



Environment

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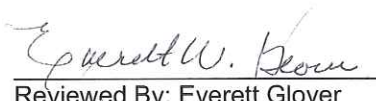
INVISTA Spartanburg Remedial Effectiveness Report November 2010

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SITE ASSESSMENT,
REMEDICATION &
REVITALIZATION


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1.0 Introduction

This report is the second of two reports for the groundwater and surface water data collected at the INVISTA Spartanburg facility in June 2010. The first report was submitted in September and provided a summary of the data collected and an assessment of the current conditions at the site. This remedial effectiveness report builds on the assessment presented in the first report.

The remedial effectiveness assessment includes a review of the historic remedial activities at the site and the results of these actions. Based on the results of historic activity and current site conditions, recommendations are provided for activities to be completed in 2011 and going forward.

2.0 Site Operational and Remediation History

Industrial activities began on the site in 1966 when Hercules, Inc. constructed a dimethyl terephthalate (DMT) production facility on the southeastern portion of the site. This facility was closed in 1978 and dismantled. In the early 1970s American Hoechst Corporation purchased the site and constructed a polyester fiber production facility west of the DMT facility. In 1986, Messer Greishiem, Inc. (MGI) leased a portion of the decommissioned DMT facility and began operating an air separations plant supplying oxygen and nitrogen for industrial uses. The site became part of the Hoechst Celanese organization with the merger of American Hoechst and Celanese Corporation in 1987. The site operated as Hoechst Celanese until the polyester business was divested in 1998 to a subsidiary of Koch Industries, Inc. From 1998 until 2004, the facility operated under the name of KoSa when the KoSa assets were merged INVISTA assets purchased from DuPont by Koch Industries and currently operates under the name of INVISTA. A portion of the original site was sold during the KoSa ownership time to Johns Mansville.

The INVISTA/Spartanburg facility currently manufactures polyester for use in various products. The major materials used in the processes include DMT, terephthalic acid, and ethylene glycol. DowTherm A™ (a mixture of 1,1-biphenyl and biphenyl ether) is used as the heat transfer medium for process control. Raw materials and other large volume process chemicals are brought in from off-site suppliers by truck and railroad tank car.

Soil and groundwater investigative activities began at the site in 1990 and multiple phases of investigation and remediation have occurred. More than \$18,000,000 has been spent in environmental activity at the site since 1990. The investigations and remediation activities were performed cooperatively with the approval of the South Carolina Department of Health and Environmental Control (SCDHEC). This work investigated and remediated the major sources of environmental impact from the industrial operations and included:

- Removal of the in-ground basins associated with the plant's industrial wastewater treatment operations through construction of a multi-million dollar, tank-based wastewater treatment plant,
- installation and operation of enhanced recovery systems on process wastewater streams,
- removal and proper disposal of wastewater treatment sludges formerly dried and held on site in unlined earthen basins,
- Construction and operation of a groundwater extraction and treatment system for the site perimeter designed to collect impacted groundwater prior to its migration off site or to the Cherokee Creek or Pacolet River which border the site,
- Performance of three phases of lactate injection targeted to enhance in-situ degradation of a chloroform plume emanating from the former DMT plant operations, and
- Performance of routine groundwater and surface water sampling and monitoring at selected monitoring points on site and in the streams that border or originate on site.

The groundwater extraction and treatment system was shut down and decommissioned with the agreement of the SCDHEC in 2003 based on the conclusions of a risk evaluation that evaluated the potential for risk to the identified receptors and concluded that terminating groundwater extraction and treatment did not present an unacceptable risk to potential on-site or adjacent receptors. The National Pollutant Discharge Elimination System (NPDES) permit associated with the groundwater treatment system was terminated in 2006 with the concurrence of the SCDHEC.

3.0 Current Site Conditions

Current site conditions are detailed in the monitoring report submitted in September. A brief summary of that report is provided below.

A site groundwater and surface water monitoring event was completed in June 2010. This event was completed as described in the Sampling and Analysis Plan (SAP) submitted to DHEC in April and approved on June 1, 2010. The sample locations included in this event are present in Figure 1. Groundwater data collected in June is summarized in Table 1 and surface water data is summarized in Table 2. Only parameters detected in at least one sample are included in Tables 1 and 2.

3.1 June 2010 Site Hydrogeology

Saprolite and residual soils historically encountered at the site have a thickness of between 5 and 120 feet over competent rock. The saprolite consists of stiff clays and silts or fine to medium sands. Near the rock/saprolite interface, the saprolite becomes coarser and contains partially weathered rock, sand, gravel and relatively unweathered quartz seams.

Groundwater elevations measured in June 2010 is presented in Figures 2 and 3. These figures include potentiometric contours for saprolite and bedrock.

Groundwater in saprolite flows away from the site in two general directions, with a divide running near the approximate center of the plant area. Groundwater north of this divide flows toward the Cherokee Creek. Groundwater south of the divide flows toward the Pacolet. A significant transitional area is present in the region of the former sludge holding area and former DMT equalization basin. Groundwater in this region flows either toward the Cherokee Creek or toward the Pacolet River depending on how far north or south the location. However, water throughout the transition flow is biased toward the conflux of the two surface water features. Groundwater flow along the southern end of the site tends to flow in a more southern direction, which is consistent with the immediate local topography.

Hydraulic gradients at the site range from 0.046 to 0.114 in saprolite and 0.028 to 0.118 in bedrock. The gradients are consistent with the gradients, which were presented in the Operating Strategy Report

3.2 June 2010 Groundwater and Surface Water Quality

The primary constituents of interest at the site are 1,4-dioxane, DowTherm A™ (1,1-biphenyl and biphenyl ether) and chloroform.

The June 2010 results for 1,4-dioxane in saprolite and bedrock are presented in Figures 4 and 5. The extent of the detections is comparable to the conditions reported in the Operating Strategy Report. 1,4-Dioxane was not detected in any surface water samples. The highest concentrations of 1,4-dioxane are reported in bedrock and saprolite in the central plant area. 1,4-Dioxane is also noted in both saprolite and bedrock near and downgradient of the Fiber 1 EQ basin. Lower concentrations are also reported in bedrock in areas near and downgradient of the former sludge drying lagoon and former DMT equalization basin.

Biphenyl ether is the primary constituent of DowTherm A™. Biphenyl ether is also more recalcitrant than 1,1-biphenyl. Therefore, the detections of biphenyl ether are both more frequent and higher in concentrations than the detections of 1,1-biphenyl.

The June 2010 results of biphenyl ether in saprolite and bedrock are presented in Figures 6 and 7. The extent of these detections is comparable to the conditions reported in the Operating Strategy Report. The detections of biphenyl ether are primarily in bedrock and range between the central plant area and the Lake Patrick area.

Extraction of phase DowTherm A™ continues from well MW-7. This location is shown on both figures 6 and 7 and is downgradient of the highest detections. Approximately 77 gallons of phase DowTherm A™ has been removed from well MW-7 since August 2001.

The June 2010 results for chloroform are presented on Figures 8 and 9. Chloroform has historically been present in a plume located at the former DMT area in the southern section of the site. The June 2010 analytical results indicate that remaining concentrations of chloroform exceeding the MCL are limited to saprolite on the southernmost edge of the property and extending to well MW-109 across I-85.

Chloroform was detected in one bedrock well in the former DMT area and in one other bedrock well on the north side of the site. Each of these detections was below the MCL.

4.0 Review of Remedial Effectiveness

4.1 1,4-Dioxane

As described in the site history section above, historic remediation of 1,4-dioxane at the site was completed through operation of a perimeter extraction system and a uv/peroxide treatment system. Based on the conclusions of the Preliminary Risk Evaluation and Operating Strategy Report and with DHEC approval, extraction along the Cherokee Creek and Pacolet River ended in early 2002.

Extraction along the southern portion of the property was terminated in early 2003 as part of the ERD remediation program. Monitoring of 1,4-dioxane was maintained as part of the sampling program for the former DMT area. Because 1,4-dioxane was removed in the last tier of screening in the preliminary risk evaluation for the north and eastern portion of the property, long term monitoring was also maintained for these areas.

Historic time vs. concentration plots for 1,4-dioxane are presented in the appendix. The plots are organized by area at the site. The first set of charts presents the trends for wells located near the conflux of the Cherokee Creek and the Pacolet River. Concentrations at wells in this area were identified by DHEC as a potential cause for impact to nearby surface water. As the trend plots demonstrate, concentrations of 1,4-dioxane in the wells in this area have declined significantly over time.

The assessment of 1,4-dioxane presented in the operating strategy report included a review of hydraulic gradients, estimated flux to surface water and anticipated surface water concentrations. The conservative calculations presented in the operating strategy report estimated 1,4-dioxane concentrations based on mean annual flow of 0.0184 mg/L in the Pacolet River and 0.644 mg/L in Cherokee Creek. Based on these concentrations the preliminary risk evaluation included in the operating strategy report removed 1,4-dioxane as a chemical of potential concern for the portions of the site near the surface water features.

Surface water monitoring prior to and since the operating strategy report has supported the conclusions of the report and has shown that the assessment was conservative. Concentrations have been <0.01 mg/L in the majority of samples and in all samples for most locations.

The hydraulic gradients used as the basis for these operating strategy report calculations are shown in figures from that report and are reprinted in the appendix to this report. Hydraulic gradients for saprolite and bedrock were re-calculated using the June 2010 data. These calculations are presented on Figures 2 and 3. The current hydraulic conditions and gradients are consistent with the values established in the operating strategy report.

The consistent hydraulic conditions, declining groundwater concentrations, and continued surface water analytical results below the reporting limit demonstrate that the conclusions and recommendations for 1,4-dioxane as presented in the operating strategy report are appropriate.

Concentration trend charts for wells located along the Cherokee Creek, as well as along the Pacolet River and the former DMT area are also included in the appendix. Concentrations of 1,4-dioxane at wells in these areas have declined or remained stable. The wells, which have shown stable

concentrations, have been at levels an order of magnitude or more less than for wells, which have demonstrated declines.

Trend plots for 1,4-dioxane in the central plant area are also presented in the appendix. Concentrations of 1,4-dioxane in the central plant area are higher than those reported in the operating strategy report. The highest concentration reported in the central plant area is 4.86 mg/L at well RW-08. This result is the highest concentration of 1,4-dioxane detected at the site during the June 2010 event. Monitoring at the site through the 1990s had indicated that concentrations ranging from 5 to 20 mg/L were regularly noted, with decreasing frequency over time. 1,4-Dioxane is mobile in groundwater and the increases noted in some wells in the central plant area are likely the result of plume migration, with overall declines in the maximum values throughout the plume.

Throughout the site, concentrations have declined over time. The concentrations of 1,4-dioxane has declined as the plume has migrated and dispersed. The Pacolet River provides a major drainage feature for the site and groundwater from the site ultimately enters the river. The mass flux of 1,4-dioxane into both the Cherokee Creek and the Pacolet River are insufficient to produce measureable concentrations. Once in surface water, natural attenuation of the remaining mass continues by UV oxidation and other processes.

The operating strategy report recommended monitoring of 1,4-dioxane. The site conditions continue to support this recommendation. Because higher concentrations have been reported in the central plant area, continued monitoring in this area, and downgradient, should be retained in the long term monitoring plan.

Recommendations for long term monitoring are included in the end of this report.

4.2 DowTherm A™

DowTherm A™ has been identified at the site with a plume existing between the central plant area and the Fiber 1 EQ basin and Lake Patrick. Free product DowTherm A™ is extracted from one well, MW-7 located immediately downgradient of the Fiber 1 EQ basin. Historic data has also indicated that lower concentrations of DowTherm A™ components are present between the former DMT equalization basin and former sludge drying lagoon areas.

Time vs. concentration trend plots for biphenyl ether are presented in the appendix. Most of the locations have demonstrated stable or declining concentrations over time. Some of the wells have shown an increase in concentrations since the early 1990s, but since the time of the Operating Strategy Report, the concentrations have been more stable.

Concentrations of biphenyl ether tend to fluctuate significantly at several wells.

Increasing concentrations of biphenyl ether are noted at well RW-08. Well RW-08 is located near well MW-07. The increases in concentration may be associated with the extraction activity.

The preliminary risk evaluation included an assessments of biphenyl ether and 1,1-biphenyl. Neither of these parameters was retained as chemicals of potential concern for humans or ecological impact for any portion of the site.

Surface water sampling has been maintained at the site and has included analysis for DowTherm A™ components. More than two hundred and fifty surface water samples have been collected from the

length of the Cherokee Creek and Pacolet River between 1999 and 2010. Neither component of DowTherm A™ has been detected in any samples, with a consistent reporting limit of <0.01 mg/L for each.

Prior to 2001 two extraction wells were in operation at the Fiber 1 EQ basin area. These wells include the existing extraction well MW-07 and well MW-39. These operations were temporarily suspended in the spring of 2001 because the compressor was over-working. The wells were investigated in August 2001. At that time, it was determined that no phase material was present in well MW-39. A revised operation schedule was established for MW-07. With the exception of brief maintenance or repair shut down periods, this operation has continued through today.

The previous investigation indicated that MW-07 is the best location for continued extraction. This well provides access to the phase material, while other locations have limitations on operations, yield, or access.

Extraction from well MW-07 is an effective remedial measure for the DowTherm A™ presence at the site and will be continued as long as phase material can be removed.

Long term monitoring for DowTherm A™ components is included in the sampling plan recommendations later in this report.

4.3 Chloroform

Remediation of chloroform has consisted of a series of enhanced reductive dechlorination events in the former DMT area and at well RW-108. Each of the events has consisted of injection of sodium lactate into one or more wells by gravity flow.

The first event occurred in May 2003. Seventy 55-gallon drums of sodium lactate solution were diluted and injected into eleven wells at the site. Additional injection was completed in a series of smaller events between the summer of 2004 and early 2005. An additional 68 drums of sodium lactate were injected over the course of these events. Finally, eight drums of lactate were diluted and injected into well RW-108 between late 2007 and early 2008.

The ERD treatment process has been highly effective in remediating the chloroform plume. Both the concentrations and the extent of chloroform detections have been significantly decreased.

The effectiveness of the ERD treatment is summarized in Table 3. Table 3 provides a list of monitoring locations in the treatment area. The locations are divided into injection locations and non-injection locations. For each well the pre-injection concentration and post injection concentration is shown. The pre-injection concentration is the highest concentration recorded between November 2001 and March 2003. These dates limit the data to results collected after the data collected for the Preliminary Risk Evaluation / Operating Strategy Report and before injection was initiated. Monitoring wells RW-47 and MW-45 were not tested during this period, so the most recent result prior to that period is listed.

As shown in Table 3, the majority of locations in the treatment area are reporting non-detect results for chloroform (<0.005 mg/L). Four saprolite locations have detections, which exceed the MCL. The locations of these detections are shown on Figure 4. These locations are on the southern edge of the property and include MW-109 located across I-85.

A receptor survey and additional off-site investigation has been completed. As a result of the receptor survey, six properties were identified for sampling. Three of these properties were determined to have existing wells. All three wells were sampled for chloroform in August 2010. In all three cases the results of the analysis were non-detect (<0.005 mg/L).

Historic sampling at surface water location SW-12 has demonstrated that some portion of the chloroform plume is captured by this stream. Concentrations in this stream have ranged from <0.005 mg/L to 0.0281 mg/L. These concentrations are significantly below the total trihalomethane MCL of 0.080 mg/L.

The downgradient area is presented in Figure 10. The locations of the three downgradient wells are included on the figure. These three private wells are located on the far side of the stream. Samples collected from all three of the wells were non-detect for chloroform (<0.005 mg/L). These results indicate that any chloroform mass passing beneath the stream is not significant in magnitude, and will ultimately still drain to this stream feature. The stream drains to the Pacolet River on the far side of the elevated area on the music camp property.

In summary, the ERD treatment has been very effective in the former DMT area. No detections are reported in bedrock exceeding the MCL for total trihalomethanes. A region of groundwater in saprolite on the southern portion of the site and extending under I-85 did not receive the full effect of the ERD treatment. Concentrations in this area are lower than concentrations reported prior to injection, but remain above the MCL. Wells located beyond this stream indicated that significant mass does not move beyond the stream. The stream drains to the Pacolet River. Any groundwater, which does not reach the stream, drains along shorter pathways, which run directly into the Pacolet River.

5.0 Recommendations

Recommendations for continued activity are presented below.

5.1 1,4-Dioxane

Monitoring of surface water samples collected at the bank and stream bed of the Cherokee Creek and the Pacolet River have supported previous analysis that the mass flux to these surface water bodies will not produce significant concentrations. Concentrations in surface water samples are consistently non-detect (<0.005 mg/L) and all surface water results in June 2010 were non-detect.

Concentrations of 1,4-dioxane in wells located near the surface water locations have declined and hydraulic gradients are consistent with previously established magnitudes.

Therefore, the data gathered has reinforced the conclusions previously approved for 1,4-dioxane at the site.

Because 1,4-dioxane concentrations persist in the central plant area, continued monitoring in that area and the downgradient areas is appropriate to provide continued confirmation of the conditions.

The sampling plan is recommended below.

5.2 DowTherm A™

Extraction from well MW-07 continues to remove free product material. The presence of DowTherm A™ is not noted in site surface waters. Concentrations are stable or declining with the exception of well RW-08, which is located near the operating extraction well.

Extraction from well MW-07 will be continued as long as product is present. Monitoring of the central plant and downgradient areas will also be continued. The proposed sampling plan is presented below.

5.3 Chloroform

The ERD treatment has been effective in reducing the extent and magnitude of concentrations of chloroform.

Remaining concentrations of chloroform, which exceed the MCL, are reported in saprolite wells in the southernmost portion of the site and extending under I-85.

Historic sampling at surface water location SW-12 has demonstrated that some portion of the chloroform plume is captured by this stream. Concentrations in this stream at location SW-12 have ranged from <0.005 mg/L to 0.0281 mg/L. These concentrations are below the total trihalomethane MCL of 0.080 mg/L. Because the SW-12 location is closer to the former plume area than other later segments of the creek, it is not expected that concentrations will increase along the creek. Because SW-12 has remained consistently at less than one third of the MCL, there is no potential for detections exceeding the MCL along this stream.

The three downgradient wells on the far side of the stream indicate a clean boundary at or very near the stream.

Based on the results of these samples, continued monitoring as needed is recommended. The proposed sampling plan is presented in the next section.

5.4 Monitoring

The proposed long term monitoring plan is presented in Table 4. The plan is based on the sampling event, which was completed in June 2010. A few wells were either removed from the sampling program or had the planned list of analyses reduced because these wells were shown to be neither inside of nor downgradient of impacted areas. The list of natural attenuation parameters was also reduced to only those parameters, which provided useful information on the conditions of the site.

Sampling will be completed on an annual basis with an event scheduled for completion in June of each year.

Sampling procedures will continue to be completed as described in the Sampling and Analysis Plan. The one exception to this is the collection of surface water samples. Because collection of samples at the bank and stream bed has provided results, which support the prior conclusions, it is recommended that sampling of surface waters will revert to mid/mid sampling. This will provide results, which reflect the overall stream conditions and will be consistent with historic procedures.

5.5 Reporting and Other Activities

A focused sampling event within the former DMT area is scheduled for completion on December of 2010. This event will be completed as described in the Sampling and Analysis Plan. A memo providing the results of this event and a brief discussion of the findings will be submitted by March 31, 2011.

Annual reports including the June analytical data, updates on phase DowTherm A™ extraction status, and any other activities will be submitted by September 30 of each year.

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Tables

Table 1
 Summary of Groundwater Analytical Results
 June 2010
 INVISTA Spartanburg Facility
 AECOM Project No. 60135440

Parameter	Unit	EW-01 6/23/2010	EW-03 6/24/2010	EW-07 6/24/2010	EW-14 6/23/2010	EW-15 6/23/2010	EW-16 6/23/2010	EW-17 6/23/2010	EW-22 6/24/2010	EW-26 6/23/2010	EW-27 6/24/2010	EW-27 Dup 6/24/2010	EW-31 6/23/2010
Volatiles Organics and 1,4-Dioxane													
1,4-dioxane	mg/L	0.0342	<0.01	0.106	0.279	<0.01	2.23	0.0139	0.967	0.0709	<0.01	<0.01	NA
2-butanone	mg/L	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	<0.01	<0.01	<0.01
acetone	mg/L	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	<0.01	<0.01	0.0126
chloroform	mg/L	NA	NA	NA	<0.005	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
1,1-dichloroethane	mg/L	NA	NA	NA	0.132	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
1,1-dichloroethene	mg/L	NA	NA	NA	0.0557	NA	NA	NA	NA	NA	0.0142	0.0146	<0.005
cis-1,2-dichloroethene	mg/L	NA	NA	NA	0.243	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
trans-1,2-dichloroethene	mg/L	NA	NA	NA	0.0432	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
1,1,2,2-tetrachloroethane	mg/L	NA	NA	NA	0.434	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
tetrachloroethene	mg/L	NA	NA	NA	<0.005	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
trichloroethene	mg/L	NA	NA	NA	0.25	NA	NA	NA	NA	NA	<0.005	<0.005	<0.005
vinyl chloride	mg/L	NA	NA	NA	0.0549	NA	NA	NA	NA	NA	<0.01	<0.01	<0.01
Dow Therm A™													
1,1-biphenyl	mg/L	<0.01	NA	NA	0.0827	NA	<0.01	NA	NA	NA	<0.01	<0.01	NA
biphenyl ether	mg/L	<0.01	NA	NA	0.967	NA	0.105	NA	NA	NA	<0.01	<0.01	NA
Field and Natural Attenuation Parameters													
alkalinity	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	190
chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.76
dissolved oxygen	mg/L	2.09	0.9	0.7	1.52	3.69	2.9	1.69	1.4	1.3	1.28	1.28	0.2
ferrous iron	mg/L	2	5.8	9	1.52	3.3	6.8	2.4	9.4	5.6	2.8	2.8	2.4
manganese (dissolved)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.61
nitrate nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1
ORP	mV	-61	8.54	9.42	-31	7.67	8.1	-61	7.91	9.44	66	66	-168
orthophosphate phosphorus	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.03
pH	su	6.18	6.6	6.9	5.99	6.3	6.5	6.02	6.6	6.8	5.41	5.41	7.24
specific conductance	umhos/cm	0.133	0.0378	0.187	0.134	0.135	0.911	0.122	0.743	0.313	0.037	0.037	383
sulfate	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
sulfide	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0622
temperature	degrees C	22.1	26.7	15.6	20.7	19.9	23.8	22.8	18.8	22.2	18	18	21
total organic carbon	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13.5
turbidity	NTU	27	15.2	6.31	7	246	24.1	33	26.5	28.5	23	23	51

NA - Not Analyzed
 degrees C - degrees Celsius
 feet MSL - feet above mean sea level
 mg/L - milligrams per liter
 mV - millivolts
 NTU = nephelometric turbidity units
 su - standard units
 umhos/cm - micromhos/cm

Table 1
 Summary of Groundwater Analytical Results
 June 2010
 INVISTA Spartanburg Facility
 AECOM Project No. 60135440

Parameter	Unit	EW-32 6/23/2010	EW-37 6/24/2010	EW-38 6/24/2010	EW-41 6/23/2010	EW-41 Dup 6/23/2010	EW-47 6/24/2010	EW-49 6/24/2010	EW-52 6/24/2010	EW-53 6/24/2010	MW-27 6/22/2010	MW-40 6/25/2010	MW-41 6/25/2010	MW-53 6/28/2010
Volatiles Organics and 4-Dioxane														
1,4-dioxane	mg/L	0.963	NA	0.0352	<0.01	<0.01	0.0175	NA	0.0131	NA	<0.01	1.56	0.0243	3.18
2-butanone	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
acetone	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
chloroform	mg/L	<0.005	<0.005	0.016	0.0625	0.0684	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
1,1-dichloroethane	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
1,1-dichloroethene	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
cis-1,2-dichloroethene	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00867	0.0556	<0.005	<0.005	NA	NA	NA
trans-1,2-dichloroethene	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
1,1,1,2-tetrachloroethane	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
tetrachloroethene	mg/L	<0.005	0.00636	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
trichloroethene	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	NA
vinyl chloride	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Low Therm A														
1,1-biphenyl	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.324
biphenyl ether	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.28
Field and Natural Attenuation Parameters														
alkalinity	mg/L	NA	29.8	NA	26.3	28.8	NA	80.2	27.8	57	NA	NA	NA	NA
chloride	mg/L	NA	11.5	NA	3.03	3.05	NA	1.95	2.81	9.45	NA	NA	NA	NA
dissolved oxygen	mg/L	0.92	1	1.89	0.5	0.5	3.9	0.4	0.2	0.4	3.89	0.7	3	0.7
ferrous iron	mg/L	1.8	0.8	2.1	2.2	2.2	<0.2	1.4	4.4	2.6	<0.2	NA	3.2	3.6
manganese (dissolved)	mg/L	NA	1.24	NA	0.974	1.02	NA	0.066	0.234	1.46	NA	NA	NA	NA
nitrate nitrogen	mg/L	NA	2.54	NA	0.19	0.2	NA	<0.1	<0.1	<0.1	NA	NA	NA	NA
ORP	mV	6.9	109	-22	53	55	197	-148	-19	-28	127	71	-45	100
orthophosphate phosphorus	mg/L	NA	<0.03	NA	<0.03	<0.03	NA	0.051	<0.03	<0.03	NA	NA	NA	NA
pH	su	6.2	5.8	6.31	5.92	5.92	5.17	7.88	6.14	6.35	5.8	5.5	6.08	4.72
specific conductance	umhos/cm	0.249	0.123	0.091	89	0.001	0.053	0.183	0.115	0.148	0.05	0.156	0.134	1.52
sulfate	mg/L	NA	<1	NA	<1	<1	NA	12.3	<1	<1	NA	NA	NA	NA
sulfide	mg/L	NA	<0.05	NA	<0.05	<0.05	NA	0.168	<0.05	0.0665	NA	NA	NA	NA
temperature	degrees C	24.3	20	19	21	21	18	22	21	21	22	21	25	27
total organic carbon	mg/L	NA	2.77	NA	3.51	2.13	NA	1.73	3.66	2.62	NA	NA	NA	NA
turbidity	NTU	1.41	2	20	37	44	20	3	32	80	6	9	188	6

NA - Not Analyzed
 degrees C - degrees Celsius
 feet MSL - feet above mean sea level
 mg/L - milligrams per liter
 mV - millivolts
 NTU = nephelometric turbidity units
 su - standard units
 umhos/cm - micromhos/cm

Table 1
 Summary of Groundwater Analytical Results
 June 2010
 INVISTA Spartanburg Facility
 AECOM Project No. 60135440

Parameter	Unit	MW-54 6/28/2010	MW-96 6/23/2010	MW-99 6/24/2010	MW-103 6/21/2010	MW-105 6/22/2010	MW-106 6/22/2010	MW-107 6/22/2010	MW-109 6/21/2010	RW-08 6/25/2010	RW-24 6/24/2010	RW-29 6/22/2010	RW-29 Dup 6/22/2010	RW-43 6/24/2010
Volatiles Organics and 1,4-Dioxane														
1,4-dioxane	mg/L	NA	0.0206	0.0364	NA	NA	<0.01	<0.01	NA	0.0539	0.664	<0.01	<0.01	1.32
2-butanone	mg/L	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	<0.01	<0.01	NA
acetone	mg/L	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	<0.01	<0.01	NA
chloroform	mg/L	NA	NA	0.00836	<0.005	0.202	0.391	0.253	0.478	NA	NA	<0.005	<0.005	NA
1,1-dichloroethane	mg/L	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
1,1-dichloroethene	mg/L	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
cis-1,2-dichloroethene	mg/L	NA	NA	0.126	<0.005	0.0164	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
trans-1,2-dichloroethene	mg/L	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
1,1,2,2-tetrachloroethane	mg/L	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
tetrachloroethene	mg/L	NA	NA	0.164	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
trichloroethene	mg/L	NA	NA	0.0319	<0.005	<0.005	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	NA
vinyl chloride	mg/L	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	<0.01	<0.01	NA
Low Therm A														
1,1-biphenyl	mg/L	<0.01	NA	NA	NA	NA	NA	NA	NA	0.357	NA	<0.01	<0.01	NA
biphenyl ether	mg/L	<0.01	NA	NA	NA	NA	NA	NA	NA	1.86	NA	<0.01	<0.01	NA
Field and Natural Attenuation Parameters														
alkalinity	mg/L	NA	NA	4.55	2.46	9.85	<1	25.1	22.2	NA	NA	65	64.5	NA
chloride	mg/L	NA	NA	1.68	3.27	6.25	8.27	1.71	2.51	NA	NA	1.23	1.24	NA
dissolved oxygen	mg/L	2.52	3	3.05	6.20	6.60	6.20	6.40	5.9	0.20	1.3	0.5	0.4	0.88
ferrous iron	mg/L	<0.2	<0.2	<0.2	<0.200	<2.00	<0.200	<0.200	<0.2	<0.200	8.6	<0.2	<0.2	<0.2
manganese (dissolved)	mg/L	NA	NA	0.051	0.05	<0.01	0.017	<0.01	<0.01	NA	NA	0.016	0.016	NA
nitrate nitrogen	mg/L	NA	NA	0.86	2.65	1.75	1	1.25	1.12	NA	NA	<0.1	<0.1	NA
ORP	mV	92	171	228	211	218	263	181	189	-201	9.22	98	81	-102
orthophosphate phosphorus	mg/L	NA	NA	<0.03	<0.03	<0.03	<0.03	0.0417	0.0495	NA	NA	<0.03	<0.03	NA
pH	su	5.85	4.76	4.66	4.9	5.43	4.92	5.85	5.9	8.16	6.7	7.99	8.01	8.76
specific conductance	umhos/cm	232	0.03	0.022	0.490	0.0610	0.0400	0.640	59	0.236	0.582	145	145	0.223
sulfate	mg/L	NA	NA	<1	<1	<1	<1	<1	<1	NA	NA	8.8	8.9	NA
sulfide	mg/L	NA	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	NA	<0.05	<0.05	NA
temperature	degrees C	24	20.6	23	19.0	20.0	20.0	18.0	19	20.0	20.6	18	18	18.1
total organic carbon	mg/L	NA	NA	1.33	1.92	1.73	2.15	1.68	1.25	NA	NA	1.08	1.1	NA
turbidity	NTU	9	15	11	8.00	<1.00	3.00	6.00	12	16.0	14.3	2	2	9

NA - Not Analyzed
 degrees C - degrees Celsius
 feet MSL - feet above mean sea level
 mg/L - milligrams per liter
 mV - millivolts
 NTU = nephelometric turbidity units
 su - standard units
 umhos/cm - micromhos/cm

Table 1
 Summary of Groundwater Analytical Results
 June 2010
 INVISTA Spartanburg Facility
 AECOM Project No. 60135440

Parameter	Unit	RW-48 6/23/2010	RW-65 6/23/2010	RW-79 6/28/2010	RW-80 6/28/2010	RW-82 6/28/2010	RW-86 6/28/2010	RW-91 6/28/2010	RW-92 6/28/2010	RW-108 6/21/2010
Volatiles Organics and 1,4-Dioxane										
1,4-dioxane	mg/L	<0.01	NA	0.176	4.86	1.25	NA	0.322	1.4	NA
2-butanone	mg/L	<0.01	<0.01	NA	NA	NA	NA	NA	NA	0.0186
acetone	mg/L	<0.01	<0.01	NA	NA	NA	NA	NA	NA	0.0459
chloroform	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
1,1-dichloroethane	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
1,1-dichloroethene	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
cis-1,2-dichloroethene	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
trans-1,2-dichloroethene	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
1,1,2,2-tetrachloroethane	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
tetrachloroethene	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
trichloroethene	mg/L	<0.005	<0.005	NA	NA	NA	NA	NA	NA	<0.005
vinyl chloride	mg/L	<0.01	<0.01	NA	NA	NA	NA	NA	NA	<0.01
Dow Therm A										
1,1-biphenyl	mg/L	NA	NA	0.0337	0.153	2.41	0.623	1.65	0.636	NA
biphenyl ether	mg/L	NA	NA	1.61	0.316	7.26	2.37	4.96	3.17	NA
Field and Natural Attenuation Parameters										
alkalinity	mg/L	249	109	NA	NA	NA	NA	NA	NA	729
chloride	mg/L	16.8	11.8	NA	NA	NA	NA	NA	NA	4.1
dissolved oxygen	mg/L	0.1	0.1	1.21	0.7	1.1	0.98	0.76	0.8	0.4
ferrous iron	mg/L	2.2	<0.2	0.2	4	4.3	3.6	3.2	2.7	1.2
manganese (dissolved)	mg/L	0.14	2.08	NA	NA	NA	NA	NA	NA	2.01
nitrate nitrogen	mg/L	<0.1	<0.1	NA	NA	NA	NA	NA	NA	<0.1
ORP	mV	-212	-191	NA	86	-71	-56	10.1	-4.6	-183
orthophosphate phosphorus	mg/L	0.387	<0.03	NA	NA	NA	NA	NA	NA	<0.03
pH	su	7.61	7.5	5.21	4.43	5.99	6.64	6.08	6.25	6.95
specific conductance	umhos/cm	0.502	307	0.186	0.936	0.376	1.29	0.442	0.966	1150
sulfate	mg/L	<1	9.65	NA	NA	NA	NA	NA	NA	<1
sulfide	mg/L	<0.05	0.0643	NA	NA	NA	NA	NA	NA	<0.05
temperature	degrees C	19	18	25	37	27	33	24	25	23
total organic carbon	mg/L	6.95	34	NA	NA	NA	NA	NA	NA	21.5
turbidity	NTU	9	2	6	7	9	10	8	5	31

NA - Not Analyzed
 degrees C - degrees Celsius
 feet MSL - feet above mean sea level
 mg/L - milligrams per liter
 mV - millivolts
 NTU = nephelometric turbidity units
 su - standard units
 umhos/cm - micromhos/cm

Table 2
Summary of Surface Water Analytical Results
June 2010

INVISTA Spartanburg Facility
AECOM Project No. 60135440

Parameter	Unit	SW-01 6/22/2010	SW-02 6/22/2010	SW-03 6/22/2010	SW-04 6/22/2010	SW-04 Dup 6/22/2010	SW-05 6/22/2010	SW-06 6/22/2010	SW-07 6/22/2010	SW-08 6/22/2010	SW-09 6/22/2010	SW-10 6/22/2010	SW-11 6/22/2010	SW-11 Dup 6/22/2010	SW-12 6/22/2010
chloroform	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0179
1,4-dioxane	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA
dissolved oxygen	mg/L	8.6	8.3	5.9	6	6	5.5	4.8	4.3	6.2	5.7	4.9	5.2	5.2	5.4
ORP	mV	134	77	101	88	88	100	100	120	127	130	140	139	139	177
pH	su	5.61	5.7	6.1	6	6	7.31	7.31	7.22	7.61	8	7.5	7.41	7.41	5.41
specific conductance	umhos/cm	0.54	0.07	0.066	0.056	0.056	0.046	0.044	0.047	0.046	0.052	0.101	0.07	0.07	0.09
temperature	degrees C	21	21	23	23	23	30	30	30	30	31	31	31	31	24
turbidity	NTU	3	4	4	5	5	11	3	3	3	6	3	7	7	6

NA - Not Analyzed
degrees C - degrees Celsius
mg/L - milligrams per liter
mV - millivolts
NTU = nephelometric turbidity units
su - standard units
umhos/cm - micromhos/cm

Table 3
Summary of ERD Treatment Effectiveness
INVISTA Spartanburg

Data in mg/L	
Injection Locations	June 2010 Concentration
EW-30	2.36
EW-31	1.57
EW-37	4.6
EW-39	8.36
EW-40	3.21
EW-41	1.74
EW-44	4.0
EW-49	0.93
EW-50	0.463
EW-53	4.02
RW-47	1.16
RW-48	15.0
RW-65	4.19
Monitoring Locations	
EW-36	0.217
EW-52	0.0135
MW-45	0.014
MW-99	0.014
MW-103	0.376
MW-105	0.349
MW-106	0.461
MW-107	0.0063
MW-109	0.14
RW-108	0.358

* - December 2008 result, most recent sample from this location

** - December 2008 result, most recent sample from this location, EW-40 and RW-47 <0.005 mg/L in June 2008

Table 4
Proposed Annual Sampling Plan
INVISTA Spartanburg Facility
AECOM Project No. 60135440

Sample Location	VOCs	1,4-Dioxane	DowTherm A	NA Params
Groundwater				
EW-01			X	
EW-14		X	X	
EW-16		X	X	
EW-17		X		
EW-22		X		
EW-26		X		
EW-32		X		
EW-38		X		
EW-41	X	X		X
EW-52	X			X
EW-53	X			X
MW-40		X		
MW-41		X		
MW-53		X	X	
MW-54			X	
MW-96		X		
MW-99	X	X		X
MW-103	X			X
MW-105	X			X
MW-106	X	X		X
MW-107	X	X		X
MW-109	X			X
RW-08		X	X	
RW-24		X		
RW-29	X	X	X	X
RW-43		X		
RW-48	X	X		X
RW-65	X			X
RW-79		X	X	
RW-80		X	X	
RW-82		X	X	
RW-86			X	
RW-91		X	X	
RW-92		X	X	
RW-108	X			X
Surface Water				
SW-01		X	X	
SW-02		X	X	
SW-03		X	X	
SW-04		X	X	
SW-05		X	X	
SW-06		X	X	
SW-07		X	X	
SW-08		X	X	
SW-09		X	X	
SW-10		X	X	
SW-11		X	X	
SW-12	X			

NA Params - Natural Attenuation Parameters:

Temperature, pH, dissolved oxygen (DO), ORP, alkalinity, chloride, nitrate, nitrite, and dissolved ferrous iron

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Figures