 1522
Hexachlorocyclopentadiene	200	100		1	50	22-122	03/30/2017 1522
Hexachloroethane	40	30		1	75	30-130	03/30/2017 1522
Indeno(1,2,3-c,d)pyrene	40	38		1	96	30-130	03/30/2017 1522
Isophorone	40	40		1	99	30-130	03/30/2017 1522
N-Nitrosodi-n-propylamine	40	46		1	116	30-130	03/30/2017 1522
N-Nitrosodiphenylamine (Diphenylamine)	40	31		1	78	18-180	03/30/2017 1522
Naphthalene	40	33		1	82	30-130	03/30/2017 1522
Nitrobenzene	40	40		1	101	30-130	03/30/2017 1522
Pentachlorophenol	80	59		1	74	30-130	03/30/2017 1522
Phenanthrene	40	36		1	91	30-130	03/30/2017 1522
Phenol	40	34		1	86	30-130	03/30/2017 1522
Pyrene	40	41		1	101	30-130	03/30/2017 1522

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		82	41-144
2-Fluorobiphenyl		78	37-129
2-Fluorophenol		67	24-127
Nitrobenzene-d5		94	38-127
Phenol-d5		84	28-128
Terphenyl-d14		84	10-148

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MS

Sample ID: SC21057-004MS
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
1,1'-Biphenyl	ND	80	64		1	80	30-130	03/30/2017 1836
2,4,5-Trichlorophenol	ND	80	62		1	77	30-130	03/30/2017 1836
2,4,6-Trichlorophenol	ND	80	58		1	73	30-130	03/30/2017 1836
2,4-Dichlorophenol	ND	80	58		1	72	30-130	03/30/2017 1836
2,4-Dimethylphenol	ND	80	60		1	75	30-130	03/30/2017 1836
2,4-Dinitrophenol	ND	160	110		1	70	30-130	03/30/2017 1836
2,4-Dinitrotoluene	ND	80	70		1	88	30-130	03/30/2017 1836
2,6-Dinitrotoluene	ND	80	71		1	88	30-130	03/30/2017 1836
2-Chloronaphthalene	ND	80	62		1	78	30-130	03/30/2017 1836
2-Chlorophenol	ND	80	63		1	78	30-130	03/30/2017 1836
2-Methylnaphthalene	ND	80	60		1	75	40-132	03/30/2017 1836
2-Methylphenol	ND	80	88		1	110	30-130	03/30/2017 1836
2-Nitroaniline	ND	80	75		1	94	30-130	03/30/2017 1836
2-Nitrophenol	ND	80	65		1	82	30-130	03/30/2017 1836
3,3'-Dichlorobenzidine	ND	80	48		1	60	30-130	03/30/2017 1836
3+4-Methylphenol	ND	80	88		1	111	30-130	03/30/2017 1836
3-Nitroaniline	ND	80	56		1	70	30-130	03/30/2017 1836
4,6-Dinitro-2-methylphenol	ND	80	63		1	78	30-130	03/30/2017 1836
4-Bromophenyl phenyl ether	ND	80	63		1	79	30-130	03/30/2017 1836
4-Chloro-3-methyl phenol	ND	80	66		1	83	30-130	03/30/2017 1836
4-Chloroaniline	ND	80	46		1	57	10-130	03/30/2017 1836
4-Chlorophenyl phenyl ether	ND	80	61		1	77	30-130	03/30/2017 1836
4-Nitroaniline	ND	80	70		1	87	30-130	03/30/2017 1836
4-Nitrophenol	ND	160	150		1	91	30-130	03/30/2017 1836
Acenaphthene	ND	80	69		1	87	30-130	03/30/2017 1836
Acenaphthylene	ND	80	70		1	87	30-130	03/30/2017 1836
Acetophenone	ND	80	83		1	104	30-130	03/30/2017 1836
Anthracene	ND	80	67		1	83	30-130	03/30/2017 1836
Atrazine	ND	80	68		1	86	30-130	03/30/2017 1836
Benzaldehyde	ND	80	44		1	56	30-130	03/30/2017 1836
Benzo(a)anthracene	ND	80	70		1	87	30-130	03/30/2017 1836
Benzo(a)pyrene	ND	80	69		1	86	30-130	03/30/2017 1836
Benzo(b)fluoranthene	ND	80	85		1	106	30-130	03/30/2017 1836
Benzo(g,h,i)perylene	ND	80	52		1	65	30-130	03/30/2017 1836
Benzo(k)fluoranthene	ND	80	81		1	101	30-130	03/30/2017 1836
bis (2-Chloro-1-methylethyl) ether	ND	80	83		1	103	30-130	03/30/2017 1836
bis(2-Chloroethoxy)methane	ND	80	69		1	87	30-130	03/30/2017 1836
bis(2-Chloroethyl)ether	ND	80	77		1	97	30-130	03/30/2017 1836
bis(2-Ethylhexyl)phthalate	ND	80	87		1	109	70-131	03/30/2017 1836
Butyl benzyl phthalate	ND	80	86		1	108	30-130	03/30/2017 1836
Caprolactam	ND	80	73		1	91	30-130	03/30/2017 1836
Carbazole	ND	80	70		1	88	30-130	03/30/2017 1836
Chrysene	ND	80	69		1	86	30-130	03/30/2017 1836
Dibenzo(a,h)anthracene	ND	80	44		1	55	30-130	03/30/2017 1836

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MS

Sample ID: SC21057-004MS
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Dibenzofuran	ND	80	68		1	85	30-130	03/30/2017 1836
Diethylphthalate	ND	80	79		1	98	30-130	03/30/2017 1836
Dimethyl phthalate	ND	80	72		1	90	30-130	03/30/2017 1836
Di-n-butyl phthalate	ND	80	83		1	104	30-130	03/30/2017 1836
Di-n-octylphthalate	ND	80	120	N	1	152	30-130	03/30/2017 1836
Fluoranthene	ND	80	71		1	89	30-130	03/30/2017 1836
Fluorene	ND	80	66		1	82	30-130	03/30/2017 1836
Hexachlorobenzene	ND	80	64		1	81	30-130	03/30/2017 1836
Hexachlorobutadiene	ND	80	51		1	64	24-110	03/30/2017 1836
Hexachlorocyclopentadiene	ND	400	140		1	34	22-122	03/30/2017 1836
Hexachloroethane	ND	80	57		1	72	30-130	03/30/2017 1836
Indeno(1,2,3-c,d)pyrene	ND	80	53		1	67	30-130	03/30/2017 1836
Isophorone	ND	80	77		1	97	30-130	03/30/2017 1836
Naphthalene	ND	80	62		1	78	30-130	03/30/2017 1836
Nitrobenzene	ND	80	78		1	98	30-130	03/30/2017 1836
N-Nitrosodi-n-propylamine	ND	80	90		1	113	30-130	03/30/2017 1836
N-Nitrosodiphenylamine (Diphenylamine)	ND	80	58		1	73	30-130	03/30/2017 1836
Pentachlorophenol	ND	160	120		1	72	30-130	03/30/2017 1836
Phenanthrene	ND	80	70		1	87	30-130	03/30/2017 1836
Phenol	ND	80	66		1	83	30-130	03/30/2017 1836
Pyrene	ND	80	75		1	94	30-130	03/30/2017 1836

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		75	37-129
2-Fluorophenol		66	24-127
Nitrobenzene-d5		92	38-127
Phenol-d5		80	28-128
Terphenyl-d14		79	10-148
2,4,6-Tribromophenol		78	41-144

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MSD

Sample ID: SC21057-004MD
Batch: 37862
Analytical Method: 8270D

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
1,1'-Biphenyl	ND	80	63		1	78	2.3	30-130	40	03/30/2017 1900
2,4,5-Trichlorophenol	ND	80	62		1	77	0.18	30-130	40	03/30/2017 1900
2,4,6-Trichlorophenol	ND	80	58		1	73	0.39	30-130	40	03/30/2017 1900
2,4-Dichlorophenol	ND	80	55		1	69	4.2	30-130	40	03/30/2017 1900
2,4-Dimethylphenol	ND	80	58		1	73	2.7	30-130	40	03/30/2017 1900
2,4-Dinitrophenol	ND	160	120		1	73	3.6	30-130	40	03/30/2017 1900
2,4-Dinitrotoluene	ND	80	71		1	89	1.3	30-130	40	03/30/2017 1900
2,6-Dinitrotoluene	ND	80	71		1	88	0.26	30-130	40	03/30/2017 1900
2-Chloronaphthalene	ND	80	61		1	76	2.5	30-130	40	03/30/2017 1900
2-Chlorophenol	ND	80	59		1	73	6.5	30-130	40	03/30/2017 1900
2-Methylnaphthalene	ND	80	58		1	72	3.4	40-132	40	03/30/2017 1900
2-Methylphenol	ND	80	86		1	108	2.6	30-130	40	03/30/2017 1900
2-Nitroaniline	ND	80	77		1	96	2.4	30-130	40	03/30/2017 1900
2-Nitrophenol	ND	80	65		1	81	0.79	30-130	40	03/30/2017 1900
3,3'-Dichlorobenzidine	ND	80	56		1	70	15	30-130	40	03/30/2017 1900
3+4-Methylphenol	ND	80	80		1	100	10	30-130	40	03/30/2017 1900
3-Nitroaniline	ND	80	54		1	67	3.5	30-130	40	03/30/2017 1900
4,6-Dinitro-2-methylphenol	ND	80	64		1	80	1.8	30-130	40	03/30/2017 1900
4-Bromophenyl phenyl ether	ND	80	62		1	77	2.9	30-130	40	03/30/2017 1900
4-Chloro-3-methyl phenol	ND	80	66		1	82	0.78	30-130	40	03/30/2017 1900
4-Chloroaniline	ND	80	39		1	49	16	10-130	40	03/30/2017 1900
4-Chlorophenyl phenyl ether	ND	80	61		1	76	0.77	30-130	40	03/30/2017 1900
4-Nitroaniline	ND	80	74		1	92	5.3	30-130	40	03/30/2017 1900
4-Nitrophenol	ND	160	63	+	1	39	79	30-130	40	03/30/2017 1900
Acenaphthene	ND	80	69		1	86	0.79	30-130	40	03/30/2017 1900
Acenaphthylene	ND	80	70		1	87	0.48	30-130	40	03/30/2017 1900
Acetophenone	ND	80	79		1	98	6.0	30-130	40	03/30/2017 1900
Anthracene	ND	80	68		1	84	1.4	30-130	40	03/30/2017 1900
Atrazine	ND	80	71		1	89	3.5	30-130	40	03/30/2017 1900
Benzaldehyde	ND	80	34		1	43	26	30-130	40	03/30/2017 1900
Benzo(a)anthracene	ND	80	69		1	87	0.81	30-130	40	03/30/2017 1900
Benzo(a)pyrene	ND	80	70		1	87	1.4	30-130	40	03/30/2017 1900
Benzo(b)fluoranthene	ND	80	83		1	104	1.9	30-130	40	03/30/2017 1900
Benzo(g,h,i)perylene	ND	80	54		1	68	3.7	30-130	40	03/30/2017 1900
Benzo(k)fluoranthene	ND	80	80		1	100	0.61	30-130	40	03/30/2017 1900
bis (2-Chloro-1-methylethyl) ether	ND	80	77		1	96	6.9	30-130	40	03/30/2017 1900
bis(2-Chloroethoxy)methane	ND	80	68		1	84	2.6	30-130	40	03/30/2017 1900
bis(2-Chloroethyl)ether	ND	80	76		1	95	1.5	30-130	40	03/30/2017 1900
bis(2-Ethylhexyl)phthalate	ND	80	86		1	107	1.8	70-131	40	03/30/2017 1900
Butyl benzyl phthalate	ND	80	84		1	105	2.6	30-130	40	03/30/2017 1900
Caprolactam	ND	80	75		1	94	3.0	30-130	40	03/30/2017 1900
Carbazole	ND	80	70		1	87	1.1	30-130	40	03/30/2017 1900
Chrysene	ND	80	69		1	86	0.63	30-130	40	03/30/2017 1900
Dibenzo(a,h)anthracene	ND	80	46		1	58	4.6	30-130	40	03/30/2017 1900

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MSD

Sample ID: SC21057-004MD
Batch: 37862
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/23/2017 1235

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
Dibenzofuran	ND	80	68		1	84	0.96	30-130	40	03/30/2017 1900
Diethylphthalate	ND	80	78		1	98	0.14	30-130	40	03/30/2017 1900
Dimethyl phthalate	ND	80	72		1	90	0.13	30-130	40	03/30/2017 1900
Di-n-butyl phthalate	ND	80	81		1	101	2.4	30-130	40	03/30/2017 1900
Di-n-octylphthalate	ND	80	120	N	1	148	2.8	30-130	40	03/30/2017 1900
Fluoranthene	ND	80	70		1	88	0.80	30-130	40	03/30/2017 1900
Fluorene	ND	80	65		1	82	0.40	30-130	40	03/30/2017 1900
Hexachlorobenzene	ND	80	63		1	79	1.7	30-130	40	03/30/2017 1900
Hexachlorobutadiene	ND	80	49		1	61	4.1	24-110	40	03/30/2017 1900
Hexachlorocyclopentadiene	ND	400	140		1	34	1.2	22-122	40	03/30/2017 1900
Hexachloroethane	ND	80	55		1	69	3.6	30-130	40	03/30/2017 1900
Indeno(1,2,3-c,d)pyrene	ND	80	55		1	69	3.6	30-130	40	03/30/2017 1900
Isophorone	ND	80	76		1	95	1.3	30-130	40	03/30/2017 1900
Naphthalene	ND	80	60		1	75	3.4	30-130	40	03/30/2017 1900
Nitrobenzene	ND	80	78		1	97	0.87	30-130	40	03/30/2017 1900
N-Nitrosodi-n-propylamine	ND	80	85		1	106	5.6	30-130	40	03/30/2017 1900
N-Nitrosodiphenylamine (Diphenylamine)	ND	80	61		1	76	4.0	30-130	40	03/30/2017 1900
Pentachlorophenol	ND	80	110	N	1	142	1.6	30-130	40	03/30/2017 1900
Phenanthrene	ND	80	70		1	87	0.012	30-130	40	03/30/2017 1900
Phenol	ND	80	62		1	77	6.7	30-130	40	03/30/2017 1900
Pyrene	ND	80	74		1	93	0.79	30-130	40	03/30/2017 1900

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		75	37-129
2-Fluorophenol		62	24-127
Nitrobenzene-d5		91	38-127
Phenol-d5		76	28-128
Terphenyl-d14		79	10-148
2,4,6-Tribromophenol		80	41-144

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: SQ38153-001
Batch: 38153
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/27/2017 1811

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
1,1'-Biphenyl	ND		1	4.0	ug/L	03/30/2017 2237
2,4,5-Trichlorophenol	ND		1	4.0	ug/L	03/30/2017 2237
2,4,6-Trichlorophenol	ND		1	4.0	ug/L	03/30/2017 2237
2,4-Dichlorophenol	ND		1	8.0	ug/L	03/30/2017 2237
2,4-Dimethylphenol	ND		1	4.0	ug/L	03/30/2017 2237
2,4-Dinitrophenol	ND		1	20	ug/L	03/30/2017 2237
2,4-Dinitrotoluene	ND		1	8.0	ug/L	03/30/2017 2237
2,6-Dinitrotoluene	ND		1	8.0	ug/L	03/30/2017 2237
2-Chloronaphthalene	ND		1	4.0	ug/L	03/30/2017 2237
2-Chlorophenol	ND		1	4.0	ug/L	03/30/2017 2237
2-Methylnaphthalene	ND		1	0.80	ug/L	03/30/2017 2237
2-Methylphenol	ND		1	4.0	ug/L	03/30/2017 2237
2-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 2237
2-Nitrophenol	ND		1	4.0	ug/L	03/30/2017 2237
3+4-Methylphenol	ND		1	4.0	ug/L	03/30/2017 2237
3,3'-Dichlorobenzidine	ND		1	4.0	ug/L	03/30/2017 2237
3-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 2237
4,6-Dinitro-2-methylphenol	ND		1	20	ug/L	03/30/2017 2237
4-Bromophenyl phenyl ether	ND		1	4.0	ug/L	03/30/2017 2237
4-Chloro-3-methyl phenol	ND		1	4.0	ug/L	03/30/2017 2237
4-Chloroaniline	ND		1	8.0	ug/L	03/30/2017 2237
4-Chlorophenyl phenyl ether	ND		1	4.0	ug/L	03/30/2017 2237
4-Nitroaniline	ND		1	8.0	ug/L	03/30/2017 2237
4-Nitrophenol	ND		1	20	ug/L	03/30/2017 2237
Acenaphthene	ND		1	0.80	ug/L	03/30/2017 2237
Acenaphthylene	ND		1	0.80	ug/L	03/30/2017 2237
Acetophenone	ND		1	4.0	ug/L	03/30/2017 2237
Anthracene	ND		1	0.80	ug/L	03/30/2017 2237
Atrazine	ND		1	4.0	ug/L	03/30/2017 2237
Benzaldehyde	ND		1	8.0	ug/L	03/30/2017 2237
Benzo(a)anthracene	ND		1	0.80	ug/L	03/30/2017 2237
Benzo(a)pyrene	ND		1	0.80	ug/L	03/30/2017 2237
Benzo(b)fluoranthene	ND		1	0.80	ug/L	03/30/2017 2237
Benzo(g,h,i)perylene	ND		1	0.80	ug/L	03/30/2017 2237
Benzo(k)fluoranthene	ND		1	0.80	ug/L	03/30/2017 2237
bis (2-Chloro-1-methylethyl) ether	ND		1	4.0	ug/L	03/30/2017 2237
bis(2-Chloroethoxy)methane	ND		1	4.0	ug/L	03/30/2017 2237
bis(2-Chloroethyl)ether	ND		1	4.0	ug/L	03/30/2017 2237
bis(2-Ethylhexyl)phthalate	ND		1	4.0	ug/L	03/30/2017 2237
Butyl benzyl phthalate	ND		1	4.0	ug/L	03/30/2017 2237
Caprolactam	ND		1	8.0	ug/L	03/30/2017 2237
Carbazole	ND		1	4.0	ug/L	03/30/2017 2237
Chrysene	ND		1	0.80	ug/L	03/30/2017 2237
Di-n-butyl phthalate	ND		1	4.0	ug/L	03/30/2017 2237

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: SQ38153-001
Batch: 38153
Analytical Method: 8270D

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/27/2017 1811

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Di-n-octylphthalate	ND		1	4.0	ug/L	03/30/2017 2237
Dibenzo(a,h)anthracene	ND		1	0.80	ug/L	03/30/2017 2237
Dibenzofuran	ND		1	4.0	ug/L	03/30/2017 2237
Diethylphthalate	ND		1	4.0	ug/L	03/30/2017 2237
Dimethyl phthalate	ND		1	4.0	ug/L	03/30/2017 2237
Fluoranthene	ND		1	0.80	ug/L	03/30/2017 2237
Fluorene	ND		1	0.80	ug/L	03/30/2017 2237
Hexachlorobenzene	ND		1	4.0	ug/L	03/30/2017 2237
Hexachlorobutadiene	ND		1	4.0	ug/L	03/30/2017 2237
Hexachlorocyclopentadiene	ND		1	20	ug/L	03/30/2017 2237
Hexachloroethane	ND		1	4.0	ug/L	03/30/2017 2237
Indeno(1,2,3-c,d)pyrene	ND		1	0.80	ug/L	03/30/2017 2237
Isophorone	ND		1	4.0	ug/L	03/30/2017 2237
N-Nitrosodi-n-propylamine	ND		1	4.0	ug/L	03/30/2017 2237
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	4.0	ug/L	03/30/2017 2237
Naphthalene	ND		1	0.80	ug/L	03/30/2017 2237
Nitrobenzene	ND		1	4.0	ug/L	03/30/2017 2237
Pentachlorophenol	ND		1	20	ug/L	03/30/2017 2237
Phenanthrene	ND		1	0.80	ug/L	03/30/2017 2237
Phenol	ND		1	4.0	ug/L	03/30/2017 2237
Pyrene	ND		1	0.80	ug/L	03/30/2017 2237

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		74	41-144
2-Fluorobiphenyl		83	37-129
2-Fluorophenol		60	24-127
Nitrobenzene-d5		91	38-127
Phenol-d5		78	28-128
Terphenyl-d14		94	10-148

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N = Recovery is out of criteria
+ = RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: SQ38153-002
Batch: 38153
Analytical Method: 8270D
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/27/2017 1811

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
1,1'-Biphenyl	40	36		1	89	30-130	03/31/2017 1808
2,4,5-Trichlorophenol	40	33		1	83	30-130	03/31/2017 1808
2,4,6-Trichlorophenol	40	33		1	83	30-130	03/31/2017 1808
2,4-Dichlorophenol	40	30		1	75	30-130	03/31/2017 1808
2,4-Dimethylphenol	40	36		1	91	30-130	03/31/2017 1808
2,4-Dinitrophenol	80	80		1	100	11-126	03/31/2017 1808
2,4-Dinitrotoluene	40	41		1	103	30-130	03/31/2017 1808
2,6-Dinitrotoluene	40	41		1	102	30-130	03/31/2017 1808
2-Chloronaphthalene	40	34		1	85	30-130	03/31/2017 1808
2-Chlorophenol	40	32		1	80	30-130	03/31/2017 1808
2-Methylnaphthalene	40	32		1	81	40-132	03/31/2017 1808
2-Methylphenol	40	42		1	105	30-130	03/31/2017 1808
2-Nitroaniline	40	45		1	112	30-130	03/31/2017 1808
2-Nitrophenol	40	35		1	89	30-130	03/31/2017 1808
3+4-Methylphenol	40	40		1	100	30-130	03/31/2017 1808
3,3'-Dichlorobenzidine	40	2.5	N	1	6.3	30-130	03/31/2017 1808
3-Nitroaniline	40	19		1	48	30-130	03/31/2017 1808
4,6-Dinitro-2-methylphenol	40	40		1	99	30-130	03/31/2017 1808
4-Bromophenyl phenyl ether	40	35		1	88	30-130	03/31/2017 1808
4-Chloro-3-methyl phenol	40	38		1	94	30-130	03/31/2017 1808
4-Chloroaniline	40	20		1	51	12-157	03/31/2017 1808
4-Chlorophenyl phenyl ether	40	34		1	86	30-130	03/31/2017 1808
4-Nitroaniline	40	36		1	89	30-130	03/31/2017 1808
4-Nitrophenol	80	91		1	113	30-130	03/31/2017 1808
Acenaphthene	40	38		1	95	30-130	03/31/2017 1808
Acenaphthylene	40	39		1	97	30-130	03/31/2017 1808
Acetophenone	40	43		1	108	30-130	03/31/2017 1808
Anthracene	40	38		1	95	30-130	03/31/2017 1808
Atrazine	40	35		1	87	30-130	03/31/2017 1808
Benzaldehyde	40	21		1	53	30-130	03/31/2017 1808
Benzo(a)anthracene	40	38		1	96	30-130	03/31/2017 1808
Benzo(a)pyrene	40	38		1	94	30-130	03/31/2017 1808
Benzo(b)fluoranthene	40	40		1	101	30-130	03/31/2017 1808
Benzo(g,h,i)perylene	40	47		1	118	30-130	03/31/2017 1808
Benzo(k)fluoranthene	40	39		1	97	30-130	03/31/2017 1808
bis (2-Chloro-1-methylethyl) ether	40	43		1	108	30-130	03/31/2017 1808
bis(2-Chloroethoxy)methane	40	37		1	93	30-130	03/31/2017 1808
bis(2-Chloroethyl)ether	40	42		1	106	30-130	03/31/2017 1808
bis(2-Ethylhexyl)phthalate	40	48		1	119	30-130	03/31/2017 1808
Butyl benzyl phthalate	40	48		1	120	30-130	03/31/2017 1808
Caprolactam	40	43		1	107	30-130	03/31/2017 1808
Carbazole	40	40		1	99	30-130	03/31/2017 1808
Chrysene	40	39		1	97	30-130	03/31/2017 1808
Di-n-butyl phthalate	40	46		1	114	30-130	03/31/2017 1808

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: SQ38153-002
Batch: 38153
Analytical Method: 8270D

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 03/27/2017 1811

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Di-n-octylphthalate	40	48		1	119	30-130	03/31/2017 1808
Dibenzo(a,h)anthracene	40	36		1	90	30-130	03/31/2017 1808
Dibenzofuran	40	38		1	95	30-130	03/31/2017 1808
Diethylphthalate	40	45		1	113	30-130	03/31/2017 1808
Dimethyl phthalate	40	41		1	101	30-130	03/31/2017 1808
Fluoranthene	40	40		1	99	30-130	03/31/2017 1808
Fluorene	40	36		1	91	30-130	03/31/2017 1808
Hexachlorobenzene	40	36		1	89	30-130	03/31/2017 1808
Hexachlorobutadiene	40	26		1	65	24-110	03/31/2017 1808
Hexachlorocyclopentadiene	200	110		1	53	22-122	03/31/2017 1808
Hexachloroethane	40	33		1	81	30-130	03/31/2017 1808
Indeno(1,2,3-c,d)pyrene	40	43		1	109	30-130	03/31/2017 1808
Isophorone	40	42		1	105	30-130	03/31/2017 1808
N-Nitrosodi-n-propylamine	40	49		1	121	30-130	03/31/2017 1808
N-Nitrosodiphenylamine (Diphenylamine)	40	25		1	61	18-180	03/31/2017 1808
Naphthalene	40	34		1	86	30-130	03/31/2017 1808
Nitrobenzene	40	41		1	103	30-130	03/31/2017 1808
Pentachlorophenol	80	66		1	83	30-130	03/31/2017 1808
Phenanthrene	40	40		1	100	30-130	03/31/2017 1808
Phenol	40	35		1	86	30-130	03/31/2017 1808
Pyrene	40	43		1	106	30-130	03/31/2017 1808

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		90	41-144
2-Fluorobiphenyl		83	37-129
2-Fluorophenol		66	24-127
Nitrobenzene-d5		100	38-127
Phenol-d5		83	28-128
Terphenyl-d14		88	10-148

PQL = Practical quantitation limit
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
ND = Not detected at or above the PQL
J = Estimated result < PQL and ≥ MDL
+ = RPD is out of criteria
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

SHEALY ENVIRONMENTAL SERVICES, INC.

106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.shealylab.com

Chain of Custody Record

Number 71321

NuEARTH

Client: 2041 INDUSTRIAL BLVD	Report to Contact: JOHN RABLEY	Telephone No. / E-mail: 803-317-8325 / jrabley@nuearthdesign.com
Address: LEXINGTON	Sampler's Signature: X	Quote No. 19716.2
City:	State: SC	Zip Code: 29072
Project Name: SCG&G FLEET MAINTENANCE SITE	Printed Name: Timothy K	Page 1 of 2
Project No.: 52561	P.O. No.: SCANECLAIMS 17002	

Analysis (Attach list if more space is needed): VOA, SVOA

SC21057

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres	HCl	HNO3	H2SO4	NaOH	ZnAc/NaOH	VOA	SVOA	Remarks / Cooler I.D.
CR-SW-01	3/21/17	10:50	G	X			2		3				3	2	
CR-SW-02	3/21/17	10:30	G	X			2		3				3	2	
CR-SW-03	3/21/17	12:15	G	X			2		3				3	2	
CR-SW-04	3/21/17	10:15	G	X			2		3				3	2	
CR-SW-05 + dup	3/21/17	12:02	G	X			2		3				6	4	
CR-SW-06	3/21/17	11:55	G	X			2		3				3	2	
CR-SW-07	3/21/17	11:05	G	X			2		3				3	2	
CR-SW-08	3/21/17	10:57	G	X			2		3				3	2	
CR-SW-09	3/21/17	10:50	G	X			2		3				3	2	
CR-SW-10	3/21/17	10:40	G	X			2		3				3	2	

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by	3/21/17	12:40	1. Received by		
2. Relinquished by		15:07	2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by			4. Laboratory received by	3/21/17	1507

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) (Yes) No Ice Pack Receipt Temp. 2.7 °C 3.3 °C

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: F-AD-133 Effective Date: 08-01-2014

Shealy Environmental Services, Inc.
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.shealylab.com

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Chain of Custody Record

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Telephone No. 803-791-9700 Fax No. 803-791-9111
www.shealylab.com

Number 71322

Client: NuEarth	Report to Contact: JOHN RABLEY	Telephone No. / E-mail: 803-317-8323 / jrabley@nuearthcleaning.com	Quote No.: 19716 2
Address: 2041 INDUSTRIAL BLVD	Sampler's Signature: X	Analysis (Attach list if more space is needed)	Page 2 of 2
City: Lexington	State: SC	Zip Code: 29072	Printed Name: Jason Williams, BENJAMIN D. BAER
Project Name: SCE&G FLEET MAINTENANCE SITE			
Project No.: 52561	P.O. No.: TEDMECLASS17002		

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	Grab / Composite	Matrix: Aqueous	Matrix: Sludge	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	Na2S2O3	VOCs (VOA)	SVOCs (SVOA)	Remarks / Cooler I.D.
CR-SW-11	3/21/17	1030	G	X			2			3			3	2	
CR-SW-12	3/21/17	1040	G	X			2			3			3	2	
CR-SW-13	3/21/17	12:20	G	X			2			3			3	2	
CR-SW-14	3/21/17	14:15	G	X			2			3			3	2	

SC21057

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished by	3/21/17	~~12:40~~	1. Received by		
2. Relinquished by	Date	Time 1507	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by	Date	Time	4. Laboratory received by: Casey Tuex	Date 3/21/17	Time 1507

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) (Yes) No Ice Pack — Receipt Temp 2.7 °C 3.3°C

SHEALY ENVIRONMENTAL SERVICES, INC.

Shealy Environmental Services, Inc.
Document Number: ME0018C-08

Page 1 of 1
Effective Date: 03/07/2017
Expiry Date: 03/07/2022

Sample Receipt Checklist (SRC)

Client: Nu Earth Cooler Inspected by/date: JW 3/21/17 Lot #: SC21057

Means of receipt: ☐ SESI ☑ Client ☐ UPS ☐ FedEx ☐ Other			
Yes ☐	No ☑		1. Were custody seals present on the cooler?
Yes ☐	No ☐	NA ☑	2. If custody seals were present, were they intact and unbroken?

pH strip ID: NA Cl strip ID: 17-314
Cooler ID/Original temperature upon receipt/Derived (corrected) temperature upon receipt:
2.7 /2.7 °C 3.3 /3.3 °C / / °C / / °C
Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 6 IR Gun Correction Factor: 0 °C
Method of coolant: ☑ Wet Ice ☐ Blue Ice ☐ Dry Ice ☐ None

Yes ☐	No ☐	NA ☑	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
Yes ☐	No ☐	NA ☑	4. Is the commercial courier's packing slip attached to this form?
Yes ☑	No ☐		5. Were proper custody procedures (relinquished/received) followed?
Yes ☑	No ☐		6. Were sample IDs listed on the COC?
Yes ☑	No ☐		7. Were sample IDs listed on all sample containers?
Yes ☑	No ☐		8. Was collection date & time listed on the COC?
Yes ☑	No ☐		9. Was collection date & time listed on all sample containers?
Yes ☑	No ☐		10. Did all container label information (ID, date, time) agree with the COC?
Yes ☑	No ☐		11. Were tests to be performed listed on the COC?
Yes ☑	No ☐		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
Yes ☑	No ☐		13. Was adequate sample volume available?
Yes ☑	No ☐		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
Yes ☐	No ☑		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
Yes ☐	No ☑	NA ☐	16. Were bubbles present >"pea-size" (¼"or 6mm in diameter) in any VOA vials?
Yes ☐	No ☐	NA ☑	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
Yes ☐	No ☐	NA ☑	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
Yes ☑	No ☐	NA ☐	19. Were all applicable NH3/TKN/cyanide/phenol/BNA (< 0.5mg/L) samples free of residual chlorine?
Yes ☐	No ☐	NA ☑	20. Were collection temperatures documented on the COC for NC samples?
Yes ☐	No ☐	NA ☑	21. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
Yes ☑	No ☐	19762	22. Was the quote number used taken from the container label?

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) _____ were received incorrectly preserved and were adjusted accordingly in sample receiving with _____ (H_2SO_4, HNO_3, HCl, NaOH) using SR # _____.

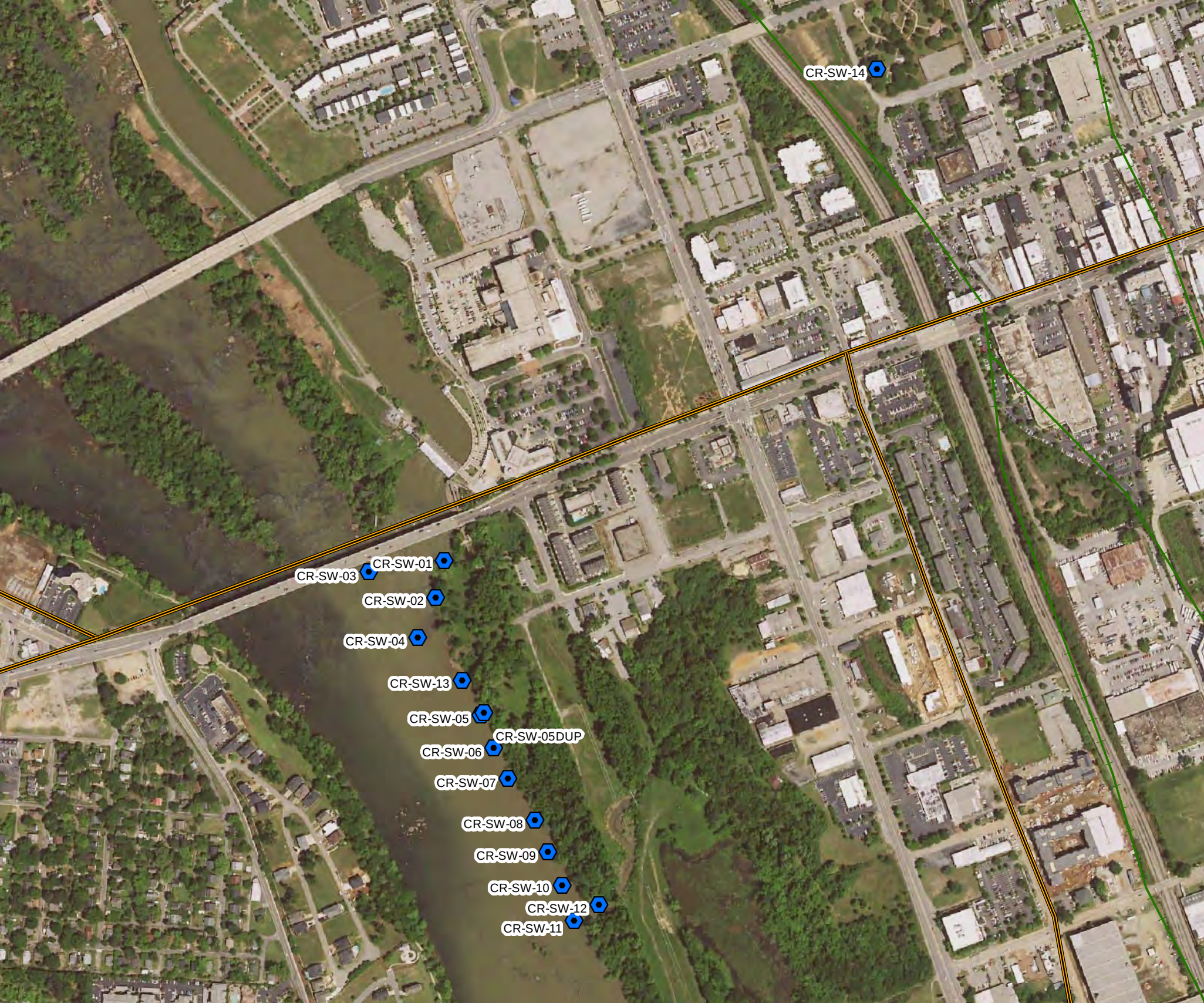
Sample(s) _____ were received with bubbles >6 mm in diameter.

Samples(s) _____ were received with TRC > 0.5 mg/L (If #21 is No) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: _____.

SC Drinking Water Project Sample(s) pH verified to be < 2 by _____ Date: _____
Sample(s) _____ were Not received at a pH of < 2 and were adjusted accordingly using SR# _____

Sample labels applied by: JW Verified by: _____ Date: 3/21/17

Comments: Trip blank not on COC


CR-SW-14
CR-SW-01
CR-SW-03
CR-SW-02
CR-SW-04
CR-SW-13
CR-SW-05
CR-SW-05DUP
CR-SW-06
CR-SW-07
CR-SW-08
CR-SW-09
CR-SW-10
CR-SW-12
CR-SW-11