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August 6, 2009

FOR INCLUSION IN THE ADMINISTRATIVE RECORD

VIA ELECTRONIC AND REGULAR MAIL

Eve Vaudo, Esq.
U.S. Environmental Protection Agency, Region 1
Office of Environmental Stewardship
1 Congress Street, Suite 1100
Mail Code SES
Boston, MA 02114-2023

Re: Response to the July 16, 2009 Action Memorandum Regarding Request for a Removal Action at the Centredale Manor Restoration Project Superfund Site, North Providence, Rhode Island

Dear Eve:

As we discussed, please find enclosed the response of Emhart Industries, Inc. ("Emhart") to EPA's July 16, 2009 Action Memorandum. Please include this letter and the enclosed comments in the Administrative Record for the Site. If you have any questions or would like to discuss the issues addressed in Emhart's enclosed comments, please do not hesitate to contact us.

Sincerely,

Laura Ford Brust

Laura Ford Brust

Direct line: 202 370 3923
lbrust@sandw.com

Enclosure

SDMS DocID 506585

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EMHART INDUSTRIES INC.'S RESPONSE TO THE JULY 16, 2009 ACTION MEMORANDUM REGARDING REQUEST FOR A REMOVAL ACTION AT THE CENTREDALE MANOR RESTORATION PROJECT SUPERFUND SITE, NORTH PROVIDENCE, RHODE ISLAND

August 6, 2009

On July 16, 2009, EPA issued an Action Memorandum concerning a proposed removal action at the Centredale Manor Restoration Project Superfund Site in North Providence, Rhode Island (the "Site"). In the Action Memorandum, EPA states that "EPA has determined that dioxin is migrating to the adjacent Woonasquatucket River. Though dioxin is not soluble in water, migration may be facilitated by elevated levels of volatile organic compounds found in the same samples." Action Memorandum (July 16, 2009), at 2.

EPA's conceptual site model is based on the alleged mobilization of dioxin to the Woonasquatucket River ("River") through: (i) cosolvency; and/or (ii) colloid-facilitated transport. Cosolvency refers to increasing a compound's capacity to dissolve in groundwater due to the presence of a completely miscible solvent at high percent levels in the groundwater. Colloid-facilitated transport refers to the transport of constituents that do not dissolve readily in groundwater, such as dioxin, whereby the constituents attach to small suspended particles ("colloids") that can be mobilized by groundwater and travel through the space between soil particles.

According to EPA's June 30, 2005 Interim-Final Remedial Investigation Report ("RI Report"), the most significant groundwater contamination at the Site is in the vicinity of monitoring well MW-05S, which is located adjacent to the Brook Village parking lot and east of the River. Groundwater samples obtained from this well were reported to contain tetrachloroethylene ("PCE") and trichloroethylene ("TCE"), which are partially miscible solvents. In 2005, EPA conducted a Semi-Permeable Membrane Device ("SPMD") study to evaluate whether dioxin is present in groundwater at the River interface in the dissolved phase.

Emhart Industries, Inc. ("Emhart") previously refuted EPA's conceptual site model in correspondence dated June 8, 2007, August 15, 2007, and October 15, 2007 (attached as Exhibits 1-3, and incorporated herein.) As explained in more detail in Exhibits 1-3, Emhart's consultant, AMEC Earth & Environmental ("AMEC") analyzed the data and literature that EPA cited, at that time, as supporting its conceptual site model and concluded:

- The surface water data do not support a zonal influx of 2,3,7,8-TCDD to the Woonasquatucket River water column;
- The data do not support the theory that 2,3,7,8-TCDD is dissolved in MW-05 groundwater;
- The SPMD data cannot be used to assess flux of 2,3,7,8-TCDD to the overlying surface water;

- MW-05S contains no free product in groundwater;
- MW-05S is not reported to contain any completely miscible solvents, such as methanol or acetone, in the solid (soil) or liquid (groundwater) phases;
- The highest reported levels of PCE and TCE in groundwater at monitoring well MW-05S are 61 mg/l and 2.5 mg/l, respectively;
- For partially miscible solvents, such as TCE and PCE, to have an appreciable effect on cosolvency or reduced sorption, the concentration in the dissolved aqueous phase must exceed 10,000 mg/l;
- The maximum reported concentration of dissolved, aqueous phase partially miscible solvents in MW-05S is 0.635% of the threshold at which cosolvency effects would be observed;
- The water solubilities of TCE and PCE are 1,100 mg/l and 150 mg/l, respectively, and thus the dissolved concentrations of these compounds in groundwater at monitoring well MW-05S could not approach the 10,000 mg/l threshold cited in literature for cosolvency effects by immiscible solvents to occur;
- Given the absence of a completely miscible solvent, such as methanol or acetone, at percent-level concentrations, and given the aqueous solubilities of TCE and PCE, enhanced solubility of dioxin cannot occur at monitoring well MW-05S;
- No cosolvency of dioxin by PCE or TCE is occurring at MW-05S; and
- Enhanced transport of 2,3,7,8-TCDD is not occurring at monitoring well MW-05S as the result of the co-occurrence of PCE and/or TCE.

In the Action Memorandum, EPA states that it is now relying on sampling results from soil borings from groundwater monitoring wells installed in January and February 2008 to support its conceptual site model. *See* Action Memorandum at 2. In accordance with an EPA-approved Scope of Work, Loureiro Engineering Associates ("LEA") installed three shallow monitoring wells (MW-LEA-01, MW-LEA-02, and MW-LEA-03) along the east embankment of the River at locations that would likely bound the alleged migration pathway from monitoring well MW-05S to the River. During the monitoring well installation process, soil samples were obtained for possible laboratory analysis. Groundwater samples were obtained from the new wells and from monitoring well MW-05S for laboratory analysis for dioxins.

As explained in Section 8 of the Shallow Groundwater Data Report dated October 10, 2008 (attached as Exhibit 4), these data do not support EPA's conceptual site model that TCE and/or PCE are acting as a cosolvent. While dioxins were detected in the unfiltered groundwater samples collected from each well, dioxins were detected in the filtered groundwater samples collected from monitoring well MW-LEA-02 only. If cosolvency were occurring at the Site, dioxins would most likely have been detected in filtered samples obtained from MW-LEA-01 and/or MW-05S because the groundwater samples obtained from these wells were reported to

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contain the highest concentrations of PCE and TCE. Also, if cosolvency were occurring, little to no difference in dioxin concentrations between the unfiltered and filtered samples would be expected. Based on the foregoing, LEA concluded that dioxin is not dissolved in groundwater.

The dioxins detected in the filtered as well as the unfiltered groundwater samples obtained from monitoring well MW-LEA-02 are likely present because they are bound to particles suspended in the groundwater at this location. A turbidity value of 13 nephalometric turbidity units (NTUs) was recorded for groundwater at monitoring well MW-LEA-02. This relatively high turbidity value is believed to be due to the disturbance to the formation caused by the sample collection process, which resulted in the suspension of particles in the groundwater. Under undisturbed conditions, these particles would not be dissociated from the formation and suspended in groundwater.

Based on the SPMD data, EPA concluded that dioxins are migrating via groundwater toward the River. As discussed above, the conditions for dioxin cosolvency have not been met at the Site, so dioxin detected in the SPMDs cannot be the result of dissolved, transported dioxin. Moreover, the data derived from the SPMDs buried in the contaminated river bank sediment are in no way indicative of colloidal transport because SPMDs do not account for colloidally-bound chemicals. The USGS states the following regarding SPMDs:

> Nonporous polymeric films such as low-density polyethylene (membrane of choice for SPMDs) contain transient cavities with maximum diameters of about 10 Å. These cavities are far too small to accommodate colloids or macromolecular dissolved organic carbon (DOC) such as humic acids.

USGS, Answers to Frequently Asked Questions About SPMD Technology, Question 7 (wwwaux.cerc.cr.usgs.gov/SPMD/SPMD_questions.htm). The only plausible way for dioxins to be found in the buried SPMD samples is through direct contact with "hot spot" contaminated soil, which contaminated the outer surface of the SMPD.

LEA concluded that dioxins are not discharging to the River. Instead, dioxins detected in the groundwater samples collected from monitoring well MW-LEA-02 and the other newly-installed monitoring wells are likely due to a "hot spot" located in this area. The proposed removal action is intended to address this area of contamination, even though, based on technical literature on cosolvency and the empirical data collected at the Site, dioxin cannot migrate and is not migrating toward the Woonasquatucket River.

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Exhibit 1

ANDREWS OFFICE PRODUCTS CAPITOL HEIGHTS, MD (K)

amec

FOR INCLUSION IN THE ADMINISTRATIVE RECORD

June 8, 2007

Ms. Anna Krasko, Project Manager
United States Environmental Protection Agency
Region 1
One Congress Street
Boston, Massachusetts 02114

RE: Comments on EPA's Conceptual Model for the Groundwater to Surface Water Transport Pathway

Dear Ms. Krasko:

At the April 23, 2007 dialog meeting, the Battelle project team presented EPA's detailed analysis of the remedial alternatives for the source area groundwater. According to Battelle's presentation, it was stated that the shallow groundwater in the immediate vicinity of well MW-05 requires remediation due to the presence and transport of tetrachloroethylene and 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) to the Woonasquatucket River via groundwater flow. We are writing on behalf of Emhart Industries, Inc., to express significant concern with the conceptual site model for the transport pathway and the data that Battelle uses to reach the conclusion that remediation is warranted for the groundwater in the vicinity of MW-05.

Our concern regarding the conceptual site model for this transport pathway stems from the following:

1. The surface water data do not support a zonal influx of 2,3,7,8-TCDD to the Woonasquatucker River water column.

2. The data do not support the idea that 2,3,7,8-TCDD is dissolved in MW-05 groundwater.

3. The Semi-Permeable Membrane Device (SPMD) data cannot be used to assess flux of 2,3,7,8-TCDD to the overlying surface water.

Each of these points is discussed below.

ZONAL INFLUX OF 2,3,7,8-TCDD

According to the Remedial Investigation Report (RI), an analysis of surface water concentrations of dioxin showed that there are two zones in the Woonasquatucket River that display advective and diffusive flux of dioxin from the sediment to the water column, one adjacent to the Source Area Soils, and a second downstream of the Allendale Dam. The RI cites a 2004 sediment

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stability study as the basis for this analysis and conclusion[1]. Because the FS is focusing on the length of the river proximate to (i.e., west of) the source area, we evaluated the data that formed the basis for this conclusion.

The 2004 sediment stability study states that the analysis of dioxin flux is based on "total dioxin" although there are no descriptions as to how total dioxin is defined. Additionally, the sediment stability study states that the effect of sediment resuspension is not expected to be a significant factor in the assessment of the data. This is important because as stated at the April 2007 dialog meeting, EPA's decision to include a groundwater remedy in the FS is based not on total dioxin, but on the apparent need to control influx of 2,3,7,8-TCDD to the surface water. Also, the RI states that the working assumption is that there is an ongoing source of 2,3,7,8-TCDD to the surface water from advection of groundwater, diffusion of sediment pore water, or from bioturbation. However, the only way bioturbation will introduce 2,3,7,8-TCDD into the surface water is through the release of particles caused by macroinvertebrates mixing the sediment surface layer. Thus, bioturbation is by definition a form of sediment resuspension, which is contrary to EPA's conceptual model.

Review of the surface water data collected in 1999[2], which forms the basis for the advective and diffusive flux conceptual model, shows that there is no advective flux of 2,3,7,8-TCDD into the Woonasquatucket River adjacent to the Source Area or in Allendale Pond that can be attributed to the groundwater and/or pore water. Table 1 summarizes the data for surface water samples collected in October and November 1999 and analyzed for 2,3,7,8-TCDD. Table 1 lists the samples in order from upstream to downstream locations on the main stem of the Woonasquatucket River. Relative sample locations are noted in the table. In addition to the sampling notes, data on total and dissolved iron and aluminum are provided as are comments derived from sampling data sheets in TetraTech NUS (2000).

Table 1 shows that of the 10 surface water samples collected in this region, six were non-detect for 2,3,7,8-TCDD. The four samples that had detectable concentrations of 2,3,7,8-TCDD were at stations WRC-SW-2010, WRC-SW-2015, APB-SW-2029, and APB-SW-2034. Although the sediment stability study surmised that the effect of sediment resuspension should not be significant, the data from the field notes and the supplemental analytical data show otherwise.

For example, surface water sample APB-SW-2029 has a total (i.e., unfiltered) 2,3,7,8-TCDD concentration of 4,000 pg/l. However, the field notes for that station describe the water as "organic sheen noted; reddish iron oxide flock; clear to red" (TTNUS, 2000). Additionally, the colocated metals samples were analyzed for both total and dissolved metals. For samples APB-SW-2029, the total iron was 113,000 µg/l, whereas the dissolved (filtered) sample has only 435 µg/l of iron. Similarly, the total aluminum in this sample was 5,070 µg/l, and the dissolved

[1] Battelle, 2004. Final Technical Memorandum Sediment Stability Study. Centredale Manor Restoration Project Superfund Site, Providence RI. November.
[2] TetraTech NUS, 2000. Final Technical Memorandum Woonasquatucket River Sediment Investigation. Centredale Manor Restoration Project Superfund Site, Providence RI. June.

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sample did not contain aluminum above the detection limit of 14 µg/l. Clearly, this sample had a significant amount of suspended particles as well as an "organic sheen". It is most likely that any 2,3,7,8-TCDD in this sample was associated with suspended particles.

Similarly, surface water sample WRC-SW-2010 had an estimated total 2,3,7,8-TCDD concentration of 10.3 pg/l. The field notes for this sample state that the water was "Clear w/ muck floating." Also, the turbidity of this station was approximately 3-4 times higher than other samples where the field notes described the water as "clear." Total and dissolved aluminum were 182 µg/l and 49 µg/l, and total and dissolved iron were 571 and 210 µg/l, respectively. Again, the data from the field notes and other supporting analytical data indicate that suspended particles were present. The data for this location is suspect given the apparent presence of suspended particles of "muck".

Sample APB-SW-2034 contained 4.3 pg/l 2,3,7,8-TCDD, though this value is reported as an EMPC value (Estimated Maximum Possible Concentration). The reported turbidity of this sample is approximately 4.5 times that for all samples without detectable levels of 2,3,7,8-TCDD. Also, the total vs. dissolved aluminum is 122 µg/l to 53.4 µg/l. There were no specific notes on the level of clarity of the water sampled in the sample log sheet. However, the turbidity data and the total vs. dissolved data indicate that suspended solids were in fact present at this sampling location.

Based on the data collected and observations of the sampling crew, the only sample whose 2,3,7,8-TCDD cannot be directly attributed to suspended particles is WRC-SW-2015. Thus, only one of the 7 samples collected downstream of MW-05 and upstream of Allendale Dam had detectable levels of 2,3,7,8-TCDD whose presence cannot be explained by the co-occurrence of suspended particles.

Clearly, these data do not support the conceptual model expressed in Section 5.3.2 of the RI report because they do not demonstrate in any way that mass transfer of pore water from the sediment bed to the water column (due to processes such as diffusion and/or groundwater advection) is occurring. Rather, the data demonstrate that where suspended solids occur, dioxin is detected in the surface water sample. This finding is not surprising given the levels of 2,3,7,8-TCDD detected in sediment samples in this stretch of the river.

SEMI-PERMEABLE MEMBRANE DEVICE (SPMD) DATA

EPA's use of the SPMD data to estimate sediment pore water concentrations of 2,3,7,8-TCDD is so uncertain and inaccurate that it makes the data unusable in determining whether the conceptual model is valid. There are many problems with using the SPMD data in the manner in which they have been used, each problem introducing very serious uncertainty. There are three primary areas where the SPMD data fail in terms of its relevance and applicability for use in this assessment. The three areas are:

- Inability to accurately predict dissolved concentrations of 2,3,7,8-TCDD in water;

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- Significant lack of credible supporting peer-reviewed or Agency-approved guidance in applying the SMPD data as it has been for this site; and

- High probability for blank contamination interference.

Each of these points is discussed below.

Inability of SPMD to predict concentrations of 2,3,7,8-TCDD in water

As part of the 2005 SPMD sampling event, Battelle deployed an SPMD into monitoring well MW-05[3]. The MW-05 SPMD was deployed for 27 days, which is consistent with the other SPMD deployment times. Upon retrieval of the MW-05 SPMD, Battelle collected an unfiltered groundwater sample from MW-05 (CMS-GW-MW05S-05) that was analyzed for 2,3,7,8-TCDD. The reported result for 2,3,7,8-TCDD from that groundwater sample was 4,144 pg/l. This concentration is roughly consistent with the levels of total 2,3,7,8-TCDD found in this well in the past (approximately between 1,100 pg/l and 4,600 pg/l).

The SPMD sample from MW-05 (CMS-SPMD-MW05S-05) was found to contain 2,3,7,8-TCDD at 2,470 pg/SMPD. Using Equation 1 from Battelle's poster presentation on SPMDs[4] in conjunction with the sampling rate correction factors provided in the Draft Feasibility Study by Battelle (f = 0.25)[5], the following calculation can be made:

$$C_w = 2{,}470 \text{ pg/SMPD}/[(3.8 \text{ l/d} \times 0.25) \times 27 \text{ days}] = 96 \text{ pg/l}$$

Cw in the above equation is the estimated concentration of 2,3,7,8-TCDD in the water column of well MW-05, assuming that the SPMD-to-water sampling conversion used by Battelle is correct.

MW-05 is the *only* location where temporally and spatially colocated groundwater and SPMD data were collected. Thus this location serves as the only source of available data that can be used to evaluate the assumption that the SPMD-to-water conversion of 2,3,7,8-TCDD actually works. When these data are used for that purpose, however, it is clear that the model does not work. In fact, the concentration predicted using the SPMD-to-water conversion (96 pg/l) is only 2 percent of that detected in the MW-05 groundwater sample (4,144 pg/l).

Compared to the sediment-deployed SPMDs, which were likely in direct contact with large quantities of suspended or deposited sediment, and water column-deployed SPMDs, which were highly fouled by vegetation, the SPMD from MW-05 was probably placed in the best location to get good agreement between SPMD-to-water estimates and the actual water concentrations. This is due to the relatively low level of suspended solids in the well and the small amount of

[3] Battelle, 2005. Chemistry Data Report Task RI-13B Semipermeable Membrane Device (SPMD) Investigation. Centredale Manor Restoration Project Superfund Site, Providence RI. November

[4] Dahlen, D., G. Durell, T. Himmer, and C. Rosiu. Semi-Permeable Membrane Device Investigation at the Woonasquatucket River. Poster Presentation .

[5] Pers. Comm. with D. Dahlen. June 2007.

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biofouling observed. It appears that the SPMD-to-water conversion use by Battelle was not able to reproduce the water sampling results at MW-05 even in the better than average conditions that existed in MW-05. If the results of the SPMD-to-water conversion are not representative for MW-05, they cannot be expected to be representative of the other locations where sampling rate interferences are likely far more problematic. Therefore, we have no confidence that the water concentrations derived with the SPMD-to-water conversions for either the sediment or the surface water samples are accurate, supportable, or useable for corroborating the Battelle conceptual model. Accordingly, there is no support for the assumption that 2,3,7,8-TCDD is dissolved in the groundwater and is being transported to the Woonasquatucket River via pore water diffusion and/or groundwater advection.

Lack of Peer-Reviewed or Agency-Approved Approach

The use of SPMDs to collect time-integrated water samples for the determination of relative concentrations hydrophobic compounds has been demonstrated in the peer-reviewed literature and has been used in the field with some success. Although there are a limited number of studies that use SPMD data to compute an estimated absolute concentration in the water column, Battelle cites no peer-reviewed or Agency-approved method which mimics the SPMD-to-water conversion approach that they used in the present study. Moreover, an SPMD-to-sediment pore water conversion is not found in the published literature.

Nearly all of the peer-reviewed literature cited by Battelle in support of the SPMD-to-water conversion focused on the sampling of water, primarily in a laboratory setting. Sediment sampling experiments cited by Battelle are also idealized laboratory experiments and cannot be expected to mimic the conditions of the system at the Woonasquatucket River.

Even Battelle states several potentially significant data gaps for this study, including:

- The lack of a known water flow and temperature used to derive the sampling rate value of 3.8 l/d for 2,3,7,8-TCDD;
- The effects of the very low flow rates encountered in the CMRP SPMD study on the sampling rate are not known;
- The flow rates for groundwater, river water and sediment pore water are not known for the CMRP site; and
- The effects of biofouling, temperature and facial velocity-turbulence effects are not known.

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Huckins et al.[6] states that environmental conditions can have a significant impact on the SPMD sampling rates. For example, facial velocity-turbulence effects can affect the sampling rate by an order of magnitude, temperature can affect the sampling rate by a factor of 4, and biofouling can affect the sampling rate by a factor of 3 or 4. Combined these factors can affect the sampling rate by over two orders of magnitude. However, there were no efforts to measure or control for these effects in the CMRP SMPD sampling. As an example, effects from reduced interfacial velocity were assumed to be negligible, when the photographic evidence shows that significant velocity effects were likely at some locations.

Additionally, in the draft portion of the Feasibility Study provided to AMEC, Battelle derives a non-peer reviewed equation for PAH sampling rates vs. flow rate. Although an equation is derived, it is not used in the assessment. Rather, Battelle relies on professional judgment to pick sampling rate correction factors. There is no back up or explanation provided for how the sampling rate correction factors were chosen.

Battelle does not discuss what effect, if any, small particle adherence may play in the higher apparent adsorption of 2,3,7,8-TCDD in sediment. Booij et al.[7] state that small particles could, "escape the [SPMD] cleansing procedure (rinsing and wiping) applied before extraction." Booij et al. go on to state that small particles with a higher sorption capacity than bulk sediment materials, which are not cleansed from the SPMD, could result in a false positive.

Although we have not seen photographs of the SPMD cages as they were retrieved from the sediment, it is very likely that sediment particles backfilled the hole and infiltrated the SPMD cages such that the SPMD surface area was in direct contact with sediment. Indeed, the sediment-deployed SPMD cages that had the highest total 2,3,7,8-TCDD concentrations on a total SPMD basis were also the two locations where there was significantly higher 2,3,7,8-TCDD in the bulk sediment than at the other location. However, the plausibility of the higher levels of dioxin in sediment being the source of the dioxin in the SPMD is not discussed by Battelle.

The methods used to convert the SPMD data to pore water concentrations have not been established in the peer-reviewed literature nor is there an EPA-approved method for such a determination. In addition, there are more unknowns in the conversion process than there are knowns. Unknowns outlined above include media-specific sampling rates, effects of temperature, biofouling, facial velocity-turbulence, water flow rates, effect of sediment in contact with SPMD, and the efficacy of the water rinse/wiping cleaning procedure to effectively clean SPMD of all non-adsorbed 2,3,7,8-TCDD. Each of these unknowns can have a significant impact on the interpretation of the SPMD results. In fact, there are so many unknowns that a

[6] Huckins, J.N., J.D. Petty, J.A. Lebo, F.V. Almeida, K. Booij, D.A. Alvarez, W.L. Cranor, R.C. Clark, and B.B. Mogensen. Development of the Permeability/Performance Reference Compound Approach for In Situ Calibration of Semipermeable Membrane Devices. *Environ. Sci. Technol.* 2002. 36, 85-91.

[7] Booij, K., H.M. Sleiderink, and F. Smedes. Calibrating the Uptake Kinetics of Semipermeable Membrane Devices Using Exposure Standards. *Environ. Toxicol. Chem.* 1998. 17, 1236-1245.

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conclusion regarding the disposition of 2,3,7,8-TCDD in the water surrounding the SPMD cannot be made with the available data.

SPMD Blank Contamination

As part of the overall SPMD study, Battelle collected an exposed SPMD trip blank. The jar housing the trip blank is opened during field activities and capped when field activities are completed. However, to our knowledge, the trip blank is neither removed from the jar nor configured inside the jar as are the deployed SPMDs inside the sampling cages so as to ensure maximum surface area exposure to the media of interest. Nevertheless, the trip blank was found to contain 83.37 pg 2,3,7,8-TCDD/SPMD, which is comparable to the quantities detected in the surface water-deployed SPMDs.

Battelle's explanation for the trip blank having such levels of 2,3,7,8-TCDD is the high efficiency of the SPMD at collecting TCDD (i.e., the 2,3,7,8-TCDD was scavenged from the air). The equation used by Battelle to back estimate 2,3,7,8-TCDD concentration requires that the amount of TCDD in the SPMD is proportional to the TCDD in the fluid passing over the sampler (water or air) and the volume of fluid to which the SPMD is exposed. This same variety of equation is used for air samples[8]. Also, Soderstrom and Bergqvist[9] have demonstrated that the wind speed to which the SPMD is exposed affects the sampling rate; increased wind speed = increased sampling rate.

The SPMD in the jar will be exposed to a volume of air determined by the volume of the jar and the time necessary for the air in the jar to be replaced by ambient air through diffusion and, given sufficient wind, air turbulence. Also, as mentioned above, the configuration of the trip blank SPMD is not designed to maximize its exposed surface area.

In contrast, the SPMDs that were deployed in the sediment, surface water and groundwater were exposed to the open air. The exposure volume will depend upon the time and wind velocity during this period of exposure. Based on the photograph taken of the retrieval of the SPMD in MW05 it can be seen that, at least for the case of this SPMD, the volume of air exposed to the MW05 SPMD is likely to be orders of magnitude higher than for the trip blank. This is surmised because the SPMD is in the direct path of the wind, unfurled where maximum exposure to the ambient air can occur. In short, it does not appear that the trip blank was deployed in a manner that would sufficiently determine the equivalent exposure to air-borne 2,3,7,8-TCDD when compared to the field sample. As a result, the data quality for all the SPMDs are considered suspect.

CONCLUSION

[8] Ockenden, W.A., H.F. Prest, G.O. Thomas, A. Sweetman, and K.C. Jones. Passive Air Sampling of PCBs: Field Calculation of the Atmospheric Sampling Rates by Triolein-Containing Semipermeable Membrane Devices. *Environ. Sci. Technol.* 1998. 32 (10), 1538-1543.

[9] Soderstrom, H.S. and P.A. Bergqvist. Passive Air Sampling Using Semipermeable Membrane Devices at Different Wind-Speeds in Situ Calibration by Performance Reference Compounds. *Environ. Sci. Technol.* 2004. 38 (18), 4828-4834.

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Based on the observations discussed above, we have significant concerns that EPA is employing a conceptual model of chemical transport that is not supported by valid data. Upon review of the 1999 surface water sampling data underlying the conceptual model, we believe that certain, important data were not included in EPA's initial evaluation of these data. When the complete set of data are considered in the analysis, the conceptual model of sediment pore water to surface water influx of 2,3,7,8-TCDD cannot be substantiated.

We have shown that the SPMD and water sampling data are internally contradictory because the data for MW-05, the only sampling point with data from both the water and the SPMD, shows a 43-fold difference in the concentration of 2,3,7,8-TCDD in water. The data from MW-05 simply does not substantiate the methods used to compute the surface water and sediment pore water concentrations. In fact, the data demonstrate how poorly the SPMDs estimate 2,3,7,8-TCDD concentrations in water. This fact, combined with the overwhelming number of unquantifiable factors, such as sampling rates, flow rates, effects of particles, biofouling, temperature, and facial velocity-turbulence, which are critically important in determining sampling rates, render the data unusable for a meaningful evaluation of the conceptual model.

Finally, we have concerns that contamination to the deployed SPMD samplers cannot be accurately assessed with the trip blank data. The only thing that we can discern from this data is that 2,3,7,8-TCDD may have been present in ambient air. However, as explained above, the degree to which the deployed SPMDs were exposed to the 2,3,7,8-TCDD in ambient air cannot be quantified.

We look forward to discussing this information with you at our June 12 meeting.

Sincerely,

Russell E. Keenan, Ph.D.
Vice President
Technical Director, Risk Assessment

Patrick O. Gwinn
Senior Environmental Scientist

cc: Ms. Deidre Dahlen, Battelle
Eve Vaudo, Esq.

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Table 1. Summary of 1999 Surface Water Sampling Data Adjacent to the Source Area at CMRP.

Sample ID	Location	Date	2,3,7,8-TCDD (pg/l)		Iron total (ug/l)	Iron dissolved (ug/l)	Aluminum total (ug/l)	Aluminum dissolved (ug/l)	Turbidity (NTU)	Notes
WRC-SW-2009	Upstream of source area soils	11/1/1999	7.2	U	229	232	44.2 J	46.3 J	1.4	
WRC-SW-2010	Adjacent to Brook Village, upstream of	11/2/1999	10.3	J	571	201	182	49 J	4.5	Clear w/ muck floating
WRC-SW-2011	Adjacent to Cap 2, ~200' downstream of MW-05	11/2/1999	5.2	U	242	189	56 J	140	1.3	Clear
WRC-SW-2012	Adjacent to Cap 2, ~400' downstream of MW-05	11/2/1999	4.9	U	335	157	67.6 J	34.9 J	1	
WRC-SW-2013	Dowstream of Cap 2, Upstream of Cap 1	11/1/1999	5.9	U	313	186	76.1	34.9 J	0.9	clear water
WRC-SW-2014	~300' downstream of Cap 1	11/1/1999	5.4	U	236	154	37 J	45.4 J	0.75	clear
WRC-SW-2015	~250' downstream of WRC-SW-2014	11/1/1999	44.4	J	234	155	35.8 J	38.8 J	0.9	oil sheen noted in sediment
APB-SW-2029	~250' upstream of Allendale Dam	10/29/1999	4000	J	113000	435	5070	14 U	3.9	Organic sheen noted; reddish iron oxide flock; clear to red
APB-SW-2034	~250' upstream of Allendale Dam	11/3/1999	4.9	EMPC	431	239	122	53.4	5.7	
APB-SW-2035	~100' upstream of Allendale Dam	11/3/1999	2.4	U	404	251	95.2	89	2	

Exhibit 2

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FOR INCLUSION IN THE ADMINISTRATIVE RECORD

August 15, 2007

Ms. Anna Krasko, Project Manager
United States Environmental Protection Agency
Region 1
One Congress Street
Boston, Massachusetts 02114

RE: Summary of Findings Regarding Cosolvency at MW-05S – Centredale Manor Restoration Project, North Providence, Rhode Island

Dear Ms. Krasko:

At the June 12, 2007 meeting among Emhart's technical consultants and EPA technical staff, its consultants from Battelle, RIDEM, and the USACE, EPA suggested that there was adequate relevant peer-reviewed literature to substantiate EPA's claim that the elevated concentrations of 2,3,7,8-TCDD reported in unfiltered groundwater samples from monitoring well MW-05S are, at least in part, due to the effects of cosolvency or enhanced solubility as a result of the co-occurrence of tetrachloroethylene (PCE) and trichloroethylene (TCE). Additionally, on June 14, 2007, EPA sent us email correspondence citing seven technical journal articles that purportedly support EPA's theory that cosolvency may be occurring at monitoring well MW-05S.

After review of the technical articles cited by EPA, we conclude that there is no supporting basis for EPA's theory that the occurrence of PCE and TCE in groundwater at monitoring well MW-05S would enhance the aqueous solubility of 2,3,7,8-TCDD. In fact, we conclude that the cited literature invalidates EPA's theory that enhanced solubility is occurring. Moreover, the cited literature refutes EPA's assertion that reduced 2,3,7,8-TCDD sorption to soil is occurring as the result of the co-occurrence of PCE and TCE. Thus, the notion that the mobility of 2,3,7,8-TCDD in the vicinity of monitoring well MW-05S is enhanced due to the presence of PCE and TCE is not supported by the research data.

This correspondence provides a meta-analysis of the literature cited by EPA in its June 14, 2007 email correspondence, and discusses the purported relevance of each referenced article to what is known about the existing conditions at monitoring well MW-05S.

Meta-Analysis of Literature

AMEC conducted a thorough review of the literature cited by EPA and found that the information presented in the papers seems to follow a progression from the investigation of simple systems in the earlier papers to the investigation of more complex systems in the more recent literature. The typical experiment discussing enhanced solubility in the earlier papers involved the use of solutions consisting of water, a solute (e.g., anthracene or another hydrophobic organic compound (HOC)), and a completely miscible solvent, such as methanol or acetone. The investigators evaluated the effect of increasing aqueous-phase solvent concentration on the solubility of the HOC. Typically, these experiments used solvent-water solutions with solvent concentrations ranging from 5% to 100%. Because the solvents used in the experiments were completely miscible, the investigations only evaluated the effect of a single phase on HOC enhanced solubility.

Similarly, earlier experiments conducted to evaluate the effect of cosolvents on reduced soil sorption only evaluated the influence of completely miscible solvents at very high concentrations (e.g., methanol-water solutions at 5% to 100% methanol). Again, because the solvents used were completely miscible, the investigations only evaluated the effect of a single phase on HOC sorption.

Although the experiments using a variety of completely miscible solvents and HOCs showed enhanced solubility and reduced soil sorption with increased solvent concentrations, the conditions applied in these experiments were not similar to the known conditions at monitoring well MW-05S. EPA's June 30, 2005 *Interim-Final Remedial Investigation Report* prepared by Battelle (RI Report) states that the primary chemical constituents in the water and soil in the vicinity of monitoring well MW-05S include PCE and 2,3,7,8-TCDD, with smaller amounts of TCE. There are no data to suggest that a completely miscible solvent, such as methanol or acetone, is present in the soil or groundwater at monitoring well MW-05S. Therefore, the literature cited by EPA evaluating enhanced solubility and/or reduced sorption due to the presence of percent levels of a completely miscible solvent cannot be used to objectively assess the conditions at monitoring well MW-05S.

It is not until data from experiments published in 1990 and 1994, in papers by Pinal et al., Rao et al., and Li and Andren, that the effects of partially miscible solvents on enhanced HOC solubility and decreased sorption were explored. In those experiments, the investigators explored the effects of enhanced solubility of HOCs in water from the addition of TCE, as well as in water-acetone mixtures. The conclusion reached from these studies is that *a partially miscible solvent, such as TCE or PCE, has no appreciable effect on the solubility or sorption of HOCs until the concentration of the partially miscible solvent dissolved in water is 1% (10,000 mg/l) or greater.* This situation will occur for PCE only when it is present in a ternary solution. An example of a ternary solution is TCE, water, and a completely miscible solvent, where the completely miscible solvent is at high percent levels in water. However, as noted above, there is no mention in the RI Report of any completely miscible solvents (like acetone) in the groundwater at MW-05S.

The following discussion provides a synopsis of each of the research papers cited by EPA in

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the June 14 email correspondence and addresses the application of the research data to monitoring well MW-05S. The discussion of the papers is presented in the same order in which they were listed in EPA's June 14 email correspondence.

Title: Solubility of Polychlorinated Biphenyls in Water/Alcohol Mixtures. 1. Experimental Data

Authors: An Li and Anders W. Andren

Journal Citation: *Environ. Sci. Technol.* 1994, *28,* 47-52.

Article Summary: Li and Andren (1994) investigate solubility of three PCB congeners in mixtures of water and normal alcohols (1-butanol, 1-pentanol, 1-hexanol, 1-heptanol, and 1-octanol). Li and Andren conclude that "the rapid drop of PCB solubility as the cosolvent alcohols change from butanol to octanol may indicate that cosolvency of water-immiscible solvents is dominantly limited by the amount of cosolvent dissolved in water." Li and Andren also state that the observed decrease in the cosolvency effect of immiscible alcohols as their polarity decreases is in agreement with the findings of Pinal et al. (1990).

Application to MW-05S: Although Li and Andren focused on alcohols and PCBs, neither of which have been reported in soil or water samples from MW-05S, their data supports the findings of Pinal et al. (1990), discussed below. In summary, the immiscible[1] and non-polar solvents reported in groundwater samples from MW-05S, principally PCE and TCE, are not anticipated to increase the solubility of HOCs, such as PCBs or dioxin, in water.

Title: Cosolvency of Partially Miscible Organic Solvents on the Solubility of Hydrophobic Organic Chemicals

Authors: R. Pinal, P.S.C Rao, L.S. Lee, P.V. Cline, and S.H. Yalkowsky

Journal Citation: *Environ. Sci. Technol.* 1990, *24,* 639-647.

Article Summary: Pinal et al. (1990) study the effects of the non-polar partially miscible organic solvent (PMOS) TCE cosolvency on the water solubility of HOCs naphthalene and anthracene (by itself and in the presence of varying amounts of a completely miscible organic solvent (CMOS) (e.g., methanol)). In all cases the PMOS or the PMOS/CMOS solution was mixed with water. Pinal et al. conclude that a non-polar PMOS can alter the HOC solubility if it is present in solution at concentrations in excess of 10,000 mg/l (>1%). The authors further state that "non-polar PMOS, such as TCE, octanol, toluene, and other similar hydrocarbons, are not expected to have appreciable cosolvency."

Application to MW-05S: TCE has been reported in groundwater samples from well MW-05S at concentrations as high as 2.5 mg/l, several orders of magnitude below the 10,000 mg/l

[1] Note that Li and Andren use the term "immiscible" while other authors use the term "partially miscible" to describe compounds that have very limited solubility in water. The terms are interchangeable.

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threshold suggested by Pinal et al. for the initiation of cosolvency effects on HOCs (like dioxin) in water. Additionally, the nonpolar solvent, PCE, has been reported in groundwater samples from MW-05S at concentrations up to 61 mg/l, again several orders of magnitude below the 10,000 mg/l threshold suggested by Pinal et al. The combined total of the maximum concentrations of TCE and PCE (63.5 mg/l) is only 0.635% of the threshold level suggested by Pinal et al. for initiation of observable cosolvent effects on HOCs in water. Given this information, it can be concluded that cosolvency effects from PCE and/or TCE are not occurring in MW-05S, and that enhanced dioxin water solubility is not plausible with respect to the groundwater in this well.

Title: Cosolvency and Sorption of Hydrophobic Organic Chemicals

Authors: P.S.C Rao, L.S. Lee, and R. Pinal

Journal Citation: *Environ. Sci. Technol.* 1990, *24,* 647-654.

Article Summary: Rao et al. (1990) study the effects of the non-polar PMOS TCE cosolvency on the sorption of HOCs anthracene and diuran to soil. Rao et al. conclude that non-polar PMOS are likely to have negligible effects on HOC sorption from predominantly aqueous solutions (i.e., where the concentration of a CMOS, such as methanol, is less than 30%). Rao et al. also note that non-polar PMOS, either dissolved in the aqueous phase or present as a separate liquid phase (i.e., NAPL), did not influence HOC sorption to soil, which suggests that the presence of a non-polar PMOS as a separate liquid will have a minimal impact on HOC sorption.

Application to MW-05S: Dissolved TCE and PCE have been reported in soil samples from MW-05S at concentrations as high as 26 and 300 mg/kg, respectively. Also, as discussed above, dissolved TCE and PCE have been reported in groundwater samples from well MW-05S at concentrations as high as 2.5 mg/l and 61 mg/l, respectively. Moreover, TCE and PCE are both non-polar PMOS.

However, there is no indication that a CMOS, such as acetone or methanol, is present at concentrations greater than 30%. Based on the conclusions from Rao et al., there is no evidence that dioxin or any other HOC would have experienced a reduction in sorption to soil as a result of the presence of the non-polar PMOS TCE and PCE. Therefore, it reasonably can be concluded that, even in the presence of TCE and PCE, dioxin in soil would not be expected to undergo enhanced transport from the soil to the underlying groundwater.

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Title: Sorption of Organic Chemicals by Soil from Multi-Solvent and Multi-Sorbate Mixtures

Authors: P.S.C Rao and L.S. Lee

Journal Citation: In *Health and Environmental Research on Complex Mixtures,* R.H. Gray, E.K. Chess, P.J Mellinger, R.G Riley (eds.), DOE Symposium Series 62, 24th Hanford Life Science Symposium, Pacific Northwest Labs, Richmand, WA. Pp. 457-471.

Article Summary: The subject paper provides a review of experiments concerning cosolvency that had been conducted to date. The paper addresses solubility and sorption changes of HOCs in the presence of water/CMOS mixtures, water/PMOS mixtures and water HOC sorption from multi-sorbate mixtures. Much of the article presents the results of CMOS/water mixtures. However, one portion titled "HOC Sorption from Immiscible Solvent Mixtures" evaluates how PMOS (in this case, toluene and n-pentane) in water affect the sorption of two herbicides (terbacil and atrazine) to soil. In all cases studied, the volume ratio of water to immiscible solvent was larger than 10. The authors conclude that "the presence of an immiscible organic solvent did not measurably affect herbicide sorption."

Application to MW-05S: Although the chemicals used in the experiments are not identical to those present in MW-05S, the results are consistent with the previously summarized papers in that an immiscible solvent will not have a measurable effect (reduction) on the sorption of HOC to soil. Again, the data presented in Rao and Lee indicate that reduced soil sorption is not occurring at MW-05S as the result of the co-occurrence of 2,3,7,8-TCDD and chlorinated solvents. Thus, enhanced transport of 2,3,7,8-TCDD due to cosolvency is not occurring at MW-05S.

Title: Solvophobic Approach for Predicting Sorption of Hydrophobic Organic Chemicals on Synthetic Sorbents and Soils

Authors: K.B. Woodburn, P.S.C. Rao, M. Fukui, and P. Nkedi-Kizza

Journal Citation: *Journal of Contaminant Hydrology.* 1988, *1*, 227-241.

Article Summary: Woodburn et al. discuss the findings from their experiments evaluating the effects of solute sorption on a model and natural solid phase in the presence of three cosolvents. The solutes used in the experiments included a variety of polycyclic aromatic hydrocarbons, alkylbenzenes, halobenzenes, and pesticides. The cosolvents used included acetone, methanol, and acetonitrile.

Application to MW-05S: The applicability of the information presented in Woodburn et al. to MW-05S is very limited because the systems they evaluated are significantly different than the known conditions at MW-05S. For example, while the cosolvents used by Woodburn et al. span a wide range of polarities, all three are completely miscible in water. This contrasts

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with the data from MW-05S, where the potential cosolvents are non-polar compounds with very limited solubility. Additionally, the most dilute solvent solutions used in the experiments were between 5% and 10% dissolved solvent in water. The highest concentration solvent solutions were 100% solvent (i.e., pure solvent). In contrast, the maximum concentration of potential cosolvents reportedly dissolved in water at MW-05S is approximately 0.006 %, about three orders of magnitude lower than the lowest concentration used by Woodburn et al.

In addition, more recent work by co-authors of the present paper, Pinal et al. (1990) and Rao et al. (1990), evaluated the effects of non-polar cosolvents with limited solubility and found that their aqueous (i.e., dissolved) concentration must exceed 1% before appreciable sorption or solubility effects are noted. As noted above, the reported dissolved concentrations of the non-polar solvents in MW-05S are more than two orders of magnitude less than 1%. In fact, the solvents reported in MW-05S, principally PCE and TCE, cannot have dissolved concentrations above 1% unless a suitable ternary solvent, such as methanol, were present at elevated concentrations. Nevertheless, there is simply not enough TCE and PCE to reach the 1% threshold. Thus, no cosolvency effects on dioxin solubility or sorption is expected at MW-05S.

Title: Influence of Organic Cosolvents on Sorption of Hydrophobic Organic Chemicals by Soils.

Authors: P. Nkedi-Kizza, P.S.C Rao and A.G. Hornsby

Journal Citation: *Environ. Sci. Technol.* 1985, *19,* 975-979

Article Summary: Nkedi-Kizza et al. assess the sorption of anthracene, diuron and atrazine by soils from aqueous solutions and binary solvents consisting of methanol-water and acetone-water.

Application to MW-05S: As discussed for Woodburn et al., the solvents used in the binary mixtures, methanol and acetone, are completely miscible in water. Also, the minimum concentration of cosolvents in water is 5%. Using the same information from Pinal et al. (1990) and Rao et al. (1990) expressed above for Woodburn et al., we conclude that no cosolvency effects are occurring at MW-05S.

Title: Sorption and Transport of Hydrophobic Organic Chemicals in Aqueous and Mixed Solvent Systems: Model Development and Preliminary Evaluation

Authors: P.S.C Rao, A.G. Hornsby, D.P Kilcrease, and P. Nkedi-Kizza,

Journal Citation: *J.Environ. Qual.* 1985, Vol. 14, no. 3.

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Article Summary: Rao et al. present the theoretical basis for the manner in which HOCs may behave in aqueous and mixed solvent mixtures. To verify these theories, Rao et al. rely on the work presented in Nkedi-Kizza et al. (1985) and Woodburn et al. (1985), both of which are reviewed and summarized above. In general, the work of Nkedi-Kizza et al. (1985) and Woodburn et al. (1985) focus on the evaluation of the effects of CMOS, such as methanol and acetone, on the sorption of HOCs.

Application to MW-05S: The work of Nkedi-Kizza et al. (1985) and Woodburn et al. (1985), and thus the reported findings in Rao et al., (1985), are not comparable to the conditions at MW-05S where there are no reported concentrations of miscible organic solvents, such as methanol or acetone. In contrast, MW-05S is reported to contain concentrations of only partially miscible solvents, PCE and TCE, which have not been shown to have an effect on cosolvency at the levels reported.

Conclusions

Based on the information known about the soil and groundwater at monitoring well MW-05S, and the data presented in the papers cited by EPA, we conclude the following:

- MW-05S contains no free product in groundwater.
- MW-05S is not reported to contain any completely miscible solvents, such as methanol or acetone, in the solid (soil) or liquid (groundwater) phases.
- The highest reported levels of PCE and TCE in groundwater at monitoring well MW-05S are 61 mg/l and 2.5 mg/l, respectively.
- For partially miscible solvents, such as TCE and PCE, to have an appreciable effect on cosolvency or reduced sorption, the concentration in the dissolved aqueous phase must exceed 10,000 mg/l.
- The maximum reported concentration of dissolved, aqueous phase partially miscible solvents in MW-05S is 0.635% of the threshold at which cosolvency effects would be observed.
- The water solubilities of TCE and PCE are 1,100 mg/l and 150 mg/l, respectively.
- Given the absence of a high concentration (percent range) of miscible solvent and the aqueous solubilities of TCE and PCE, the dissolved aqueous phase concentrations of PCE or TCE in groundwater at monitoring well MW-05S could not approach the 10,000 mg/l threshold cited in literature for cosolvency effects by immiscible solvents to occur.
- No cosolvency of dioxin by PCE or TCE is occurring at MW-05S.
- Enhanced transport of 2,3,7,8-TCDD is not occurring at monitoring well MW-05S as

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the result of the co-occurrence of PCE and/or TCE.

The papers that EPA has cited to support the theory that there is cosolvency or enhanced solubility of 2,3,7,8-TCDD at monitoring well MW-05S due to the presence PCE and/or TCE do not support EPA's claim. Many of the papers are simply not applicable due to the differences in systems examined by the researchers and the conditions that exist at monitoring well MW-05S. However, even with respect to those papers that examine systems that are similar to the conditions at MW-05S (e.g., the presence of a partially miscible solvent and a hydrophobic organic compound in water), the research clearly demonstrates that enhanced solubility of the hydrophobic organic compound, 2,3,7,8-TCDD, is not occurring. Moreover, the relevant research leads to the conclusion that reduced sorption to soil (and thus higher mobility) of 2,3,7,8-TCDD has not occurred at monitoring well MW-05S.

The results of the meta-analysis further support and augment the information and analysis presented in our June 8, 2007 letter, in which we discuss EPA's flawed conceptual site model for the groundwater to surface water pathway and its inappropriate interpretation of the SPMD results. Given the overwhelming evidence contradicting EPA's position, we request that EPA reconsider its conceptual site model for the groundwater to surface water pathway and its interpretation of the SPMD results.

Sincerely,

Russell E. Keenan, Ph.D.
Vice President
Technical Director, Risk Assessment

Patrick O. Gwinn
Senior Environmental Scientist

cc: Ms. Deidre Dahlen, Battelle
Eve Vaudo, Esq., U.S. EPA
Cornell Rosiu, U.S. EPA
Louis Maccarone, RIDEM
Jerome C. Muys, Jr., Esq.
Jeffrey M. Karp, Esq.
Laura Ford Brust, Esq.
Mr. Jeffrey Loureiro (LEA)
Mr. David Scotti (LEA)

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Exhibit 3

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October 15, 2007
Ms. Anna Krasko, Project Manager
United States Environmental Protection Agency
Region 1
One Congress Street
Boston, Massachusetts 02114

RE: Centredale Manor Site: Alleged Facilitated Transport of Dioxin from MW-05S to the Woonasquatucket River

Dear Ms. Krasko:

We are writing on behalf of Emhart Industries, Inc. in furtherance of our prior correspondence disputing EPA's assertion that groundwater at the above-referenced Site is an ongoing source or a migration pathway of dioxin to the Woonasquatucket River. In your September 14, 2007 letter to David Scotti of Loureiro Engineering Associates, Inc. (LEA), you state that EPA believes that the data indicate the area around monitoring well MW-05S is likely acting as an ongoing source of 2,3,7,8-TCDD and volatile organic compounds (VOCs) discharging to the Woonasquatucket River. In our previous letters dated June 8, 2007 and August 15, 2007 on the matter of monitoring well MW-05S, we have provided the reasons why we do not believe the data are indicative of a dissolved 2,3,7,8-TCDD groundwater plume discharging to the Woonasquatucket River. In the September 14, 2007 letter, you provided a hyperlink (http://www.epa.gov/ada.download/issue/facili.pdf) in the context of explaining that there are several mechanisms at work which, individually or in combination, could be associated with the observed groundwater data.

The hyperlinked document, Superfund Ground Water Issue (Huling, 1989)[1], discusses the potential for enhanced solubility of hydrophobic organic compounds (HOC) as the result of cosolvency with other organic solvents present, and/or colloidal transport. Our August 15, 2007 letter provided a detailed review and analysis of the literature pertaining to the alleged cosolvency effect. It is important to note that the Huling (1989) document was published in August 1989; therefore, the author of that document did not have the benefit of the literature published after that date. This timing point is particularly important because the peer-reviewed literature that is most pertinent to conditions observed at monitoring well MW-05S was not published until 1990 and later. All of the literature cited for the effect of cosolvency in the Huling (1989) document evaluated the effect of high concentrations (percent levels) of completely miscible solvents (e.g., acetone, methanol, etc.) on the solubility of HOC. As discussed in our August 15, 2007 letter, these conditions do not exist at monitoring well MW-05S.

[1] Huling, 1989. Superfund Ground Water Issue – Facilitated Transport. U.S. Environmental Protection Agency, Office of Research and Development, Office of Solid Waste and Emergency Response. EPA/540/4-89/003. August.

The literature published subsequent to Huling (1989) evaluated the effect of chlorinated solvents on HOC solubility. The studies discussed found that for partially miscible solvents, such as trichloroethylene (TCE) and tetrachloroethylene (PCE), to have an appreciable effect on cosolvency or reduced sorption, the concentration in the dissolved aqueous phase must exceed 10,000 milligrams per liter (mg/l). Given the absence of a high concentration (percent range) of a completely miscible solvent and the aqueous solubilities of TCE and PCE, the dissolved aqueous phase concentrations of PCE or TCE in groundwater at monitoring well MW-05S could not approach the 10,000 mg/l threshold cited in literature for cosolvency effects by immiscible solvents to occur (Pinal et al, 1990[2] and Rao et al, 1990[3]). As a result, a cosolvency effect is not occurring at monitoring well MW-05S.

Further support for the conclusion that a cosolvency effect is not occurring at monitoring well MW-05S is evidenced by the semi-permeable membrane device (SPMD) data from monitoring well MW-05S. Based on Battelle's estimates, these data demonstrate that only approximately 2% of the dioxin present in the unfiltered water sample is in the dissolved formed. If chemical cosolvency were occurring at monitoring well MW-05S, a much higher percentage of the dioxin would be expected in the dissolved form. Clearly, however, this is not the case.

The other mechanism for enhanced solubility discussed in Huling (1989) is a colloidal process whereby HOC preferentially sorbs to colloids that are small enough to travel with groundwater through the soil pores. The data collected by EPA and its consultants cannot be used to confirm EPA's inference that dioxin is being mobilized toward the river via colloidally facilitated transport. For example, other than the SPMD deployment in the groundwater at monitoring well MW-05S, EPA has not attempted to quantify the proportion of dioxin sorbed to colloidal material. EPA's data derived from the SPMDs buried in the contaminated river bank sediment are in no way indicative of colloidal transport because SPMDs do not account for colloidally-bound chemicals. As the USGS states:[4]

> "Nonporous polymeric films such as low-density polyethylene (membrane of choice for SPMDs) contain transient cavities with maximum diameters of about 10 Å. These cavities are far too small to accommodate colloids or macromolecular dissolved organic carbon (DOC) such as humic acids.
>
> Also, comparisons of chemical concentrations determined by using traditional analytical methods for ultra-filtered river water (colloids and DOC > 50 Å diameter were removed)

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[2] R. Pinal, P.S.C Rao, L.S. Lee, P.V. Cline, and S.H. Yalkowsky. *Environ. Sci. Technol.* 1990, *24,* 639-647.

[3] P.S.C Rao, L.S. Lee, and R. Pinal. *Environ. Sci. Technol.* 1990, *24,* 647-654.

[4] http://wwwaux.cerc.cr.usgs.gov/SPMD/SPMD_questions.htm#7.%20Do%20SPMDs%20sample%20only%20dissolved%20or%20vapor%20phase%20chemicals?

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and those estimated from SPMDs exposed to river water appear to confirm that SPMDs sample only dissolved residues, which are readily bioavailable."

Based on the USGS statements, the data from the SPMDs buried in the contaminated sediment cannot be used to assess whether colloids are transporting dioxin via groundwater because the SPMDs exclude colloids and, by extension, the chemicals that may be sorbed on the colloid.

Moreover, if EPA is theorizing that dioxin is being transported by colloids in groundwater, then the methods used by Battelle to estimate corresponding pore water concentrations of dioxins are not appropriate or valid. This is because the theory concerning the sampling of water by SPMDs includes only dissolved chemicals and does not include chemicals transported via colloids. As a result, the equations used by Battelle, their other shortcomings notwithstanding, are not appropriate to estimate pore water concentrations of dioxins sorbed to colloidal material.

To date, EPA's discussions regarding the theory that dioxin is being transported from monitoring well MW-05S to the Woonasquatucket River involve a notion that facilitated transport of dioxin is occurring due to cosolvency, colloidal transport, or some combination thereof. However, the most relevant peer-reviewed literature on the matter of cosolvency as it relates to monitoring well MW-05S, Pinal et al. (1990) and Rao et al. (1990), clearly demonstrates that the TCE and PCE present in groundwater at monitoring well MW-05S is not affecting the solubility of dioxin. This conclusion is substantiated by the results of the concurrent SPMD and unfiltered groundwater sampling at monitoring well MW-05S which, according to Battelle's calculations, demonstrates that approximately 2% of the dioxin in the unfiltered groundwater is actually dissolved in the water. The remaining 98% of the dioxin is particle-bound. Thus, if enhanced solubility due to cosolvency were occurring, the SPMD and unfiltered groundwater sampling results should be in relatively good agreement, yet they are not.

As for the notion that facilitated transport of dioxin is occurring due to colloidal transport, the data collected to date cannot possibly be used to confirm this theory. The data from monitoring well MW-05S (SPMD and unfiltered groundwater) suggest that a majority of the dioxin in water is sorbed to suspended particles. This outcome is not unexpected. As discussed above, SPMDs simply do not sample chemicals that are sorbed to suspended particles or colloids. Hence the difference in the unfiltered groundwater and SPMD samples' results from monitoring well MW-05S. Therefore, the SPMDs buried in the contaminated sediment did not sample chemicals that are sorbed to suspended particles or colloids in pore water.

The foregoing discussion raises the following question: If dioxin is not being transported as a result of chemical cosolvency and the SPMDs do not sample colloidally-bound chemicals, why are there relatively high levels of dioxin present in the SPMDs buried in the contaminated sediment? The likely answer is that the SPMDs were not adequately cleaned; therefore, contaminated sediment residue remained on the SPMD during the sample extraction phase. This answer is sensible because of the intimate contact of the sediment with the sediment-deployed SPMDs. Also, no studies ever have been conducted to assess the efficacy of the method employed by Battelle to clean the SPMDs of sediment residue. Thus, it is possible, and likely probable, that the Kimwipe cleaning was not effective in removing all sediment residue from the

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surface of the SPMD. In addition, this answer is the only one that does not defy the available data, nor does it contradict all peer-reviewed scientific literature on cosolvency and SPMD sampling characteristics. In contrast, EPA's present position contradicts this literature.

To use the existing data in support of EPA's current theory, one must make the unreasonable and far-reaching assumptions that (1) the dioxin (which based on Battelle's data and calculations is overwhelmingly bound to suspended particles) in monitoring well MW-05S desorbs and becomes dissolved during the transport from monitoring well MW-05S to the Woonasquatucket River; and (2) by the time the dioxin reaches the SPMDs buried in the sediment, it is dissolved and available for SPMD uptake. This hypothesis is untenable, and there are no data to corroborate it. In fact, all the data and the scientific literature point to the conclusion that dioxin is not being transported from monitoring well MW-05S to the Woonasquatucket River. Accordingly, Emhart again requests that EPA reconsider its conceptual site model for the groundwater to surface water pathway, and its interpretation of the SPMD results.

Sincerely,

Russell E. Keenan, Ph.D.
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Exhibit 4

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SHALLOW GROUNDWATER DATA REPORT

Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

October 10, 2008

Prepared for

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LIST OF ACRONYMS

AEL	Averill Environmental Laboratory, Inc.
AMEC	AMEC Earth and Environmental, Inc.
BGS	Below Ground Surface
CLP	Contract Laboratory Program
CMRP	Centredale Manor Restoration Project
DAT	Data/Analysis Technologies, Inc.
ERA	Environmental Resource Associates®
ES	Environmental Standards, Inc.
HSA	Hollow-Stem Auger
IDW	Investigation-Derived Waste
LEA	Loureiro Engineering Associates, Inc.
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquids
NTUs	Nephalometric Turbidity Units
OD	Outside-Diameter
ORP	Oxidation-Reduction Potential
PALs	Performance Acceptance Limits™
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PCE	Tetrachloroethylene
PE	Performance Evaluation
PID	Photoionization Detector
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference

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SOPs	Standard Operating Procedures
SOW	Scope of Work
SPMD	Semi-Permeable Membrane Device
TCDD	Tetrachlorodibenzo-p-dioxin
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TEFs	Toxicity Equivalent Factors
TEQs	Toxicity Equivalents
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
WHO	World Health Organization

LIST OF UNITS

mg/kg	milligrams per kilogram
ng/kg	nanograms per kilogram
µg/kg	micrograms per kilogram
mg/l	milligrams per liter
µg/l	micrograms per liter
pg/l	picograms per liter
ppm	parts per million
%	percent

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1. INTRODUCTION

This report is submitted on behalf of Emhart Industries, Inc. (Emhart) to present the data collected by Loureiro Engineering Associates, Inc. (LEA) during an investigation of shallow groundwater in the vicinity of monitoring well MW-05S located adjacent to the Brook Village Associates Limited Partnership (Brook Village) parking lot and east of the Woonasquatucket River (River) at the Centredale Manor Restoration Project Superfund site located in North Providence, Rhode Island (CMRP). The shallow groundwater investigation activities included the installation of monitoring wells screened within the subsurface overburden material. In addition, these activities included groundwater sampling and the laboratory analysis of the groundwater samples obtained during the investigation activities. The data obtained from the shallow groundwater investigation are presented in this report following a description of the methods and procedures used to collect the data.

This report is organized as follows:

- Pertinent background information regarding the investigation activities is provided in Section 2.
- The purpose and objectives of the investigation and this report are presented in Section 3.
- The field methods and procedures used to collect the shallow groundwater data are described in Section 4.
- The laboratory analytical methods used during the investigation are presented in Section 5.
- The laboratory data assurance review procedures are presented in Section 6.
- The results of the shallow groundwater investigation activities are presented in Section 7.
- An evaluation of the results is presented in Section 8.
- The implications of the data on the remedial alternatives under evaluation are discussed in Section 9.
- A recommendation is presented in Section 10.
- References are provided in Section 11.

To support the discussion provided in this report, the shallow groundwater data are summarized in tables and drawings appended to this report.

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2. BACKGROUND

2.1 Overview

The United States Environmental Protection Agency (USEPA) is conducting a Remedial Investigation (RI) and Feasibility Study (FS) for the CMRP. In June 2005, the USEPA released the *Interim Final Remedial Investigation Report* (Report) prepared by Battelle (2005a) in which the CMRP data collected by the USEPA up to that time are summarized. In the Report, the USEPA presents what it considers to be plausible fate and transport theories for constituents of concern at the CMRP. One theory postulated by the USEPA is that shallow groundwater in the vicinity of monitoring well MW-05S (the study area), located adjacent to the Brook Village parking lot and east of the River, is a pathway and/or transport mechanism for constituents of concern at the CMRP. The locations of monitoring well MW-05S and other monitoring wells installed to monitor groundwater at the CMRP are shown in the site plan presented as Drawing 2-1.

2.2 Historical Data

2.2.1 RI Data and Post-RI Data

A summary of the relevant background data presented in the Report and the subsequently-collected SPMD data and 2005 Lyman Mill Pond sediment data is provided in this section. These data include the data used by the USEPA to support their fate and transport theory for shallow groundwater beneath the area of monitoring well MW-05S. Data are presented for the following media: soil, groundwater, vapor diffusion samplers, surface water, SPMDs, and sediment.

2.2.2 Groundwater Data

According to the USEPA and the Report, groundwater samples collected from monitoring well MW-05S were reported to contain trichloroethylene (TCE) at concentrations ranging from 1,800 micrograms per liter (µg/l) to 2,500 µg/l and tetrachloroethylene (PCE) at concentrations ranging from 28,000 µg/l to 61,000 µg/l. Also, groundwater samples collected from this well were reported to contain 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) at concentrations ranging from 1,030 picograms per liter (pg/l) to 4,180 pg/l. A summary of volatile organic compounds (VOCs) and dioxins reported to be present in groundwater in the vicinity of monitoring well MW-05S is provided in Drawing 2-2.

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2.2.3 Soil Data

The USEPA reported that soil samples collected from borings CMS-451, CMS-453, MW-15D, and MW-05S contained 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Soil samples collected from a depth of 4 to 6 feet below the ground surface (bgs) at soil borings CMS-451, MW-15D, and MW-05S were reported to contain 140,000 nanograms per kilogram (ng/kg), 2,645 ng/kg, and 20,454 ng/kg, respectively. The maximum 2,3,7,8-TCDD concentration reported for the soil samples collected from soil boring CMS-453 was 62,000 ng/kg (6 to 7 feet bgs). The duplicate soil samples obtained from a depth of 3 to 4 feet bgs at CMS-453 were reported to contain 2,3,7,8-TCDD at concentrations of 11,000 ng/kg and 42,900 ng/kg. A summary of the dioxin concentrations in soil at these soil boring locations is provided in Drawing 2-3.

Based on the laboratory analyses of soil samples collected from soil boring MW-05S, chlorinated VOCs are present in soil at this location. Concentrations of PCE and TCE were reported at 300 milligrams per kilogram (mg/kg) and 26 mg/kg, respectively in the soil sample collected from a depth of 4 to 6 feet below ground surface (bgs) at this boring location. Also, PCE, TCE, and *cis*-1,2-dichloroethylene (cis-1,2-DCE) were detected at 250 mg/kg, 36, mg/kg and 43 mg/kg, respectively in the soil sample collected from a depth of 4 to 6 feet bgs at boring CMS-451. In addition, chlorinated solvents, including PCE and TCE, were found to be present in soil samples obtained from soil borings CMS-417, CMS-419, and CMS-060 advanced in this area of the CMRP. In addition, the USEPA provides in the Report that a small quantity of non-aqueous phase liquid (NAPL) was observed to be present in soil encountered during the advancement of the soil boring for monitoring well MW-05S. However, no NAPL was observed atop the water table in monitoring well MW-05S.

2.2.4 Vapor Diffusion Samples

In the Report, the USEPA suggests that chlorinated VOCs, and possibly dioxins, are migrating in overburden groundwater from the vicinity of monitoring well MW-05S and are discharging into the River. As presented in the Report, the nature and extent of VOCs in groundwater is consistent with the results of the United States Geological Survey (USGS) study in which vapor diffusion samples were collected from the River. This study was conducted to assess the potential extent of the area through which VOC-impacted groundwater arguably flows and discharges to the River. As reported, this study identified the seepage of groundwater contaminated with VOCs along the River immediately downstream of monitoring well MW-05S. As presented in the Report, VOCs are not adversely impacting surface water and sediment quality in the River; however, the USEPA noted that it is possible that VOC contamination in the

vicinity of monitoring well MW-05S has mobilized dioxin, and stated that it may be discharging to the River.

2.2.5 Surface Water

The flux of dioxin from the River bed (sediment) to surface water in Allendale and Lyman Mill Ponds under low-flow, non-resuspending conditions was evaluated as part of a sediment stability study conducted by the USEPA (Battelle, 2004). As part of the sediment stability study, the USEPA collected surface water samples and had them analyzed for dioxins. Based on the surface water results, the USEPA drew preliminary conclusions about dioxin loading to the surface water during non-resuspending conditions in Allendale and Lyman Mill Ponds.

Of relevance, the USEPA concluded that an average dioxin load of approximately 110 milligrams per day (mg/day) are added to the River and the upstream portion of Allendale Pond. The USEPA assumed the mass transfer of pore water from the sediment to the surface water, due to a combination of various processes including diffusion, bioturbation, and groundwater flux, to be the main source of dioxin. The USEPA identified another possible source of dioxin in this area of the CMRP as the discharge of contaminated groundwater in this area of the CMRP. Based on this study, the USEPA also concluded that minimal net export of dioxin from Allendale and Lyman Mill Ponds occurs during low-flow, non-resuspending conditions; the background load of dioxin entering the CMRP is approximately equal to the load over Lyman Mill Dam during low-flow periods.

2.2.6 Semi-Permeable Membrane Devices (SPMDs)

The USEPA explains in the Report that while it is not clear whether or not dioxins are discharging to the River, and whether or not the magnitude of any such discharge is significant, additional investigation is in progress to assess whether overburden groundwater is a significant transport pathway for dioxins. The additional investigation to which the USEPA alluded was a semi-permeable membrane device (SPMD) study through which additional information on dioxin in groundwater, surface water, and sediment was obtained (Battelle, 2005b).

In June 2005, the USEPA conducted the SPMD study, which involved the collection of SPMD and co-located sediment and/or groundwater samples. The SPMDs were deployed in sediment, surface water and in monitoring well MW-05S. As initially presented by the USEPA, the results of this study may be used to suggest that the highest concentrations of dioxins were detected in the SPMD sediment samples that were collected nearest monitoring well MW-05S (SPMD-03 and SMPD-04), and lower concentrations of dioxins were reported for the SPMD sediment samples that were collected upstream and downstream of these locations (SPMD-01, SPMD-02,

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and SPMD-05) (Drawing 2-1). Based on the results of this study, the USEPA concluded that groundwater is the likely ongoing source or migration pathway of dioxins to the River.

The USEPA subsequently revised the presentation of the study results to correct the findings initially presented (USEPA 2008). As corrected by the USEPA, the findings of this study show that the highest concentrations of dioxins were detected in SPMD sediment samples SPMD-02 and SMPD-03, and lower concentrations of dioxins were reported for SPMD sediment samples SPMD-01, SPMD-04, and SPMD-05. Additionally, the corrected collocated surface water SPMD data do not support a flux of dioxin to the river. The only SPMD surface water result that is discernable from the levels found in the SPMD blank is the result for one of the replicate samples collected from SPMD-2, which is upstream of the elevated VOC zone identified in the Vapor Diffusion sampling study. This replicate surface water SPMD sample contained elevated levels of dioxin. However, its corresponding replicate sample contained levels of dioxin that were not discernable from the SPMD trip blank. Thus, the concentration reported for the replicate sample may be attributed to field sampling and/or laboratory contamination. Based on this result, dioxin is not present at this location. Such extreme sample result variation for replicate samples is unacceptably high, and renders the data unusable for the purposes of supporting EPA's conceptual model that there is a net positive flux of dioxin to this reach of the River. In fact, the in-stream SPMD data suggest the opposite; that there is no difference in dioxin concentrations between locations upstream and downstream of the VOC zone identified by the Vapor Diffusion sampling study.

2.2.7 Sediment

The USEPA has collected sediment samples from the River bed proximate to monitoring well MW-05S. Based on the analyses performed on these samples, concentrations of dioxin range from 2.58 ng/kg in sediment located upstream of the area of monitoring well MW-05S to 5,096 ng/kg in sediment proximate to monitoring well MW-05S and collocated with SPMD sample SPMD-04 (Drawing 2-4).

The USEPA and Battelle presented the results of the SPMD study at the April 23, 2007 Dialogue Meeting, concluding that groundwater in the vicinity of monitoring well MW-05S is an on-going source or migration pathway of dioxin transport to the River. During this meeting, Battelle and the USEPA presented a series of remedial alternatives being evaluated as part of the FS for groundwater in the vicinity of monitoring well MW-05S. The remedial alternatives identified at that time included: (i) no further action; (ii) de-watering and excavation; (iii) the installation of a hydraulic containment barrier; (iv) the installation of a passive reactive barrier (biowall); and (v) *in-situ* chemical oxidation.

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2.3 Current USEPA Transport Theory

In various letters of correspondence to the USEPA, LEA and AMEC, technical consultants for Emhart, challenged the USEPA's conclusion that the CMRP data support the theory that dioxin is being transported via groundwater to the River (LEA, 2007 and AMEC 2007a, b, c). In correspondence dated September 14, 2007, the USEPA reiterated and clarified its position that groundwater contaminated with VOCs in an area around monitoring well MW-05S is likely an ongoing source or migration pathway for dioxins discharging to the River. The USEPA's conceptual transport model is based on the mobilization of dioxin to the River through: (i) cosolvency, defined as an increased potential for migration due to reduced sorption to soil or enhanced solubility of compounds that typically adhere to soil, are repelled by groundwater, and, if present at all, are only present in groundwater in minor concentrations; and/or (ii) colloid-facilitated transport, defined as the increased mobility that results from the sorption of normally immobile compounds to mobile colloids.

With regard to the USEPA's cosolvency theory, the USEPA has postulated that increased solubility of dioxins is occurring in the area of monitoring well MW-05S due to the presence of PCE and/or TCE, which act as a cosolvent. Specifically, the USEPA has suggested that 2,3,7,8-TCDD is preferentially dissolved in the groundwater/cosolvent mixture rather than adsorbing onto surrounding soils, resulting in an increase in 2,3,7,8-TCDD mobility and transport within groundwater toward the River.

With regard to colloid-facilitated transport, the USEPA has suggested that the normally immobile dioxins have attached to mobile colloids in groundwater and are discharging to the River. Colloids are suspended particles that may be mobilized by groundwater and may move through the interstitial space between soil particles by what is referred to as colloidal transport. The colloids may serve as a transport mechanism for otherwise immobile contaminants that adsorb to the colloids. The increased mobility that results from the sorption of normally immobile compounds to mobile colloids is referred to as colloid-facilitated transport.

The letters of correspondence prepared by AMEC (2007a, b, c) include the available empirical data from the site investigation conducted by the USEPA and information provided in published literature that may be used to refute the transport theories proposed by the USEPA. Based on the assessment of the available empirical data and the published literature, AMEC concluded that the transport theories espoused by the USEPA are unsupported. Additionally, there is some uncertainty regarding the extent of impacted soil and groundwater in the vicinity of monitoring well MW-05S. As discussed below, LEA conducted supplemental data gathering activities to further assess the USEPA's theories regarding the groundwater transport pathway, and to gather

additional information on the extent of impacted soil and groundwater in the vicinity of monitoring well MW-05S.

2.4 Scope of Work

To further assess whether or not there is an ongoing source of dioxin discharging to the River from the area of monitoring well MW-05S, LEA installed three groundwater monitoring wells screened within the subsurface, overburden material. The monitoring wells, designated as MW-LEA-01, MW-LEA-02, and MW-LEA-03, were located as close as possible to the River, as shown in Drawing 2-1. Groundwater samples were obtained from these wells and from nearby monitoring well MW-05S. The monitoring wells were installed and sampled in accordance with the Scope of Work (SOW) presented to the USEPA under correspondence dated November 13, 2007, as subsequently amended to address the USEPA's November 21, 2007 comments. The amended SOW that was subsequently approved by the USEPA was presented in correspondence dated January 7, 2008, a copy of which is provided in Appendix A.

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3. PURPOSE AND OBJECTIVES

The purpose and objectives of this report are to summarize the relevant CMRP data, including the recently-obtained data, and to evaluate these data in light of what is known about the fate and transport of dioxins in the environment as presented in the published literature. Specifically, in evaluating the data we seek to answer the following questions:

1. Do the data support the USEPA's theory that dioxins are being transported in groundwater as the result of cosolvency?; and

2. Do the data support the USEPA's theory that dioxins are being transported in groundwater as the result of colloid-facilitated transport?

An additional purpose of this report is to examine the remedial alternatives presented by the USEPA and Battelle at the April 23, 2007 Dialog Meeting in light of the information obtained from the implementation of the SOW. Specifically, the adequacy of the range of remedial alternatives under evaluation is discussed. Also, the accuracy of the relative cost information for implementing each such alternative in light of the presently known extent of impacted soil and shallow groundwater beneath the study area is discussed.

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4. FIELD METHODS AND PROCEDURES

4.1 Monitoring Well Location

In accordance with the USEPA-approved SOW, LEA installed monitoring wells MW-LEA-01, MW-LEA-02, and MW-LEA-03 along the east embankment of the River at locations that would likely bound the extent of the area through which VOC-impacted groundwater arguably flows and discharges to the River (Drawing 2-1). The wells were located adjacent to the USGS vapor diffusion sample locations for which the highest concentrations of TCE and PCE were reported (VS-012, VS-013, VS-014, VS-015, and VS-016), and the SPMD locations for which the highest dioxin concentrations were reported (SPMD02, SPMD03, and SPMD04). Monitoring well MW-LEA-02 was located approximately 15 to 20 feet west of monitoring well MW-05S. Monitoring well MW-LEA-01 was located approximately 30 feet north of this monitoring well, and monitoring well MW-LEA-03 was installed approximately 30 feet south of this well location. The three monitoring wells were installed to evaluate groundwater conditions downgradient of monitoring well MW-05S.

4.2 Soil Boring Advancement

The wells were installed on January 31, 2008 and February 5, 2008 using hollow-stem auger (HSA) drilling techniques in accordance with LEA's *Standard Operating Procedure for Hollow-Stem Auger Soil Borings* and LEA's *Standard Operating Procedure for Installing and Developing Monitoring Wells and Piezometers* (Appendix B). At each monitoring well location, a soil boring was advanced by Geosearch, Inc. under the direct supervision of an LEA geologist. At the location for monitoring well MW-LEA-01, a soil boring was advanced to a depth of approximately 14 feet bgs; at monitoring well MW-LEA-02, a soil boring was advanced to a depth of approximately 12 feet bgs, and at monitoring well MW-LEA-03, a soil boring was advanced to a depth of approximately 10 feet bgs. The soil boring for monitoring well MW-LEA-01 was advanced to a depth of 14 feet bgs as requested by a field representative of the USEPA, following a discussion with the LEA geologist regarding the subsurface materials encountered at a depth of 10 to 12 feet bgs. The soil borings for monitoring wells MW-LEA-02 and MW-LEA-03 were completed at depths agreed upon by the field representative of the USEPA.

4.3 Soil Sampling

During the soil boring process, discrete samples were collected from each two-foot interval of subsurface materials penetrated with a stainless steel split-spoon sampling device so that the field

geologist could: (i) screen the samples for the presence of VOCs using a photoionization detector (PID); and (ii) prepare a field boring log documenting the visual classification of the soils encountered. The soils were classified using a modified Burmeister soil classification system in accordance with LEA's *Standard Operating Procedure for Geologic Logging of Unconsolidated Sedimentary Materials* (Appendix B). Copies of the Geologic Boring Logs are provided in Appendix C. The Geologic Boring Logs include the identification of fill material and/or contamination based on PID readings and visual and olfactory observations. Copies of the LEA Daily Field Report Forms are provided in Appendix D.

Each discrete soil sample was placed into containers supplied by the analyzing laboratory, Data/Analysis Technologies, Inc. of Plain City, Ohio (DAT). Each container was then labeled by field personnel with the sample identification, requested analysis, date and time of sample collection, and the sampler's initials. Once labeled, the samples were immediately placed on ice in coolers. To meet the objectives of the soil characterization process, a number of quality assurance/quality control (QA/QC) samples were obtained in accordance with LEA's *Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities* (Appendix B). The QA/QC samples included Performance Evaluation (PE) samples, field duplicate samples, and field equipment rinsate blank samples.

The soil and QA/QC samples from each boring were then shipped via overnight courier to DAT in coolers under custody seals and proper chain-of-custody documentation. The QA/QC and soil samples were submitted to the analyzing laboratory with a request that the samples be placed on hold DAT placed the samples on hold, and pending LEA's request to release select samples from hold based on PID readings, visual inspection of the subsurface materials, and/or the results of the groundwater samples that are collected from the monitoring wells, DAT was to analyze the samples for dioxins/furans using USEPA Method 8290A.

4.4 Monitoring Well Construction

At each boring location, a monitoring well was constructed of 1.5-inch diameter, Schedule 40, polyvinyl chloride (PVC) pre-packed (Vee-Pack™) screen, in which factory–installed ceramic beads fill the annulus between the inner (1.5-inch diameter) and outer (2.0-inch diameter) screen barrels. Each well includes a PVC end cap and a five-foot section of continuous-slot screen (0.012-inch slot Vee-Pack™) attached to which a section of 2-inch diameter PVC riser extends to approximately 2.5 feet above the ground surface. During the construction of each well, a secondary filter pack (20/40 mesh (0.33" – 0.016") sand) was placed within the annulus between the outer well screen and the borehole, from the base of the borehole to a minimum of two feet above the top of the well screen. Using bentonite chips, a seal was placed in the annulus above

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the sand pack. The borehole was sealed to within two to three feet of the ground surface. The bentonite chips were hydrated with clean, potable water. The wells were completed at the surface within a protective sleeve of 4-inch outside-diameter (OD) steel casing set into two to three feet of concrete. The protective steel casing sticks up approximately two to three feet above the ground surface. The protective steel casing of each well is locked with a steel cover. Copies of the Well Completion Logs are provided in Appendix C.

4.5 Monitoring Well Development

On February 8, 2008, monitoring wells MW-LEA-01, MW-LEA-02, MW-LEA-03, and MW-05S were developed in accordance with LEA's *Standard Operating Procedure for Installing and Developing Monitoring Wells and Piezometers* (Appendix B). In accordance with this procedure, an effort was made to clear the screened interval of each well and the surrounding filter pack of fine material using a surge block and pump. Throughout the well development process, the following geochemical parameters for groundwater were recorded to evaluate the formation water entering the monitoring well: temperature, pH, and turbidity. The specific conductance of the groundwater purged from each well could not be recorded due to a malfunctioning conductivity probe. Each well was purged dry during the development process. Following groundwater recovery, each well was subsequently surged and pumped dry again. Copies of the LEA Daily Field Report Forms documenting the monitoring well development process and the recorded groundwater parameters are provided in Appendix D.

4.6 Monitoring Well Survey

Guerriere & Halnon, Inc., a licensed land surveyor certified by the State of Rhode Island surveyed the locations of the newly installed monitoring wells relative to the existing site features and existing monitoring wells installed at the CMRP. The elevation of the top of the PVC casing of each monitoring well was surveyed relative to the existing datum and monitoring well network. The survey data were used to evaluate the general direction of groundwater flow in the vicinity of monitoring well MW-05S and the newly installed monitoring wells.

4.7 Groundwater Sampling

On February 25, 2008, depth-to-water measurements were recorded at each newly installed well and at existing nearby monitoring wells GEC-2, GEC-3, GEC-4, GEC-5, GEC-6, GEC-7, MW-05S, MW-6, MW-14M, and MW-15D. The depth to the surface water was also measured from the River staff gauge located along the west embankment of the River. As provided by the USEPA, monitoring wells GEC-2 and GEC-7 have since been abandoned by Brook Village Associates Limited Partnership (Brook Village). These two wells were installed by Brook

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Village to assess impacts to the subsurface from their underground storage tank fuel oil storage operations. The depth-to-water measurements were obtained to calculate groundwater elevations in the area of investigation using the monitoring well top of PVC casing elevation data.

Once the depth-to-water was recorded at the monitoring wells, groundwater samples were obtained from monitoring wells MW-LEA-01, MW-LEA-02, MW-LEA-03, and MW-05S using low-flow sampling techniques in accordance with LEA's *Standard Operating Procedure for Low Flow (Low Stress) Liquid Sample Collection and Field Analysis* (Appendix B). Consistent with this procedure, a peristaltic pump and dedicated tubing were used to pump groundwater from the mid-section of the saturated, screened interval of each well. Groundwater was then pumped from the wells into a flow-through cell, and the following geochemical parameters for groundwater were recorded: pH, temperature, specific conductance, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity. Measurements of these parameters were recorded approximately every ten minutes until the parameters stabilized, or for a minimum of two hours or until the well pumped dry. Stabilization was generally considered to be achieved when three consecutive readings were within the following limits: pH ± 0.1 units; temperature (± 3 percent (%)); specific conductance (± 3%); dissolved oxygen (± 10%); ORP (± 10 millivolts); and turbidity (± 10% and below 10 nephalometric turbidity units (NTUs)). The groundwater pumping and sampling process was focused on obtaining groundwater samples that were as turbid-free and clear as possible. The parameters were recorded on the Field Sampling Record Forms provided in Appendix D.

Once purged, groundwater samples were collected directly from the pump discharge tubing into pre-preserved containers supplied by the analyzing laboratories, DAT and Averill Environmental Laboratory, Inc. of Plainville, Connecticut (AEL). One field-filtered and one unfiltered groundwater sample were collected from each of the wells for laboratory analysis. One duplicate set of groundwater samples was obtained from monitoring well MW-LEA-02. First, the unfiltered samples were obtained and then, using a 0.45 micron in-line filter, the filtered samples were collected.

Each container was then labeled by field personnel with the sample identification, requested analysis, preservative, date and time of sample collection, and the sampler's initials. Once labeled, the samples were immediately placed on ice in coolers.

To meet the objectives of the shallow groundwater characterization process, a number of QA/QC samples were obtained in accordance with LEA's *Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities* (Appendix B). The QA/QC samples

included double-blind PE samples, field duplicate samples, trip blank samples, and field equipment rinsate blank samples.

The groundwater and QA/QC samples were then shipped via overnight courier to DAT and AEL, as appropriate, in coolers under custody seals and proper chain-of-custody documentation.

4.8 Decontamination of Field Equipment and Materials

All field equipment and materials that were used during the groundwater investigation activities consisted of clean, disposable materials or were decontaminated prior to introducing the equipment and materials into the ground at each monitoring well location. The field equipment decontamination procedures are included in the Standard Operating Procedures (SOPs) presented in Appendix B. The purpose of using standard decontamination procedures was to prevent the potential spread of contamination at monitoring well locations, thereby preventing the extraneous introduction of contamination at a sampling location. During soil boring advancement, soil sampling, and monitoring well installation procedures, the decontamination process involved steam cleaning the hollow-stem augers and the down-hole drilling tools in a decontamination tub. The stainless steel split-spoon sampling device was decontaminated by washing this tool with a phosphate-free detergent and rinsing the tool with de-ionized water. The field decontamination process used during monitoring well development and sampling activities involved the use of a portable decontamination system consisting of decontamination solutions in individual spray containers and a small, portable trough to contain decontamination fluids.

The well development and sampling equipment was decontaminated using the following general procedure:

- Wash and scrub the sampling equipment with a phosphate-free detergent.
- Rinse the equipment with de-ionized water.
- Rinse the equipment with a dilute methanol/water solution.
- Rinse the equipment with de-ionized water.
- Allow the sampling equipment to air dry.

4.9 Management of Investigation-Derived Waste

During the course of the shallow groundwater investigation activities, soil drill cuttings and groundwater purged from the monitoring wells were containerized in 55-gallon drums. Additionally, detergent-containing waters were generated during the decontamination of sampling equipment. These investigation-derived wastes (IDW) were properly containerized in

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four separate 55-gallon drums. The drums were properly labeled as either "soil drill cuttings", "monitoring well purge water", or "decontamination fluids", as appropriate. The label on each drum was used to identify the date of containerization and the location from which the material was derived. The 55-gallon drums were stored on Cap No. 1, behind the locked gate of the chain-linked fence, pending transportation to an approved off-site disposal facility.

To characterize the IDW for off-site disposal, one composite sample was collected from the two drums containing the soil drill cuttings. This sample was composited from one grab sample collected at depths of 1/3 and 2/3 into the soil contained within each drum. The grab samples were mixed in a stainless steel bowl to provide a homogenous sample that was placed into containers supplied by DAT. The sample container was then labeled by field personnel with the sample identification, requested analysis, date and time of sample collection, and the sampler's initials. Once labeled, the containers were immediately placed on ice in coolers. The composite sample of the soil drill cuttings was shipped via overnight courier to DAT in coolers under custody seal and proper chain-of-custody documentation.

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5. LABORATORY ANALYTICAL METHODS

5.1 Soil and Associated QA/QC Samples

The composite sample of the soil drill cuttings was analyzed by DAT for dioxins/furans using USEPA Method 8290A. The soil samples collected at each soil boring location and the corresponding QA/QC samples were not released from hold, and therefore were not analyzed.

5.2 Groundwater and Associated QA/QC Samples

The unfiltered groundwater samples were analyzed by DAT for dioxins/furans using USEPA Method 8290A. In addition, the unfiltered groundwater samples were analyzed by AEL for VOCs using USEPA Method 8260C; for Total Suspended Solids (TSS) using USEPA Method 160.2; and for Total Dissolved Solids (TDS) using USEPA Method 160.1. The filtered groundwater samples were analyzed by DAT for dioxins/furans using USEPA Method 8290A, and for TDS by AEL using USEPA Method 160.1.

Analyzing the filtered groundwater samples with a 0.45 micron filter would provide data indicative of the dissolved fraction and thus a tool to assess whether or not cosolvency is occurring at the CMRP. Evidence that the cosolvency-effect is not occurring would be provided by laboratory results of filtered groundwater samples that show that dioxins are not present. The presence of dioxin in the filtered groundwater samples, however, would not necessarily indicate that dioxins are dissolved if undisturbed, turbid-free groundwater samples are not obtained. In that event, the presence of dioxins may be attributed to dioxin compounds that are adsorbed to particles not normally in suspension but which are present in the groundwater sample due to the disturbance of the groundwater during the sampling process.

The QA/QC samples obtained at the time of groundwater sampling were analyzed for the same parameters for which the corresponding groundwater samples were analyzed: The PE samples were analyzed for dioxins/furans using USEPA Method 8290A; the trip blank samples were analyzed for VOCs using USEPA Method 8260C; and equipment rinsate blank samples were analyzed by DAT for dioxins/furans using USEPA Method 8290A, and by AEL for VOCs using USEPA Method 8260C, TSS using USEPA Method 160.2, and TDS using USEPA Method 160.1.

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6. LABORATORY ANALYTIC DATA QUALITY ASSURANCE REVIEW

The laboratory analytical data generated from the dioxin/furan and VOC analyses were subjected to third-party data validation by Environmental Standards, Inc. of Valley Forge, Pennsylvania (ES), to whom comprehensive Contract Laboratory Program (CLP)-like raw data packages were provided by each laboratory. The dioxin/furan data were validated by ES at a Tier III or full validation level using guidance from the *National Functional Guidelines for Chlorinated Dioxin and Furan Data Review* (USEPA, 2005). The VOC data were validated by ES at a Tier III or full validation level using guidance from the *Region 1, EPA – New England Data Validation Functional Guidelines for Evaluating Environmental Analysis* (USEPA 1996).

As part of the laboratory analytical data QA review, the data were evaluated to assess the usability of the analytical results and compliance relative to SW-846 Method 8290A and SW-846 Method 8260C, as appropriate. In addition, the deliverables prepared according to the CLP-like data packages were evaluated by ES. Based on the evaluations performed by ES, data quality issues for specific samples and specific evaluation criteria were identified. Organic data qualifiers were assigned to laboratory analytical results where necessary to assess the qualitative and/or quantitative reliability of the results based on the criteria evaluated.

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7. RESULTS

7.1 Subsurface Soil

As shown in the Geologic Boring Logs provided in Appendix C, the subsurface materials encountered during the advancement of the monitoring well borings consist generally of unsorted silt, sand and gravel with trace amounts of anthropogenic debris to a depth of approximately six feet bgs. Anthropogenic material identified in these deposits included wood, geotextile fabric, glass, and concrete. In general, loose to very dense, fine-grained to coarse-grained sand and sub-angular to sub-rounded gravel are found underlying these deposits.

At depths ranging from approximately four to thirteen feet bgs, dark brown and black discoloration and staining are imparted to the sand and gravel deposits. The highest field PID measurements were recorded for the soil samples obtained from these deposits. A maximum PID reading of 395 parts per million (ppm) total ionizable VOCs, relative to an isobutylene standard of 100 ppm, was recorded for monitoring well MW-LEA-01 at a depth of 8 to 10 feet bgs. A PID reading of 249 ppm total ionizable VOCs, relative to an isobutylene standard of 100 ppm, was recorded for monitoring well MW-LEA-02 at a depth of 8 to 10 feet bgs. The PID responses for the soil samples screened below these samples decrease with depth. Light brown to dark white fine to coarse sand and sub-angular to rounded gravel deposits exist below these stained deposits. The soil samples obtained from the boring advanced for monitoring well MW-LEA-03 did not exhibit a PID response.

A summary of the sampling and analytical information for the composite sample obtained from the soil drill cuttings IDW is provided in Table 6-1. The laboratory analytical results for this sample are presented in Table 6-2. A summary of the laboratory results and the corresponding toxicity equivalent factors (TEFs) and toxicity equivalents (TEQs) is provided in Table 6-3. As shown in Tables 6-2 and 6-3, a number of polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF) compounds were detected in the composite soil sample.

The congeners detected in this sample include: 2,3,7,8-TCDD; 2,3,4,7,8-PeCDF; OCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,6,7,8-HxCDD; and OCDD. The 2005 World Health Organization (WHO) TEFs were used to calculate the TEQs. The congener contributing the most to the TEQ was reported to be 2,3,7,8-TCDD, for which a TEQ concentration of 40 micrograms per kilogram (µg/kg) was reported. However, the laboratory result for 2,3,7,8-TCDD was qualified by ES as estimated due to a high surrogate recovery and a high continuing calibration percent difference coupled with increasing instrument sensitivity.

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7.2 Groundwater Elevations

On February 25, 2008, groundwater at the site was observed at depths ranging from approximately 2.6 feet bgs (GEC-7) to 8.0 feet bgs (MW-LEA-01). Groundwater elevations were calculated from the depth-to-water measurements and top-of-casing elevations for each well. The groundwater elevations are provided in Table 6-4. Using a site plan as a base map, the groundwater elevations were contoured as depicted in Drawing 6-1. The groundwater elevation contours outside the area of the Brook Village parking lot that are depicted in this drawing represent May 4, 2001 data obtained by Tetra-Tech NUS (2001) as presented in Figure 3-12 of the Report (Battelle 2005). Groundwater is assumed to flow perpendicular to the contour lines from areas of higher groundwater elevation to areas of lower groundwater elevation. As shown in Drawing 6-1, there appears to be a hydraulic mounding affect surrounding piezometer P-2. The cause of this mounding affect is unknown. Based on the data collected, shallow groundwater appears to flow from monitoring well MW-05S toward the River.

7.3 Groundwater Data

7.3.1 Groundwater Geochemical Data

A summary of the geochemical parameters recorded just prior to collecting the groundwater samples is provided in Table 6-5. The laboratory results for the analyses for TSS and TDS are also summarized in this table. Copies of the AEL laboratory reports provided for the analysis for TSS and TDS are included in Appendix E.

As shown in Table 6-5, the highest TDS concentrations were reported for the groundwater samples obtained from monitoring well MW-LEA-02. The TDS concentrations for the duplicate pair of samples obtained from this well were reported to be 730 milligrams per liter (mg/l) and 760 mg/l for the field-filtered samples and 740 mg/l and 720 mg/l for the unfiltered samples. were reported to contain relatively high concentrations of TSS. The TSS concentrations in the duplicate pair of groundwater samples obtained from monitoring well MW-LEA-02 were reported to be 2 mg/l and 11.2 mg/l. The range in reported concentrations is believed to be due to the limited yield of the well, and the fact that groundwater within the well was drawn down and the well was dewatered during the sampling process. These conditions resulted in a significant disturbance to the water column within the well, the well screen annulus and the surrounding formation, which increased the variability of the resulting groundwater chemistry.

The turbidity of the groundwater at the time of sampling at monitoring well MW-LEA-02 is indicative of the disturbance to the formation materials surrounding the well. A turbidity value of 13 NTUs was reported for the groundwater sample obtained from this well location and

turbidity measurements were recorded at values greater than approximately 22 NTUs prior to the final measurement at the time of sampling.

Also, it is believed that the limited yield of monitoring well MW-LEA-02 resulted in the relatively high TDS, TSS, and turbidity values recorded for groundwater at this location. In other words, the values are believed to be an artifact of the groundwater sampling process and not representative of undisturbed groundwater. During the sampling process, the volume of groundwater collected for the desired analyses and the limited yield of the well resulted in drawing down the groundwater and dewatering the well, necessitating that the full sample volume be collected upon recharge of the well. This confluence of factors contributed to the relatively high turbidity, TSS, and TDS values recorded for groundwater at this well location.

The temperature measurements that were recorded are not indicative of groundwater temperature as they were affected by the ambient air temperature at the time of sampling.

7.3.2 Volatile Organic Compound Data

A summary of the sampling and analytical information for the groundwater samples obtained from monitoring wells MW-LEA-01, MW-LEA-02, MW-LEA-03, and MW-05S is provided in Table 6-6. A summary of the VOCs detected in groundwater is provided in Table 6-7. Copies of the DAT laboratory analytical reports are provided in Appendix F. As noted in Section 7.4.2.2, below, the reported concentrations of VOCs were qualified by ES.

As shown in Table 6-7, VOCs were detected in each of the groundwater samples collected. The highest concentrations of VOCs were detected in the groundwater sample collected from monitoring well MW-LEA-01. A PCE concentration of 160,000 µg/l was reported for the groundwater sample obtained from this well. The total concentration of VOCs detected in this sample was 203,000 µg/l. Other VOCs detected in the sample obtained from monitoring well MW-LEA-01 include cis-1,2-DCE, reported to be present at a concentration of 16,000 µg/l, and TCE, reported to be present at a concentration of 27,000 µg/l. Lower concentrations of these VOCs were detected in the samples collected from monitoring wells MW-05S and MW-LEA-02. The sample collected from monitoring well MW-LEA-03 was reported to contain a PCE concentration of 590 µg/l; however, cis-1,2-DCE and TCE were not detected in this sample.

As shown in Table 6-7, only chlorinated VOCs were detected in the groundwater sample obtained from monitoring well MW-LEA-03. No water-miscible compounds such as acetone or methyl ethyl ketone were detected, indicating that a truly mixed solvent system is not present in the shallow groundwater in this area of the CMRP. Thus, a decrease in the sorption coefficient

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and retardation factor or an increase in the solubility of the dioxins would not be expected as might occur in a truly mixed solvent system (AMEC 2007b)

7.3.3 Dioxin/Furan Data

A summary of the dioxins/furans detected in groundwater is provided in Table 6-8 along with the corresponding TEFs and TEQs. Copies of the DAT 8290A laboratory analytical reports are provided in Appendix F. As noted in Section 7.4.2.2, below, the reported concentrations of dioxins/furans were qualified by ES.

As shown in Table 6-8, 2,3,7,8-TCDD was detected in each of the unfiltered groundwater samples at concentrations ranging from 68 pg/l (MW-LEA-01) to 6,154 pg/L (MW-LEA-02). Also, 2,3,7,8-TCDD was detected in the duplicate pair of field-filtered samples obtained from monitoring well MW-LEA-02 (727 pg/l and 288 pg/l). Dioxins were not detected in the field-filtered samples obtained from monitoring wells MW-LEA-01, MW-LEA-03, or MW-05S.

7.4 Quality Assurance/Quality Control Data Summary

7.4.1 Quality Control Data Summary

With regard to the soil laboratory analytical results, the recoveries presented in the laboratory analytical report for the matrix spike (MS) and matrix spike duplicate (MSD) samples were within the control limits of the method. The analyte 2,3,7,8-TCDD was apparently not uniformly dispersed within the sample and led to sample MS and MSD results that were not comparable. The laboratory control spikes were within limits and the internal standard recoveries and internal standard ion ratios met the QC guidelines in USEPA Method 8290A.

A summary of the sampling and analytical information for the field QC samples analyzed is provided in Table 6-9. A summary of the results reported for the field duplicate samples obtained from monitoring well MW-LEA-02 is provided in Table 6-10. The VOC results for the duplicate pair of unfiltered groundwater samples were greater than five times (>5x) the lowest calibration standard concentration and the relative percent difference (RPD) was greater than 20 percent. The 2,3,7,8-TCDD results for both samples of each of the filtered and unfiltered field duplicate pair of groundwater samples were greater than five times (>5x) the lowest calibration standard concentration and the relative percent difference (RPD) was greater than 20 percent. Thus, the laboratory precision is considered to be outside the acceptable range provided by the USEPA guidance, and the positive results for the VOCs and the 2,3,7,8-TCDD in the field duplicate pairs should be considered estimated. Accordingly, the results have been flagged "J" by ES. These findings do not affect the overall usability of the data for meeting the objectives of

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the investigation: to assess whether or not dioxins are being transported in groundwater as the result of cosolvency or colloid-facilitated transport.

A summary of the constituents detected in the trip blank and field equipment blank samples is provided in Table 6-11. The field samples associated with these QC samples have been qualified appropriately by ES, as documented in the ES Quality Assurance Review Reports provided in Appendix G.

The double-blind groundwater PE sample provided to DAT for 8290A analysis was obtained from Environmental Resource Associates® (ERA). This PE sample was provided by ERA with a 2,3,7,8-TCDD certified value of 3,010 pg/l and Performance Acceptance Limits™ (PALs) ranging from 2,290 pg/l to 3,460 pg/l. A copy of the ERA certification documentation for this PE sample is provided in Appendix H. The PE sample was submitted to DAT with the appearance of a field sample; the PE sample was submitted to DAT as both an unfiltered and a filtered groundwater sample. A summary of the sampling and analytical information for the PE samples analyzed is provided in Table 6-12.

A summary of the dioxins/furans detected in the PE samples is provided in Table 6-13. A 2,3,7,8-TCDD concentration of 5,101 pg/l was reported by DAT for the PE sample analyzed with the unfiltered groundwater samples. This concentration exceeds the upper acceptance limit of this sample (3,460 pg/l). Accordingly, the positive results for 2,3,7,8-TCDD in all unfiltered groundwater samples are considered to be estimated and have been flagged "J" by ES. A 2,3,7,8-TCDD concentration of 2,850.55 pg/l was reported by DAT for the sample analyzed with the filtered groundwater samples. This result is within the PALs of the sample. Thus, the results for the associated filtered groundwater samples were not qualified. The PE sample findings do not affect the overall usability of the data for meeting the objectives of the investigation.

Based on the data obtained for the quality control samples, LEA assessed the analytical results to be usable for the objectives of the investigation.

7.4.2 Quality Assurance Data Summary

7.4.2.1 Soil Laboratory Analytical Results

Based on the validation of the soil composite and associated QC samples, ES reported that overall the majority of the analytical data are acceptable for use as reported by DAT. ES concluded the data quality for the PCDD/PCDF compounds is generally acceptable; however, there were several aspects of the data that required qualification:

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- The result for 2,3,7,8-TCDD was qualified as estimated due to a high surrogate recovery and a high continuing calibration percent difference coupled with increasing instrument sensitivity.

- The results for several PCDD/PCDF compounds were qualified as Estimated Maximum Possible Concentrations due to out-of-criteria ion abundance rations.

- All positive results reported with concentrations less than the concentration of the lowest calibration standard were qualified as estimated

7.4.2.2 Groundwater Laboratory Analytical Results

Based on the validation of the groundwater and associated QC samples, ES concluded that the quality of the data generated from the 8260C analyses was generally adequate; however, the following qualifications were made:

- The results for several compounds in several samples were rejected because the compounds were not recovered in the associated laboratory control samples.

- The positive results for several compounds in several samples should be considered to be "not detected" due to laboratory and equipment blank contamination.

- The reported positive results for several compounds in several samples were qualified as estimated due to calibration issues, low matrix spike recoveries, and field duplicate imprecision.

- The reported positive results for several compounds in several samples should be considered estimated due to undiluted and diluted analysis results' imprecision and quantitation that exceeded the instrument calibration range.

- All reporting limits were raised to the level of the low concentration standard in the initial calibration (with sample-specific dilution adjustments).

Based on the validation of the groundwater and associated QC samples, ES concluded that the quality of the data generated from the 8290A analyses was generally acceptable; however, the following qualifications were made:

- The results for a few PCDD/PCDF compounds in several unfiltered samples were qualified due to blank contamination.

- The results for 2,3,7,8-TCDF in all filtered samples were qualified as estimated due to low recoveries in the laboratory control sample and MS/MSD analyses.

- The results for 2,3,7,8-TCDD in all unfiltered samples were qualified as estimated due to a high performance evaluation sample result.

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- The results for 2,3,7,8-TCDD in the filtered and unfiltered field duplicate pair were qualified as estimated due to field duplicate imprecision.

- The results for several PCDD/PCDFs in several samples were qualified as estimated due to high continuing calibration percent differences coupled with decreasing instrument sensitivity.

- All positive results reported with concentrations less than the concentration of the lowest level calibration standard were qualified as estimated.

Based on the results of the quality assurance reviews of the analytical results and CLP-like data packages, the sample analytical results were assessed to be usable for the objectives of the investigation that were presented in Section 3.

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8. EVALUATION OF RESULTS

8.1 Cosolvency

The data obtained for monitoring well MW-LEA-01 do not support the USEPA's conceptual model that TCE and/or PCE are acting as a cosolvent, and, thereby increasing the ability of dioxin to dissolve in water, resulting in larger amounts of 2,3,7,8-TCDD in groundwater that may mobilize toward the River. The unfiltered groundwater sample obtained from monitoring well MW-LEA-01 was reported to contain the highest concentration of PCE (160,000 µg/l) and the lowest dioxin TEQ concentration (68 pg/l). More importantly, dioxins were not detected in the filtered groundwater sample obtained from this well.

Although the concentration of PCE in the sample collected from monitoring well MW-05S, 40,000 ug/l, is not as high as the PCE concentration reported for monitoring well MW-LEA-01, it is moderately high compared to the results of samples previously collected from this well. Similar to monitoring well MW-LEA-01, 2,3,7,8-TCDD was detected in the unfiltered sample from MW-05S (339 pg/l), but it was not detected in the filtered sample.

If cosolvency were occurring at the CMRP, this effect most likely would be observed at monitoring well MW-LEA-01 and/or monitoring well MW-05S because the groundwater samples obtained from these wells were reported to contain the highest concentrations of PCE and TCE. Evidence of the cosolvency-effect would be identified by higher concentrations of dioxin indicating larger amounts of dioxin dissolved in groundwater. Also, little to no difference in dioxin concentrations between the unfiltered and filtered samples would be expected. If the dioxin were dissolved, it would not be particle-bound, but rather in solution and in equilibrium with the particle-bound fraction and freely able to pass through the field filter.

In reviewing the results presented in Table 6-8 for the samples obtained from monitoring wells MW-LEA-01 and MW-05S, it is shown that dioxins were not detected in the field-filtered groundwater samples obtained from these monitoring wells. Thus, elevated levels of VOCs do not correlate with elevated levels of dioxins dissolved in groundwater that are allegedly subject to increased mobility and transport. The groundwater data obtained from these wells support the position cited in the technical, peer-reviewed and published literature summarized by AMEC (2007b): in the absence of a very high concentrations of water-miscible compound such as acetone, there is no increased ability of dioxins or other hydrophobic organic compounds to dissolve in water, and there is no increased potential for migration. The laboratory data provide evidence that dioxins are not dissolved in groundwater at monitoring wells MW-LEA-01 and MW-05S or at monitoring well MW-LEA-03. Therefore, these data may be used to support the

theory that cosolvency is not occurring at monitoring wells MW-LEA-01 and MW-05S, and most undoubtedly is not occurring at the CMRP.

Although dioxins were detected in the field-filtered sample obtained from monitoring well MW-LEA-02, it is unlikely that cosolvency is occurring at this location because the concentrations of chlorinated VOCs were reported to be equal to or less than those reported for monitoring wells MW-LEA-01 and MW-05S. Based on the data for the field-filtered groundwater samples obtained for monitoring wells MW-LEA-01 and MW-05S, cosolvency is not occurring. Thus, at monitoring well MW-LEA-02, where concentrations of chlorinated VOCs were reported to be equal to or less than those reported for monitoring wells MW-LEA-01 and MW-05S, it is reasonable to conclude that cosolvency similarly is not occurring.

8.2 Colloid-Facilitated Transport

As discussed, the concentration of dioxin reported to be present in the filtered samples obtained from monitoring well MW-LEA-02 is believed to represent dioxin that passed through the filter while bound to particles suspended in groundwater. This belief is predicated upon the concentrations of TSS and TDS reported for the groundwater samples obtained from this well, the field-measured turbidity of the groundwater at the time of sampling, and the documented behavior of dioxins in the environment (EPA 2006). The degree of suspended particles in a groundwater sample is measured by the turbidity of the groundwater. A turbidity value of 13 NTUs was recorded for groundwater at monitoring well MW-LEA-02. This relatively high turbidity value is believed to be due to the disturbance to the formation caused by the groundwater sampling process, which resulted in the suspension of particles in the groundwater as documented by the relatively high TSS values reported for the samples obtained from this well.

The dioxin concentrations reported for the filtered samples obtained from monitoring well MW-LEA-02 represent the dissolved fraction, the particle-bound fraction, or both. Most, if not all, dioxin occurring in water will adhere to sediments and suspended silts. If any 2,3,7,8-TCDD is dissolved in groundwater, it will tend to come out of solution and sorb onto the fine soil particles that comprise the till and fill materials within the subsurface at the CMRP. Moreover, it is likely that the soil through which groundwater is flowing would impede the movement of colloids.

The presence of dioxins in groundwater at monitoring well MW-LEA-02 does not support the USEPA's theory that dioxins are mobilizing to the River from monitoring well MW-05S. As discussed above, the presence of dioxins is believed to be attributed to the suspension of

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immobile particles during the groundwater sampling process. Under undisturbed conditions, these particles would not be dissociated from the formation and suspended in groundwater.

If particle-bound dioxin were being transported via groundwater, then the SPMDs that were buried in the sediment would not be a tool that could be used to detect their presence. As pointed out by AMEC (2007c), SPMDs have been shown to exclude colloidally-bound dioxin and to only adsorb soluble chemicals. As discussed above, dioxins are not dissolved in groundwater that is discharging to the River. Thus, the dioxin concentrations reported by the USEPA for the SPMD samples must be due to the extraneous introduction of sediment into the SPMD samples.

The only other manner in which dioxins could enter the SPMD samplers buried in the sediment would be if colloidal-bound material desorbed from the colloid, became freely soluble in groundwater, and then was taken up by the SPMD. This mass transformation process is very highly unlikely to have occurred. Thus, we conclude that the data from the SPMDs buried in the sediment have little utility other than to corroborate that the river sediment contains elevated 2,3,7,8-TCDD, which is known from the collocated sediment samples. More specifically, the data from the SPMDs buried in sediment cannot be used to assess the presence of compounds bound to colloids.

Assuming arguendo that the SPMD data may be used to assess the USEPA's theory that dioxins are being transported via groundwater, a review of the USEPA-corrected in-stream SPMD data reveals that the dioxin concentrations do not change significantly from upstream sampling location SPMD-1 to the sampling location adjacent to monitoring well MW-05S (SPMD-3) and the downstream locations (SPMD-4 and SPMD-5). The results obtained for upstream sampling location SMPD-2, are questionable given that the result for one of the replicate samples is not discernable from the trip blank level and the result for the other replicate sample is nearly 6.5 times the first replicate. The extreme variation in these results is unacceptably high and renders the data unusable for the purposes of supporting EPA's conceptual model that there is a net positive flux of dioxin to this reach of the River. In fact, the in-stream SPMD data suggest the opposite; that there is no difference in dioxin concentrations between locations upstream and downstream of the VOC zone identified by the Vapor Diffusion sampling study. Furthermore, except for the higher level replicate at SPMD-2, the concentrations of dioxins reported for all in-stream SPMD locations are indistinguishable from the dioxin concentrations reported for the trip blank, and may be attributed to field sampling and/or laboratory contamination. Although distinguishable from the results reported for the trip blank, the results of the higher-level replicate at SPMD-2 cannot be relied on because of the significant difference in dioxin concentrations reported for the replicate samples collected from this location.

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If dioxins are being mobilized from the area of monitoring well MW-05S toward the River, there would be an expected increase in in-stream SPMD concentrations from locations sampled upstream of monitoring well MW-05S to downstream locations, perhaps with a spike at, and just below, the discharge point, defined by USGS vapor diffusion sample locations SV-12, VS-013, VS-014, VS-015, and VS-016. A review of the USEPA-corrected data reveals, however, that there is no increase in dioxin concentrations at or just below the discharge point, and, if anything, there is an increase upstream of this area and monitoring well MW-05S.

Moreover, based on the USEPA-corrected SPMD data, the highest collocated sediment dioxin concentrations were reported for the samples obtained upstream and upgradient of the discharge point defined by the USGS vapor diffusion study. A review of the data (incorrect) initially reported by the USEPA did reveal the highest sediment levels to be within the discharge zone; however, the USEPA-corrected data reveal the highest sediment dioxin concentrations to be upgradient of this area and monitoring well MW-05S. This finding does not support the USEPA's transport theory. Rather this finding supports the concept that the area with high dioxin concentrations in soil extend well beyond monitoring well MW-05S.

Thus, the CMRP data do not support the USEPA's alternative theory that dioxins have mobilized from the study area through colloid-facilitated transport.

8.3 Expanded Area of Impacted Soil and Groundwater

As discussed above, the presence of dioxins in groundwater at monitoring well MW-LEA-02 does not necessarily signify, in any sense, that dioxins are mobilizing through cosolvency or colloid-facilitated transport to the River, as the USEPA contends. However, if cosolvency and colloid-facilitated transport are not occurring, then what transport mechanisms account for the discharge of dioxins to the River? The simple answer is none. There are no transport mechanisms to account for the mobility of dioxins because dioxins are not discharging to the River. Rather, based on the field observations and laboratory results, dioxins detected in the groundwater samples collected from monitoring well MW-LEA-02 and the other newly-installed monitoring wells represent the concentrations of dioxins present beneath an area that extends significantly beyond the immediate vicinity of monitoring well MW-05S. This theory of an expanded area of contaminated subsurface is supported by the data and is consistent with what is known about the fate and transport of dioxins and other hydrophobic organic compounds in the environment. This belief is predicated upon the following:

1. Field Observations: Dark stains were observed to be imparted to the subsurface materials encountered during the installation of monitoring well MW-LEA-01 and monitoring well MW-LEA-02 at depths ranging from approximately four feet to

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twelve feet below the ground surface (bgs). The subsurface materials encountered at these depths were observed to exhibit the maximum photoionization detector (PID) readings at these well locations. A maximum PID reading of 395 parts per million (ppm) total ionizable VOCs relative to an isobutylene standard of 100 ppm was recorded for monitoring well MW-LEA-01 at a depth of 8 to 10 feet. A PID reading of 249 ppm total ionizable VOCs relative to an isobutylene standard of 100 ppm was recorded for monitoring well MW-LEA-02 at a depth of 8 to 10 feet bgs. These field observations suggest that the study area is not defined by the conditions observed at monitoring well MW-05S; rather, it extends at least to monitoring wells MW-LEA-01 and MW-LEA-02. The extent of this area to the north, east and south is still unknown.

2. Laboratory Results for Groundwater - VOCs: Based on the laboratory results, the concentrations of VOCs reported for the groundwater samples obtained from monitoring wells MW-LEA-01 and MW-LEA-02 are some of the highest concentrations reported for groundwater at the CMRP. The maximum PCE concentration reported for the groundwater samples collected from monitoring well MW-05S was 61,000 µg/l. This concentration is less than the PCE concentration reported for the groundwater sample obtained from monitoring well MW-LEA-01 (160,000 µg/l). Based on these data and the field observations noted above, the study area is not defined by conditions observed at monitoring well MW-05S; rather, it extends at least to wells MW-LEA-01 and MW-LEA-02.

3. Laboratory Results for Groundwater – Dioxins: Further, the study area is not defined by the dioxin concentrations reported for monitoring well MW-05S. Based on the laboratory results, the dioxin concentrations reported for the unfiltered groundwater samples obtained from monitoring well MW-LEA-02 (2,743 pg/l and 6,154 pg/l) exceed or are within the range of concentrations measured in unfiltered groundwater samples obtained from monitoring well MW-05S (4,180 pg/l; 4,144 pg/l; 1,460 pg/l; and 1,030 pg/l). Thus, the study area extends at least to monitoring well MW-LEA-02.

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Laboratory Results for Soil – Dioxins: The dioxin TEQ concentration of 39,888 ng/kg reported for the composite soil sample is comparable to the dioxin TEQ concentrations reported by the USEPA for the study area. As provided in the RI, and summarized in Section 3.2, dioxin TEQ concentrations above 1,000 ng/kg were found at depth in soil samples obtained from soil boring CMS-451 (140,000 ng/kg at 4 to 6 feet bgs) and the borings for monitoring wells MW-05S (20,455 ng/kg at 4 to 6 feet bgs), CMS-453 (11,000 ng/kg and 42,900 ng/kg at 3 to 4 feet bgs, and 62,000 ng/kg at 6 to 7 feet bgs) and MW-15D (2,645 ng/kg). Based on the dioxin concentration of the composite sample collected from the soil drill cuttings generated during the installation of monitoring wells MW-LEA-01, MW-LEA-02, and MW-LEA-03, and on the field observations for boring MW-LEA-02, it is reasonable to assume that the soil cuttings from the installation of monitoring well MW-LEA-02, where the highest concentrations of dioxin was detected in groundwater, contributed significantly to the overall concentration of dioxin in the composite sample. Moreover, it is believed that monitoring well MW-LEA-02 is installed in an area defined by elevated dioxin concentrations similar to the area of monitoring well MW-05S.

For the reasons enumerated above, the presence of dioxins in groundwater at monitoring well MW-LEA-02 does not signify that dioxins are mobilizing toward the River from monitoring well MW-05S. Rather, the data indicate that the study area is not limited to the area around monitoring well MW-05S, but extends beyond the area of this well, and, at a minimum, includes the area of monitoring well MW-LEA-02. Moreover, the USEPA's theory of colloid-facilitated transport does not comport with what is known about the behavior of dioxins in the environment. Dioxins occurring in the subsurface have a strong affinity to bind to soil particles. Thus, a more likely scenario, and one that is as equally well supported by the data, is that the dioxin-bound particles are immobile and will not move from the study area.

8.4 Summary of Evaluation

The CMRP data do not support the USEPA's alternative theory that dioxins have mobilized from the study area through colloid-facilitated transport. The data clearly do demonstrate that cosolvency is not occurring in this area of the CMRP, and, that the study area extends beyond monitoring well MW-05S to the area of monitoring well MW-LEA-02. Given that monitoring well MW-LEA-02 appears to be in the study area and that the suspended particle content of the groundwater samples obtained from this well are attributable to the sampling process, it is

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inappropriate for the USEPA to rely on the groundwater data from monitoring well MW-LEA-02 to support its theory that groundwater is a migration pathway of dioxin by means of colloid-facilitated transport. Based on what is known about the behavior of dioxin in the environment, it is far more likely that the dioxin reported to be present in the groundwater in this area of the CMRP is particle-bound and immobile.

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9. IMPLICATIONS OF DATA ON REMEDIAL ALTERNATIVES

In light of the expanded study area discovered by conducting the supplemental sampling program, the USEPA's cost estimates for the remedial alternatives under consideration are too low and do not reflect the actual cost of implementing any of those alternatives. For instance, the USEPA estimated the dewatering and excavation alternative at $2.2 million. This estimate is based on the excavation of soil to approximately four feet below the ground surface, and the removal of approximately 3,400 cubic yards of soil. Based on the data that reveal an expanded study area, it is estimated that the potential cost to implement the dewatering and excavation remedy could be as high as $20 million, nearly an order of magnitude higher than that estimated by the USEPA. Therefore, it is inappropriate to use the estimated costs in evaluating the remedial alternatives for this area of the CMRP, or to screen-out other potential alternatives.

If other potential remedial alternatives were to be evaluated, the remedial costs in this area could be substantially less considering that the data show that dioxins are not being mobilized to the River through cosolvency or colloid-facilitated transport. The dioxin-impacted soils in this area of the CMRP are not any different than impacted soils at adjacent areas that have been capped (Cap No. 1 and Cap No. 2). Accordingly, the soils in the expanded study area should not be addressed any differently than the impacted soils beneath Cap No. 1 and Cap No. 2. Therefore, the range of remedial alternatives being evaluated by the USEPA for shallow groundwater should be expanded to include the capping alternatives that the USEPA already has implemented or is considering for other action areas of the CMRP.

For example, the universe of potential remedial alternatives for shallow groundwater in this area of the CMRP should be expanded to include a limited excavation and capping alternative; a far more cost-effective alternative that is equally as protective of the environment as the USEPA's dewatering and excavation alternative. The elements of such a remedial alternative would include the following steps: (i) incorporate a restriction on the future use of groundwater; (ii) remove impacted soil along the potential discharge area of the east embankment of the River and place the soil in the proposed nearshore confined disposal facility; and (iii) cap the remaining source area. This proposed alternative is consistent with the capping approach selected by the USEPA and implemented at the adjacent areas of the site (Cap No. 1 and Cap No. 2). Moreover, the cost to implement this alternative is estimated to be less than $1 million, and is likely to be between $500,000 and $750,000. This cost is significantly less than the cost estimated to implement any of the alternatives currently being evaluated by the USEPA, even for the impacted subsurface limited to the area surrounding monitoring well MW-05S.

10. RECOMMENDATION

It is recommended that the universe of potential remedial alternatives for shallow groundwater in this area of the CMRP be expanded to include a limited excavation and capping alternative.

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UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 1 - NEW ENGLAND

IN THE MATTER OF:	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMOVAL ACTION
Centredale Manor Restoration Project Superfund Site	
North Providence, Rhode Island	U.S. EPA New England CERCLA Docket No. 01-2009-0086
Emhart Industries, Inc.	
Respondent	Proceeding Under Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622

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I. JURISDICTION AND GENERAL PROVISIONS

1. This Administrative Settlement Agreement and Order on Consent ("Settlement Agreement") is entered into voluntarily by the United States Environmental Protection Agency ("EPA") and Emhart Industries, Inc. ("Respondent"). This Settlement Agreement provides for the performance of a removal action by Respondent at or in connection with a portion of the property located at 2072 and 2074 Smith Street in North Providence, Rhode Island, as well as other locations to which contamination from that area has come to be located or from which that contamination came, known as the "Centredale Manor Restoration Project Superfund Site" or the "Site."

2. This Settlement Agreement is issued under the authority vested in the President of the United States by Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622, as amended ("CERCLA").

3. EPA has notified the State of Rhode Island (the "State") of this action pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

4. EPA and Respondent recognize that this Settlement Agreement has been negotiated in good faith and that the actions undertaken by Respondent in accordance with this Settlement Agreement do not constitute an admission of any liability. Respondent does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Settlement Agreement, the validity of the findings of fact, conclusions of law, and determinations in Sections IV and V of this Settlement Agreement, and denies any liability or violation of law. Respondent agrees to comply with and be bound by the terms of this Settlement Agreement and further agrees that it will not contest the basis or validity of this Settlement Agreement or its terms.

II. PARTIES BOUND

5. This Settlement Agreement applies to and is binding upon EPA and Respondent and its heirs, successors and assigns. Any change in ownership or corporate status of Respondent including, but not limited to, any transfer of assets or real or personal property shall not alter Respondent's responsibilities under this Settlement Agreement.

6. Respondent is jointly and severally liable for carrying out all activities required by this Settlement Agreement.

7. Respondent shall ensure that its contractors, subcontractors, and representatives receive a copy of this Settlement Agreement and comply with this Settlement Agreement. Respondent shall be responsible for any noncompliance with this Settlement Agreement.

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III. DEFINITIONS

8. Unless otherwise expressly provided in this Settlement Agreement, terms used in this Settlement Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Settlement Agreement or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601, *et seq.*

b. "Day" shall mean a calendar day. In computing any period of time under this Settlement Agreement, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

c. "Effective Date" shall be the effective date of this Settlement Agreement as provided in Section XXIX.

d. "EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

e. "Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

f. "National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

g. "Settlement Agreement" shall mean this Administrative Settlement Agreement and Order on Consent and all appendices attached hereto. In the event of conflict between this Settlement Agreement and any appendix, this Settlement Agreement shall control.

h. "Paragraph" shall mean a portion of this Settlement Agreement identified by an Arabic numeral.

i. "Parties" shall mean EPA and Respondent.

j. "RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, *et seq.* (also known as the Resource Conservation and Recovery Act).

k. "Respondent" shall mean Emhart Industries, Inc.

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l. "RIDEM" shall mean the Rhode Island Department of Environmental Management and any successor departments or agencies of the State.

m. "Section" shall mean a portion of this Settlement Agreement identified by a Roman numeral.

n. "Site" shall mean the Centredale Manor Restoration Project Superfund Site, which is comprised of 2072 and 2074 Smith Street in North Providence, Rhode Island (Plat 14, Lots 200 and 250, encompassing approximately 9.7 acres) as well as surface water, sediment and floodplain areas of the Woonasquatucket River from Route 44 southerly to the Allendale Dam and further below to the Lyman Mill Dam, including all contaminated areas within this area as well as any other locations to which contamination from this area has come to be located.

o. "State" shall mean the State of Rhode Island.

p. "Statement of Work" or "SOW" shall mean the statement of work for implementation of the removal action, as set forth in Appendix A to this Settlement Agreement, and any modifications made thereto in accordance with this Settlement Agreement.

q. "United States" shall mean the United States of America including its departments, agencies and instrumentalities.

r. "Waste Material" shall mean 1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); 2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); and 3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27).

s. "Work" shall mean all activities Respondent is required to perform under this Settlement Agreement.

IV. EPA'S FINDINGS OF FACT

9. The Centredale Manor Restoration Project Superfund Site is located in North Providence, Rhode Island. It consists of two parcels, 2072 and 2074 Smith Street (Plat 14, Lots 200 and 250, encompassing approximately 9.7 acres), as well as surface water, sediment and floodplain areas of the Woonasquatucket River from Route 44 southerly to the Allendale Dam and further below to the Lyman Mill Dam, including all contaminated areas within this area as well as any other locations to which contamination from this area has come to be located.

10. Prior to 1936, the properties were occupied by Centredale Worsted Mills, a woolens manufacturing plant. Atlantic Chemical Company, a chemical manufacturer, began operating on a portion of the Site in approximately 1940. Atlantic Chemical Company changed its name in 1953 to Metro-Atlantic, Inc., and operated until the late 1960s or early 1970s. In the late 1960s or early 1970s, Metro-Atlantic, Inc., changed its name to Crown-Metro, Inc. The chemical company ceased operating at the Site in the early 1970s. New England Container

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Company operated a drum reconditioning facility on a portion of the Site from 1952 until the early 1970s. A major fire in the early 1970s destroyed most of the structures at the Site. In 1976, Brook Village Associates Limited Partnership purchased 2072 Smith Street, where the chemical company previously operated, and completed construction of an apartment building that provides affordable housing to the elderly. Centerdale Manor Associates purchased 2074 Smith Street in 1983 and built a similar building. Evidence suggests that the operations of the chemical companies and the drum reconditioning facility at the Site resulted in releases and threats of releases of hazardous substances at the Site.

11. Respondent is a successor to certain assets and liabilities of the chemical companies which operated at the Site.

12. Acting on a verbal approval of funding, EPA initiated a removal action (including sampling and placement of temporary fencing around contaminated surface soil) in January 1999. An Action Memorandum documenting this verbal approval, and authorizing additional activities, was issued on May 4, 1999.

13. On September 13, 1999, an Action Memorandum addendum was issued which changed the scope of the ongoing removal activities to include designing and implementing a Flood Evaluation Study of the Site and surrounding area; designing and implementing interim soil caps for specific areas of the Site; and reconstruction of the former tailrace at the eastern edge of the Site.

14. In 1999, EPA began conducting Remediation Investigation ("RI") activities at the Site.

15. On September 15, 1999, EPA mailed Notice of Potential Liability letters to three potentially responsible parties ("PRPs"): Brook Village Associates Limited Partnership; Centerdale Manor Associates Limited Partnership; and New England Container Company, Inc. On December 2, 1999, EPA issued a proposed Administrative Order on Consent ("AOC") for time-critical removal activities to Brook Village Associates Limited Partnership and Centerdale Manor Associates Limited Partnership. These negotiations were unsuccessful.

16. On February 3, 2000, EPA issued a letter to the three PRPs requesting that they voluntarily perform or finance an Engineering Evaluation/Cost Analysis ("EE/CA") for a portion of the Site. The parties declined to negotiate. The EE/CA was completed in September 2000.

17. On February 28, 2000, EPA mailed two additional Notice of Potential Liability letters to Respondent and Crown- Metro, Inc. Negotiations with these two PRPs, as well as the three PRPs previously named, to perform or fund the remaining time-critical removal activities at the Site were not successful.

18. The Site was placed on the National Priorities List ("NPL") on March 6, 2000.

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19. On April 12, 2000, EPA issued a Unilateral Administrative Order ("UAO") to Respondent and four other PRPs at the Site, ordering the parties to complete time-critical removal activities at the Site including completion of the second interim soil cap and implementation of certain flood control measures. EPA approved the PRPs' Completion of Work Report on September 11, 2000.

20. On April 27, 2000, EPA issued a letter to Respondent and the four other PRPs requesting that they indicate their interest in completing the RI/FS at the Site, and reimbursing EPA for its past costs. These negotiations were unsuccessful and EPA continued to work on the RI/FS.

21. On June 1, 2000, a second Action Memorandum addendum was issued transitioning certain time-critical removal activities to non-time critical removal activities and noting that the second interim soil cap and certain flood control measures would be performed by PRPs at the Site pursuant to a UAO.

22. On January 18, 2001, EPA issued an Action Memorandum to remove contaminated soils and sediments from properties subject to residential and recreational use and to restore the Allendale Dam to minimize further migration of contaminated sediment in the River. On March 26, 2001, EPA issued a Second UAO to Respondent and the four other PRPs at the Site, ordering the parties to implement the Work in the Action Memorandum. The Allendale Dam restoration was completed in February, 2002. EPA approved the PRPs' Completion of Work Report on May 13, 2005.

23. In 2003, EPA mailed Notice of Potential Liability letters to eleven additional parties.

24. By letter dated May 5, 2003, EPA requested that all the PRPs participate in the Third Administrative Order on Consent for a Removal Action ("Third AOC") to complete time critical removal activities in the tailrace portion of the Site. Ten PRPs, including Respondent, signed the Third AOC which became effective on September 16, 2003. Pursuant to the Third AOC, Respondent and three other PRPs constructed a cap over contaminated soil and sediment, and installed storm drainage equipment intended to separate soil, sediment, debris and other materials at the outfall of a storm drain line. Six other PRPs contributed to the costs of the work. EPA issued a Notice of Completion for this work on June 27, 2006.

25. In October 2003, EPA issued a UAO to two PRPs that declined to sign the Third AOC. That UAO ordered both parties to participate and cooperate with the respondents to the Third AOC. Subsequently, both PRPs contributed to the costs of the removal action.

26. In May 2004, EPA issued two additional general notice letters.

27. In 2006, Respondent agreed to place fill around the storm drainage equipment installed pursuant to the Third AOC; armor the slopes; replace the manhole covers; and replace

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the screen in the concrete pipe outfall. This work was completed by Respondent in the Fall of 2006.

28. In September, 2007, Respondent signed an Administrative Settlement Agreement and Order on Consent pursuant to which it agreed to perform certain studies and investigations to assist EPA in its analysis of the conditions that would potentially result from the removal of the Allendale and Lyman Mill Dams.

29. In 2007 and 2008, EPA issued a total of 9 additional Notices of Potential Liability.

30. Analysis of soils, sediments, wetlands and flood plain samples at the Site indicated elevated levels of hazardous substances, pollutants or contaminants, including 2,3,7,8-Tetrachlorodibenzo-*p*- Dioxin ("dioxin"), polychlorinated biphenyls ("PCBs" or "Aroclors"), polycyclic aromatic hydrocarbons ("PAHs"), including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, metals (including antimony, arsenic, chromium, lead, and manganese), and several Volatile Organic Compounds ("VOCs") and Semi-Volatile Organic Compounds ("SVOCs").

31. Soil samples taken in the vicinity of monitoring well MW-5 located adjacent to the Brook Village parking lot have revealed dioxin concentrations up to 33 ppb in surficial and sub-surface soils. This removal action is a continuing response to reduce the potential for migration of contaminants.

32. The installation of an engineered cap near monitoring well MW-5 and excavation and off-site disposal of contaminated soils will mitigate potential migration of dioxin. Groundwater monitoring points will be installed to assess effectiveness of this removal action.

33. On July 16, 2009, the Director of EPA's Office of Site Remediation and Restoration, or his designee, signed an Action Memorandum approving EPA's proposed removal action ("Action Memorandum"). The Action Memorandum is attached as Appendix B. Respondent submitted a response to EPA's signed Action Memorandum for inclusion in the Administrative Record. This removal action is based on documents and data which will be available to the public in the Administrative Record for public review within 60 days of the inception of these proposed actions, as described in the National Contingency Plan (40 CFR 300.415(m)(i)).

V. EPA'S CONCLUSIONS OF LAW AND DETERMINATIONS

34. Based on the Findings of Fact set forth above, and the Administrative Record supporting this removal action, EPA has determined that:

a. The Centredale Manor Restoration Project Superfund Site is a "facility" as defined by Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

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b. The contamination found at the Site, as identified in the Findings of Fact above, includes "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

c. Respondent is a "person" as defined by Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

d. Respondent is a responsible party under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a).

e. The conditions described in Paragraphs 30 and 31 of the Findings of Fact above constitute an actual or threatened "release" of a hazardous substance from the facility as defined by Section 101(22) of CERCLA, 42 U.S.C.§ 9601(22).

f. The removal action required by this Settlement Agreement is necessary to protect the public health, welfare, or the environment and, if carried out in compliance with the terms of this Settlement Agreement, will be consistent with the NCP, as provided in Section 300.700(c)(3)(ii) of the NCP.

VI. SETTLEMENT AGREEMENT AND ORDER

Whereas, EPA has identified a "groundwater action area" on the Site that it believes may present an imminent and substantial endangerment to public health, welfare, or the environment due to the presence of elevated levels of dioxin and other hazardous substances in subsurface soils;

Whereas, the removal action to be performed pursuant to this Settlement Agreement will involve the removal and off-site disposal of subsurface soils and the installation of a cap in the groundwater action area, all of which are intended to mitigate a potential release of contaminants into the environment; and

Whereas, the removal action to be performed pursuant to this Settlement Agreement is intended to be consistent with the efficient performance of long term remedial action, and EPA believes that, subject to post-implementation monitoring, the removal action will mitigate a potential risk to public health, welfare or the environment posed by this area of the Site; and

Based upon the foregoing Findings of Fact, Conclusions of Law, Determinations, and the Administrative Record for this Site, it is hereby Ordered and Agreed that Respondent shall comply with all provisions of this Settlement Agreement, including, but not limited to, all attachments to this Settlement Agreement and all documents incorporated by reference into this Settlement Agreement.

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VII. DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR

35. Respondent shall retain one or more contractors to perform the Work and shall notify EPA of the name(s) and qualifications of such contractor(s) within seven (7) days of the Effective Date. Respondent shall also notify EPA of the name(s) and qualification(s) of any other contractor(s) or subcontractor(s) retained to perform the Work at least seven (7) days prior to commencement of such Work. EPA retains the right to disapprove of any or all of the contractors and/or subcontractors retained by Respondent. If EPA disapproves of a selected contractor, Respondent shall retain a different contractor and shall notify EPA of that contractor's name and qualifications within five (5) days of EPA's disapproval.

36. Within seven (7) days after the Effective Date, Respondent shall designate a Project Coordinator who shall be responsible for administration of all actions by Respondent required by this Settlement Agreement and shall submit to EPA the designated Project Coordinator's name, address, telephone number, and qualifications. To the greatest extent possible, the Project Coordinator shall be present on Site or readily available during Site work. EPA retains the right to disapprove of the designated Project Coordinator. If EPA disapproves of the designated Project Coordinator, Respondent shall retain a different Project Coordinator and shall notify EPA of that person's name, address, telephone number, and qualifications within five (5) days following EPA's disapproval. Receipt by Respondent's Project Coordinator of any notice or communication from EPA relating to this Settlement Agreement shall constitute receipt by Respondent.

37. EPA has designated Edward Bazenas of the Emergency Planning and Response Branch, Region 1, as its On-Scene Coordinator ("OSC"). Except as otherwise provided in this Settlement Agreement, Respondent shall direct all submissions required by this Settlement Agreement to the OSC at the U.S. Environmental Protection Agency, Region 1, One Congress Street, Suite 1100, Mail Code HBR, Boston, Massachusetts 02114-2023.

38. EPA and Respondent shall have the right, subject to Paragraph 36, to change their respective designated OSC or Project Coordinator. Respondent shall notify EPA five (5) days before such a change is made. The initial notification may be made orally, but shall be promptly followed by a written notice.

VIII. WORK TO BE PERFORMED

39. Respondent shall perform the actions necessary to implement the Statement of Work which is attached as Appendix A to this Settlement Agreement and generally includes: (1) focused excavation and off-site disposal of contaminated soil; (2) installation of steel sheeting to control surface water during the construction; (3) the backfilling and regrading of the excavation area; (4) installation of an engineered cap; (5) installation of groundwater monitoring points; and (6) one round of monitoring.

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40. Work Plan and Implementation.

a. Within fourteen (14) days after the Effective Date, Respondent shall submit to EPA for approval a draft Work Plan for performing the removal action generally described in Paragraph 39 above. The draft Work Plan shall provide a description of, and an expeditious schedule for, the actions required by this Settlement Agreement.

b. EPA may approve, disapprove, require revisions to, or modify the draft Work Plan in whole or in part consistent with the attached Statement of Work within seven (7) days of receipt of the draft Work Plan or within seven (7) days of the Effective Date, whichever is later. If EPA requires revisions, Respondent shall submit a revised draft Work Plan within seven (7) days of receipt of EPA's notification of the required revisions. Respondent shall implement the Work Plan as approved in writing by EPA in accordance with the schedule approved by EPA. Once approved, or approved with modifications, the Work Plan, the schedule, and any subsequent modifications shall be incorporated into and become fully enforceable under this Settlement Agreement.

c. Respondent shall not commence any Work except in conformance with the terms of this Settlement Agreement. Respondent shall not commence implementation of the Work Plan developed hereunder until receiving written EPA approval pursuant to Paragraph 40(b).

41. Health and Safety Plan. Within seven (7) days after the Effective Date, Respondent shall submit for EPA review and comment a plan that ensures the protection of the public health and safety during performance of on-Site work under this Settlement Agreement. This plan shall be prepared in accordance with EPA's Standard Operating Safety Guide (PUB 9285.1-03, PB 92-963414, June 1992). In addition, the plan shall comply with all currently applicable Occupational Safety and Health Administration ("OSHA") regulations found at 29 C.F.R. Part 1910. If EPA determines that it is appropriate, the plan shall also include contingency planning. Respondent shall incorporate all changes to the plan recommended by EPA and shall implement the plan during the pendency of the removal action.

42. Quality Assurance and Sampling.

a. All sampling and analyses performed pursuant to this Settlement Agreement shall conform to EPA direction, approval, and guidance regarding sampling, quality assurance/quality control ("QA/QC"), data validation, and chain of custody procedures. Respondent shall ensure that the laboratory used to perform the analyses participates in a QA/QC program that complies with the appropriate EPA guidance. Respondent shall follow, as appropriate, "Quality Assurance/Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures" (OSWER Directive No. 9360.4-01, April 1, 1990), as guidance for QA/QC and sampling. Respondent shall only use laboratories that have a documented Quality System that complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), and "EPA Requirements

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for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001)," or equivalent documentation as determined by EPA. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program ("NELAP") as meeting the Quality System requirements.

b. Upon request by EPA, Respondent shall have such a laboratory analyze samples submitted by EPA for QA monitoring. Respondent shall provide to EPA the QA/QC procedures followed by all sampling teams and laboratories performing data collection and/or analysis.

c. Upon request by EPA, Respondent shall allow EPA or its authorized representatives to take split and/or duplicate samples. Respondent shall notify EPA not less than ten (10) days in advance of any sample collection activity, unless shorter notice is agreed to by EPA. EPA shall have the right to take any additional samples that EPA deems necessary. Upon request, EPA shall allow Respondent to take split or duplicate samples of any samples it takes as part of its oversight of Respondent's implementation of the Work.

43. Post-Removal Site Control. In accordance with the Work Plan schedule, or as otherwise directed by EPA, Respondent shall submit a proposal for post-removal site control consistent with Section 300.415(*l*) of the NCP and OSWER Directive No. 9360.2-02.

44. Reporting.

a. Respondent shall submit a written progress report to EPA concerning actions undertaken pursuant to this Settlement Agreement every thirtieth (30th) day after the date of receipt of EPA's approval of the Work Plan until termination of this Settlement Agreement, unless otherwise directed in writing by the OSC. These reports shall describe all significant developments during the preceding period, including the actions performed and any problems encountered, analytical data received during the reporting period, and the developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

b. Respondent shall submit four (4) copies of all plans, reports or other submissions required by this Settlement Agreement, the Statement of Work, or any approved work plan. Upon request by EPA, Respondent shall submit such documents in electronic form.

45. Final Report. Within forty five (45) days after completion of all Work required by this Settlement Agreement, Respondent shall submit for EPA review and approval a final report summarizing the actions taken to comply with this Settlement Agreement. The final report shall conform, at a minimum, with the requirements set forth in Section 300.165 of the NCP entitled "OSC Reports." The final report shall include a good faith estimate of total costs or a statement of actual costs incurred in complying with the Settlement Agreement, a listing of quantities and types of materials removed off-Site or handled on-Site, a discussion of removal and disposal options considered for those materials, a listing of the ultimate destination(s) of those materials, a presentation of the analytical results of all sampling and analyses performed, and accompanying

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appendices containing all relevant documentation generated during the removal action (*e.g.*, manifests, invoices, bills, contracts, and permits). The final report shall also include the following certification signed by a person who supervised or directed the preparation of that report:

"Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

46. Off-Site Shipments.

a. Respondent shall, prior to any off-Site shipment of Waste Material from the Site to an out-of-state waste management facility, provide written notification of such shipment of Waste Material to the appropriate state environmental official in the receiving facility's state and to the OSC. However, this notification requirement shall not apply to any off-Site shipments when the total volume of all such shipments will not exceed 10 cubic yards.

i. Respondent shall include in the written notification the following information: 1) the name and location of the facility to which the Waste Material is to be shipped; 2) the type and quantity of the Waste Material to be shipped; 3) the expected schedule for the shipment of the Waste Material; and 4) the method of transportation. Respondent shall notify the state in which the planned receiving facility is located of major changes in the shipment plan, such as a decision to ship the Waste Material to another facility within the same state, or to a facility in another state.

ii. The identity of the receiving facility and state will be determined by Respondent following the award of the contract for the removal action. Respondent shall provide the information required by Paragraphs 46(a) and 46(b) as soon as practicable after the award of the contract and before the Waste Material is actually shipped.

b. Before shipping any hazardous substances, pollutants, or contaminants from the Site to an off-site location, Respondent shall obtain EPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)(3), 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Respondent shall only send hazardous substances, pollutants, or contaminants from the Site to an off-site facility that complies with the requirements of the statutory provision and regulation cited in the preceding sentence.

IX. SITE ACCESS

47. If the Site, or any other property where access is needed to implement this Settlement Agreement, is owned or controlled by Respondent, Respondent shall, commencing on the Effective Date, provide EPA, the State, and their representatives, including contractors, with

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access at all reasonable times to the Site, or such other property, for the purpose of conducting any activity related to this Settlement Agreement.

48. Where any action under this Settlement Agreement is to be performed in areas owned by or in possession of someone other than Respondent, Respondent shall use best efforts, consistent with the property owners' obligations pursuant to the Consent Decrees entered in *United States v. Brook Village Associates Limited Partnership and Centerdale Manor Associates*, C.A. No. 05-195 (D.R.I), to obtain all necessary access agreements within fourteen (14) days after the Effective Date, or as otherwise specified in writing by the OSC. Respondent shall immediately notify EPA if after using best efforts it is unable to obtain such agreements. Respondent shall describe in writing its efforts to obtain access. EPA may then assist Respondent in gaining access, to the extent necessary to effectuate the response actions described in this Settlement Agreement, using such means as EPA deems appropriate. EPA reserves the right to bring an action to recover any costs and attorney's fees incurred in obtaining such access, in accordance with Section XIX (Reservation of Rights By EPA).

49. Notwithstanding any provision of this Settlement Agreement, EPA and the State retain all of their access authorities and rights, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

X. ACCESS TO INFORMATION

50. Respondent shall provide to EPA and the State, upon request, copies of all non-privileged documents and information within its possession or control or that of its contractors or agents relating to the implementation of this Settlement Agreement, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondent shall also make available to EPA and the State, for purposes of investigation, information gathering, or testimony, its employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

51. Respondent may assert business confidentiality claims covering part or all of the documents or information submitted to EPA and the State under this Settlement Agreement to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Documents or information determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies documents or information when they are submitted to EPA and the State, or if EPA has notified Respondent that the documents or information are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such documents or information without further notice to Respondent.

52. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Respondent asserts such a privilege in lieu of providing documents, it shall provide EPA and the State with the following: 1) the title of the document, record, or information; 2) the date of the

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document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the contents of the document, record, or information; and 6) the privilege asserted by Respondent. However, no final documents, reports or other information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

53. No claim of confidentiality shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Site.

XI. RECORD RETENTION

54. Until 10 years after Respondent's receipt of EPA's notification pursuant to Section XXVII (Notice of Completion of Work), Respondent shall preserve and retain all non-identical copies of records and documents (including records or documents in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to the performance of the Work or the liability of any person under CERCLA with respect to the Site, regardless of any corporate retention policy to the contrary. Until 10 years after Respondent's receipt of EPA's notification pursuant to Section XXVII (Notice of Completion of Work), Respondent shall also instruct its contractors and agents to preserve all documents, records, and information of whatever kind, nature or description relating to performance of the Work.

55. At the conclusion of this document retention period, Respondent shall notify EPA and the State at least 90 days prior to the destruction of any such records or documents, and, upon request by EPA or the State, Respondent shall deliver any such records or documents to EPA or the State. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Respondent asserts such a privilege, it shall provide EPA or the State with the following: 1) the title of the document, record, or information; 2) the date of the document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the subject of the document, record, or information; and 6) the privilege asserted by Respondent. However, no final documents, reports or other information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

56. Respondent hereby certifies that to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information (other than identical copies) relating to its potential liability regarding the Site since notification of potential liability by EPA or the State or the filing of suit against it regarding the Site and that it has fully complied with any and all EPA requests for information pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927.

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XII. COMPLIANCE WITH OTHER LAWS

57. Respondent shall perform all actions required pursuant to this Settlement Agreement in accordance with all applicable state and federal laws and regulations except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 6921(e), and 40 C.F.R. §§ 300.400(e) and 300.415(j). In accordance with 40 C.F.R. § 300.415(j), all on-Site actions required pursuant to this Settlement Agreement shall, to the extent practicable, as determined by EPA, considering the exigencies of the situation, attain applicable or relevant and appropriate requirements ("ARARs") under federal environmental or state environmental or facility siting laws. Respondent shall identify ARARs in the Work Plan subject to EPA approval.

XIII. EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES

58. In the event of any action or occurrence during performance of the Work which causes or threatens a release of a hazardous substance from the Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action. Respondent shall take these actions in accordance with all applicable provisions of this Settlement Agreement, including, but not limited to, the Health and Safety Plan, in order to prevent, abate or minimize such release or endangerment caused or threatened by the release. Respondent shall also immediately notify the OSC or, in the event of his/her unavailability, the Regional Duty Officer, Emergency Planning and Response Branch, EPA Region 1, at (617) 723-8928, and the National Response Center at (800) 424-8802 of the incident or Site conditions. In the event that Respondent fails to take appropriate response action as required by this Paragraph, and EPA takes such action instead, EPA reserves the right to bring an action to recover such costs, in accordance with Section XIX (Reservation of Rights By EPA).

59. Respondent shall submit a written report to EPA within seven (7) days after any such release, setting forth the events that occurred and the measures taken or to be taken to mitigate any release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release. This reporting requirement is in addition to, and not in lieu of, reporting under Section 103(c) of CERCLA, 42 U.S.C. § 9603(c), and Section 304 of the Emergency Planning and Community Right-To-Know Act of 1986, 42 U.S.C. § 11004, *et seq.*

XIV. AUTHORITY OF ON-SCENE COORDINATOR

60. The OSC shall be responsible for overseeing Respondent's implementation of this Settlement Agreement. The OSC shall have the authority vested in an OSC by the NCP, including the authority to halt, conduct, or direct any Work required by this Settlement Agreement, or to direct any other removal action undertaken at the Site. Absence of the OSC from the Site shall not be cause for stoppage of work unless specifically directed by the OSC.

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XV. DISPUTE RESOLUTION

61. Unless otherwise expressly provided for in this Settlement Agreement, the dispute resolution procedures of this Section shall be the exclusive mechanism for resolving disputes arising under this Settlement Agreement. The Parties shall attempt to resolve any disagreements concerning this Settlement Agreement expeditiously and informally.

62. If Respondent objects to any EPA action taken pursuant to this Settlement Agreement, it shall notify EPA in writing of its objection within seven (7) days of such action, unless the objection has been resolved informally. EPA and Respondent shall have fourteen (14) days from EPA's receipt of Respondent's written objection to resolve the dispute through formal negotiations (the "Negotiation Period"). The Negotiation Period may be extended at the sole discretion of EPA.

63. Any agreement reached by the Parties pursuant to this Section shall be in writing and shall, upon signature by both parties, be incorporated into and become an enforceable part of this Settlement Agreement. If the Parties are unable to reach an agreement within the Negotiation Period, Respondent or EPA may, by providing notice in writing, request the employment of a neutral mediator to be selected in accordance with EPA guidance on the use of Alternative Dispute Resolution. Respondent and EPA shall, in the first instance, consider employing EPA's in-house mediator. Such mediation shall be non-binding and shall not last longer than 30 days from the date of selection of the mediator unless extended by written agreement of EPA and Respondent. If neither party requests mediation, or the dispute is not resolved at the end of the mediation period, an EPA management official at the branch chief level or higher will issue a written decision on the dispute to Respondent. The decision of EPA shall be incorporated into and become an enforceable element of this Settlement Agreement upon Respondent's receipt of the EPA decision regarding the dispute. Respondent's obligations under this Settlement Agreement shall not be tolled by submission of any objection for dispute resolution under this Section. Any agreement reached by the Parties pursuant to this Section shall not alter Respondent's obligation to perform or complete other tasks required by the Settlement Agreement which are not directly affected by the agreement reached pursuant to this Section.

64. Following resolution of the dispute, as provided by this Section, Respondent shall fulfill the requirement that was the subject of the dispute in accordance with the agreement reached or with EPA's decision, whichever occurs. No EPA decision made pursuant to Paragraph 63 shall constitute a final action giving rise to judicial review.

XVI. FORCE MAJEURE

65. Respondent agrees to perform all requirements of this Settlement Agreement within the time limits established under this Settlement Agreement, unless the performance is delayed by a *force majeure*. For purposes of this Settlement Agreement, a *force majeure* is defined as any event arising from causes beyond the control of Respondent, or of any entity controlled by Respondent, including but not limited to its contractors and subcontractors, which delays or prevents performance of any obligation under this Settlement Agreement despite Respondent's

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best efforts to fulfill the obligation. *Force majeure* does not include financial inability to complete the Work or increased cost of performance.

66. If any event occurs or has occurred that may delay the performance of any obligation under this Settlement Agreement, whether or not caused by a *force majeure* event, Respondent shall notify EPA orally within seven (7) days of when Respondent first knew that the event would likely cause a delay. Within seven (7) days thereafter, Respondent shall provide to EPA in writing an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Respondent's rationale for attributing such delay to a *force majeure* event if it intends to assert such a claim; and a statement as to whether, in the opinion of Respondent, such event may cause or contribute to an endangerment to public health, welfare or the environment. Failure to comply with the above requirements shall preclude Respondent from asserting any claim of *force majeure* for that event for the period of time of such failure to comply and for any additional delay caused by such failure.

67. If EPA agrees that the delay or anticipated delay is attributable to a *force majeure* event, the time for performance of the obligations under this Settlement Agreement that are affected by the *force majeure* event will be extended by EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the *force majeure* event shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a *force majeure* event, EPA will notify Respondent in writing of its decision. If EPA agrees that the delay is attributable to a *force majeure* event, EPA will notify Respondent in writing of the length of the extension, if any, for performance of the obligations affected by the *force majeure* event.

XVII. STIPULATED PENALTIES

68. Respondent shall be liable to EPA for stipulated penalties in the amounts set forth in Paragraphs 69 and 70 for failure to comply with the requirements of this Settlement Agreement specified below, unless excused under Section XVI (*Force Majeure*). "Compliance" by Respondent shall include completion of the activities under this Settlement Agreement or any work plan or other plan approved under this Settlement Agreement identified below in accordance with all applicable requirements of law, this Settlement Agreement, the SOW, and any plans or other documents approved by EPA pursuant to this Settlement Agreement and within the specified time schedules established by and approved under this Settlement Agreement.

69. Stipulated Penalty Amounts - Work.

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 69(b):

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Penalty Per Violation Per Day	Period of Noncompliance
$250	1st through 14th day
$500	15th through 30th day
$1,000	31st day and beyond

b. Compliance Milestones: Deadlines for Commencing Work, and Completing Work, shall be specified in the Work Plan.

70. Stipulated Penalty Amounts - Reports. The following stipulated penalties shall accrue per violation per day for failure to submit timely or adequate reports or other written documents pursuant to Paragraphs 44, 45 and 46.

Penalty Per Violation Per Day	Period of Noncompliance
$100	1st through 14th day
$250	15th through 30th day
$500	31st day and beyond

71. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: 1) with respect to a deficient submission under Section VIII (Work to be Performed), during the period, if any, beginning on the 31st day after EPA's receipt of such submission until the date that EPA notifies Respondent of any deficiency; and 2) with respect to an agreement reached or a final position issued pursuant to Section XV (Dispute Resolution), during the period, if any, beginning on the 21st day after the Negotiation Period begins until the date that an agreement is reached or a final position is issued regarding such dispute. Nothing in this Settlement Agreement shall prevent the simultaneous accrual of separate penalties for separate violations of this Settlement Agreement.

72. Following EPA's determination that Respondent has failed to comply with a requirement of this Settlement Agreement, EPA may give Respondent written notification of the failure and describe the noncompliance without unreasonable delay. EPA may send Respondent a written demand for payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA has notified Respondent of a violation.

73. All penalties accruing under this Section shall be due and payable to EPA within 30 days of Respondent's receipt from EPA of a demand for payment of the penalties, unless Respondent invokes the dispute resolution procedures under Section XV (Dispute Resolution).

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All payments to EPA under this Section shall be paid by certified or cashier's check(s) made payable to "EPA Hazardous Substances Superfund," shall be mailed to U.S. Environmental Protection Agency, Fines and Penalties, Cincinnati Finance Center, P.O. Box 979077, St. Louis, MO 63197-9000, shall indicate that the payment is for stipulated penalties, and shall reference the EPA Region and Site/Spill ID Number 016P, the EPA Docket Number 01-2009-0086, and the name and address of the party(ies) making payment. Copies of check(s) paid pursuant to this Section, and any accompanying transmittal letter(s), shall be sent to EPA as provided in Paragraph 37.

74. The payment of penalties shall not alter in any way Respondent's obligation to complete performance of the Work required under this Settlement Agreement.

75. Penalties shall continue to accrue during any dispute resolution period, but need not be paid until 15 days after the dispute is resolved by agreement or by receipt of EPA's decision.

76. If Respondent fails to pay stipulated penalties when due, EPA may institute proceedings to collect the penalties, as well as Interest. Respondent shall pay Interest on the unpaid balance, which shall begin to accrue on the date of demand made pursuant to Paragraph 72. Nothing in this Settlement Agreement shall be construed as prohibiting, altering, or in any way limiting the ability of EPA to seek any other remedies or sanctions available by virtue of Respondent's violation of this Settlement Agreement or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Sections 106(b) and 122(l) of CERCLA, 42 U.S.C. §§ 9606(b) and 9622(l), and punitive damages pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3). Provided, however, that EPA shall not seek civil penalties pursuant to Section 106(b) or 122(l) of CERCLA or punitive damages pursuant to Section 107(c)(3) of CERCLA for any violation for which a stipulated penalty is provided in this Section, except in the case of a willful violation of this Settlement Agreement or in the event that EPA assumes performance of a portion or all of the Work pursuant to Section XIX, Paragraph 80. Notwithstanding any other provision of this Section, EPA may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Settlement Agreement.

XVIII. COVENANT NOT TO SUE BY EPA

77. In consideration of the actions that will be performed and the payments that will be made by Respondent under the terms of this Settlement Agreement, and except as otherwise specifically provided in this Settlement Agreement, EPA covenants not to sue or to take administrative action against Respondent pursuant to Sections 106 and 107(a) of CERCLA, 42 U.S.C. §§ 9606 and 9607(a), for the Work. This covenant not to sue shall take effect upon the Effective Date and is conditioned upon the complete and satisfactory performance by Respondent of all obligations under this Settlement Agreement. This covenant not to sue extends only to Respondent and does not extend to any other person.

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XIX. RESERVATIONS OF RIGHTS BY EPA

78. Except as specifically provided in this Settlement Agreement, nothing in this Settlement Agreement shall limit the power and authority of EPA or the United States to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants or contaminants, or hazardous or solid waste on, at, or from the Site. Further, nothing in this Settlement Agreement shall prevent EPA from seeking legal or equitable relief to enforce the terms of this Settlement Agreement, from taking other legal or equitable action as it deems appropriate and necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA or any other applicable law.

79. The covenant not to sue set forth in Section XVIII above does not pertain to any matters other than those expressly identified therein. EPA reserves, and this Settlement Agreement is without prejudice to, all rights against Respondent with respect to all other matters, including, but not limited to:

a. claims based on a failure by Respondent to meet a requirement of this Settlement Agreement;

b. liability for costs incurred or to be incurred by EPA at the Site;

c. liability for performance of response actions other than the Work;

d. criminal liability;

e. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

f. liability arising from the past, present, or future disposal, release or threat of release of Waste Materials outside of the Site; and

g. liability for costs incurred or to be incurred by the Agency for Toxic Substances and Disease Registry related to the Site.

80. Work Takeover. In the event EPA determines that Respondent has ceased implementation of any portion of the Work, is seriously or repeatedly deficient or late in its performance of the Work, or is implementing the Work in a manner which may cause an endangerment to human health or the environment, EPA may assume the performance of all or any portion of the Work as EPA determines necessary. Respondent may invoke the procedures set forth in Section XV (Dispute Resolution) to dispute EPA's determination that takeover of the Work is warranted under this Paragraph. EPA reserves the right to bring an action to recover any costs incurred by the United States in performing the Work pursuant to this Paragraph, in accordance with Section XIX (Reservation of Rights By EPA). Notwithstanding any other

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provision of this Settlement Agreement, EPA retains all authority and reserves all rights to take any and all response actions authorized by law.

XX. COVENANT NOT TO SUE BY RESPONDENT

81. Respondent covenants not to sue and agrees not to assert any claims or causes of action against the United States, or its contractors or employees, with respect to the Work or this Settlement Agreement, including, but not limited to:

a. any direct or indirect claim for reimbursement from the Hazardous Substance Superfund established by 26 U.S.C. § 9507, based on Sections 106(b)(2), 107, 111, 112, or 113 of CERCLA, 42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, or 9613, or any other provision of law;

b. any claim arising out of response actions at or in connection with the Site, including any claim under the United States Constitution, the Rhode Island State Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, as amended, or at common law; or

c. any claim against the United States pursuant to Sections 107 and 113 of CERCLA, 42 U.S.C. §§ 9607 and 9613, relating to the Work or this Settlement Agreement, except that Respondent specifically reserves any and all claims under Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B), against the United States Department of the Navy and the United States Department of the Air Force in connection with the Work or this Settlement Agreement.

82. Nothing in this Agreement shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

XXI. OTHER CLAIMS

83. By issuance of this Settlement Agreement, the United States and EPA assume no liability for injuries or damages to persons or property resulting from any acts or omissions of Respondent. The United States or EPA shall not be deemed a party to any contract entered into by Respondent or its directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out actions pursuant to this Settlement Agreement.

84. Except as expressly provided in Section XVIII (Covenant Not to Sue by EPA), nothing in this Settlement Agreement constitutes a satisfaction of or release from any claim or cause of action against Respondent or any person not a party to this Settlement Agreement, for any liability such person may have under CERCLA, other statutes, or common law, including but not limited to any claims of the United States for costs, damages and interest under Sections 106 and 107 of CERCLA, 42 U.S.C. §§ 9606 and 9607.

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85. No action or decision by EPA pursuant to this Settlement Agreement shall give rise to any right to judicial review, except as set forth in Section 113(h) of CERCLA, 42 U.S.C. § 9613(h).

XXII. CONTRIBUTION

86. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and that Respondent is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Sections 113(f)(2) and 122(h)(4) of CERCLA, 42 U.S.C. §§ 9613(f)(2) and 9622(h)(4), for "matters addressed" in this Settlement Agreement. The "matters addressed" in this Settlement Agreement are the Work.

87. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B), pursuant to which Respondent has, as of the Effective Date, resolved its liability to the United States for the Work.

88. Nothing in this Settlement Agreement precludes the United States or Respondent from asserting any claims, causes of action, or demands for indemnification, contribution, or cost recovery against any persons not parties to this Settlement Agreement. Nothing in this Settlement Agreement diminishes the right of the United States, pursuant to Section 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613(f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).

XXIII. INDEMNIFICATION

89. Respondent shall indemnify, save and hold harmless the United States, its officials, agents, contractors, subcontractors, employees and representatives from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, or subcontractors, in carrying out actions pursuant to this Settlement Agreement. In addition, Respondent agrees to pay the United States all costs incurred by the United States, including but not limited to attorneys fees and other expenses of litigation and settlement, arising from or on account of claims made against the United States based on negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, subcontractors and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Settlement Agreement. The United States shall not be held out as a party to any contract entered into by or on behalf of Respondent in carrying out activities pursuant to this Settlement Agreement. Neither Respondent nor any such contractor shall be considered an agent of the United States.

90. The United States shall give Respondent notice of any claim for which the United States plans to seek indemnification pursuant to this Section and shall consult with Respondent prior to settling such claim.

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91. Respondent waives all claims against the United States for damages or reimbursement or for set-off of any payments made or to be made to the United States, arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays. In addition, Respondent shall indemnify and hold harmless the United States with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of Work pursuant to this Settlement Agreement, including, but not limited to, claims on account of construction delays.

XXIV. INSURANCE

92. At least seven (7) days prior to commencing any on-Site work under this Settlement Agreement, Respondent shall secure, and shall maintain for the duration of this Settlement Agreement, comprehensive general liability insurance and automobile insurance with limits of one million dollars, combined single limit, naming EPA as an additional insured. Within the same time period, Respondent shall provide EPA with certificates of such insurance and a copy of each insurance policy. Respondent shall submit such certificates and copies of policies each year on the anniversary of the Effective Date. In addition, for the duration of the Settlement Agreement, Respondent shall satisfy, or shall ensure that their contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of Respondent in furtherance of this Settlement Agreement. If Respondent demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering some or all of the same risks but in an equal or lesser amount, then Respondent need provide only that portion of the insurance described above which is not maintained by such contractor or subcontractor.

XXV. FINANCIAL ASSURANCE

93. Within 90 days of the Effective Date, Respondents shall establish and maintain financial security for the benefit of EPA in the amount of $1.5 million in one or more of the following forms, in order to secure the full and final completion of Work by Respondents:

a. a surety bond unconditionally guaranteeing payment and/or performance of the Work;

b. one or more irrevocable letters of credit, payable to or at the direction of EPA, issued by financial institution(s) acceptable in all respects to EPA;

c. a trust fund administered by a trustee acceptable in all respects to EPA;

d. a policy of insurance issued by an insurance carrier acceptable in all respects to EPA, which ensures the payment and/or performance of the Work;

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e. a written guarantee to pay for or perform the Work provided by one or more parent companies of Respondent, or by one or more unrelated companies that have a substantial business relationship with Respondent; including a demonstration that any such guarantor company satisfies the financial test requirements of 40 C.F.R. Part 264.143(f); and/or

f. a demonstration of sufficient financial resources to pay for the Work made by Respondent, which shall consist of a demonstration that Respondent satisfies the requirements of 40 C.F.R. Part 264.143(f).

94. Any and all financial assurance instruments provided pursuant to this Section shall be in form and substance satisfactory to EPA, determined in EPA's sole discretion. In the event that EPA determines at any time that the financial assurances provided pursuant to this Section (including, without limitation, the instrument(s) evidencing such assurances) are inadequate, Respondent shall, within 30 days of receipt of notice of EPA's determination, obtain and present to EPA for approval one of the other forms of financial assurance listed in Paragraph 93, above. In addition, if at any time EPA notifies Respondent that the anticipated cost of completing the Work has increased, then, within 30 days of such notification, Respondent shall obtain and present to EPA for approval a revised form of financial assurance (otherwise acceptable under this Section) that reflects such cost increase. Respondent's inability to demonstrate financial ability to complete the Work shall in no way excuse performance of any activities required under this Settlement Agreement.

95. If Respondent seeks to ensure completion of the Work through a guarantee pursuant to Subparagraph 93(e) or 93(f) of this Settlement Agreement, Respondent shall (i) demonstrate to EPA's satisfaction that the guarantor satisfies the requirements of 40 C.F.R. Part 264.143(f); and (ii) resubmit sworn statements conveying the information required by 40 C.F.R. Part 264.143(f) annually, on the anniversary of the Effective Date or such other date as agreed by EPA, to EPA. For the purposes of this Settlement Agreement, wherever 40 C.F.R. Part 264.143(f) references "sum of current closure and post-closure costs estimates and the current plugging and abandonment costs estimates," the dollar amount to be used in the relevant financial test calculations shall be the current cost estimate of $1.5 million for the Work at the Site plus any other RCRA, CERCLA, TSCA, or other federal environmental obligations financially assured by the relevant Respondent or guarantor to EPA by means of passing a financial test.

96. If, after the Effective Date, Respondent can show that the estimated cost to complete the remaining Work has diminished below the amount set forth in Paragraph 93 of this Section, Respondent may reduce the amount of the financial security provided under this Section to the estimated cost of the remaining Work to be performed. Respondent shall submit a proposal for such reduction to EPA, in accordance with the requirements of this Section, and may reduce the amount of the security after receiving written approval from EPA. In the event of a dispute, Respondent may seek dispute resolution pursuant to Section XV (Dispute Resolution). Respondent may reduce the amount of security in accordance with EPA's written decision resolving the dispute.

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97. Respondent may change the form of financial assurance provided under this Section at any time, upon notice to and prior written approval by EPA, provided that EPA determines that the new form of assurance meets the requirements of this Section. In the event of a dispute, Respondent may change the form of the financial assurance only in accordance with the written decision resolving the dispute.

XXVI. MODIFICATIONS

98. The OSC may make modifications to any plan or schedule or Statement of Work in writing or by oral direction. Any oral modification will be memorialized in writing by EPA promptly, but shall have as its effective date the date of the OSC's oral direction. Any other requirements of this Settlement Agreement may be modified in writing by mutual agreement of the Parties.

99. If Respondent seeks permission to deviate from any approved work plan or schedule or Statement of Work, Respondent's Project Coordinator shall submit a written request to EPA for approval outlining the proposed modification and its basis. Respondent may not proceed with the requested deviation until receiving oral or written approval from the OSC pursuant to Paragraph 93.

100. No informal advice, guidance, suggestion, or comment by the OSC or other EPA representatives regarding reports, plans, specifications, schedules, or any other writing submitted by Respondent shall relieve Respondent of its obligation to obtain any formal approval required by this Settlement Agreement, or to comply with all requirements of this Settlement Agreement, unless it is formally modified.

XXVII. NOTICE OF COMPLETION OF WORK

101. When EPA determines, after EPA's review of the Final Report, that all Work has been fully performed in accordance with this Settlement Agreement, with the exception of any continuing obligations required by this Settlement Agreement, including post removal site controls, EPA will provide written notice to Respondent. If EPA determines that any such Work has not been completed in accordance with this Settlement Agreement, EPA will notify Respondent, provide a list of the deficiencies, and require that Respondent modify the Work Plan if appropriate in order to correct such deficiencies. Respondent shall implement the modified and approved Work Plan and shall submit a modified Final Report in accordance with the EPA notice. Failure by Respondent to implement the approved modified Work Plan shall be a violation of this Settlement Agreement.

XXVIII. INTEGRATION/APPENDICES

102. This Settlement Agreement and its appendices constitute the final, complete and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Settlement Agreement. The Parties acknowledge that there are no

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representations, agreements or understandings relating to the settlement other than those expressly contained in this Settlement Agreement.

XXIX. EFFECTIVE DATE

103. This Settlement Agreement shall be effective five (5) days after the Settlement Agreement is signed by the Director, Office of Site Remediation and Restoration.

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The undersigned representative of Respondent certifies that it is fully authorized to enter into the terms and conditions of this Settlement Agreement and to bind the parties it represent(s) to this document.

Agreed this 5th day of AUGUST, 2009.

For Respondent EMHART INDUSTRIES, INC.

By Linda A Biagioni

Title VICE PRESIDENT

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It is so ORDERED and Agreed this 6th day of August, 2009.

BY: _____

James T. Owens, III
Director, Office of Site Remediation and Restoration
Region 1
U.S. Environmental Protection Agency

EFFECTIVE DATE: August 11, 2009

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APPENDIX A

STATEMENT OF WORK

This Statement of Work is provided for the Centredale Manor Restoration Project in North Providence, Rhode Island

Preface

EPA has determined that the Respondent has the ability to promptly and properly prevent, mitigate, or eliminate the threats posed by hazardous substances at the Site. Therefore, EPA has issued a Administrative Settlement Agreement and Order on Consent (Order) to the Respondent with this attached Statement of Work (SOW).

As described previously in the Order, EPA has undertaken Removal Actions at the Site to prevent exposure and control migration of dioxin contamination at the Site. This statement of work addresses the Removal Activities which are proposed in the Action Memorandum for the Centredale Manor Restoration Project, dated July 16, 2009.

The Order and SOW compel the Respondent to develop a **work plan** (plan) for implementing the specific actions described below. The components of this work plan (also called a "deliverable") must be submitted to EPA for approval before implementation. The work plan shall consist of/describe the components listed below:

GENERAL COMPONENTS

1. All actions taken by the Respondent shall not be inconsistent with the National Contingency Plan (NCP), found in Title 40, Part 300 of the Code of Federal Regulations (40 CFR 300)

2. The Respondent shall communicate freely with the On-Scene Coordinator (OSC) prior to and during development of plans and deliverables, and throughout the implementation of approved plans. At a minimum, **weekly** progress meetings will be scheduled throughout the implementation of the Order.

3. **Site Security** - The plan shall provide for on-site security during construction and thereafter. The effectiveness of signs, fences, and barriers will be evaluated during the construction phase to determine if they adequately restrict access. If not deemed to be sufficient by the OSC, additional fencing, the placement of security guards or other measures may be warranted. Site security shall be maintained until EPA determines that the threats posed by conditions at the Site are eliminated or substantially mitigated.

4. **Project schedule** - The plan will provide a detailed project schedule, including completion dates for interim activities. Out of respect for the residents, noisy equipment (such as dump trucks or bulldozers) will not be operated before 0800hrs. **Daily, weekly and project work schedules** will be provided to the OSC.

5. **Site-Specific Health and Safety Plan (HASP)** - The Respondent shall develop and implement a HASP for all activities to be conducted at the Site in accordance with the NCP §300.150, and OSHA 1910.50. The HASP shall be developed to protect all on-site personnel and the general public. Private employers are responsible for the health and safety of their own employees. Nothing contained in this SOW or the Order shall relieve the Respondent of this liability. The HASP shall be provided to EPA for review and approval within 7 days of the effective date of the Order.

6. **Traffic Management Plan** - The Respondent shall develop a traffic management plan to provide for safe and efficient movement of response related vehicles entering and exiting the site, as well as on site traffic control. The Traffic Management Plan shall be provided to EPA for review and approval within 7 days of the effective date of the Order.

7. **Quality Assurance Plan (QAP)** - The Respondent shall develop a QAP to be used in conducting all field and laboratory analysis. The QAP shall ensure that analytical results generated are of known quality. The QAP will be consistent with the Region 1, EPA-New England *Compendium of Quality Assurance Project Plan Guidance.* The QAP shall be provided to EPA for review and approval within 7 days of the effective date of the Order.

8. **Completion of Work Report (CWR)** - Upon completion of the tasks in this Order and SOW, the Respondent shall submit a CWR summarizing the work performed. At a minimum, the CWR will provide an estimate of the Respondent's costs incurred; identify all required activities and certify that each has been completed in accordance with the approved plans; include original photographs with written descriptions; include analytical results of any environmental samples collected during the period of performance, in both tables and on site maps; include 'as-built' drawings of any structures or features constructed; contain a chronology of onsite activities; identify subcontractors and their roles. The CWR shall be provided to EPA for review and approval within 45 days of the completion of the other tasks in this Order and SOW.

SPECIFIC ACTIONS

9. Install steel sheeting on the riverbank to control surface water
10. Perform limited excavation to the specified lines and grades, as negotiated in the Administrative Settlement and Order on Consent, sufficient to remove primary source dioxin contaminated soils
11. Conduct dewatering and water treatment as necessary
12. Provide off-site disposal of primary source dioxin contaminated soils
13. Backfill and re-grade the excavation to existing grades and slopes
14. Install an engineered impermeable cap compliant with RCRA regulations to control percolation of precipitation and prevent direct contact with any remaining contaminated soils

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15. Install groundwater/pore water monitoring points near the ground water/ surface water interface
16. Conduct one round of ground water/pore water sample collection and analysis to evaluate the effectiveness of the engineered impermeable cap
17. Construct erosion control armoring on the riverbank
18. Repair any response related damages including landscaping, pavement and walkways
19. Obtain all necessary local, state or federal permits for construction, except as specifically exempted by the OSC
20. Confirm and attain applicable or relevant and appropriate requirements under federal environmental or state environmental laws to the extent practicable

21. **Other specific actions**

At any time prior to the completion of the work specified in this SOW, EPA may determine that additional tasks are necessary, consistent with this SOW, in order to achieve the objectives of the Order, the SOW and CERCLA.

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APPENDIX B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

CONTAINS ENFORCEMENT-SENSITIVE INFORMATION

MEMORANDUM

DATE: July 16, 2009

SUBJ: Request for a Removal Action at the Centredale Manor Restoration Site, North Providence, Bristol County, Rhode Island - **Action Memorandum**

FROM: Ted Bazenas, On-Scene Coordinator
Emergency Response and Removal Section II

THRU: Steven R. Novick, Chief
Emergency Response and Removal Section II

Arthur V. Johnson III, Chief
Emergency Planning & Response Branch

TO: James T. Owens III, Director
Office of Site Remediation and Restoration

I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the proposed removal action at the Centredale Manor Restoration Site (the Site or CMRP), which is located in North Providence, Bristol County, Rhode Island. Hazardous substances, present in soil, surface water, sediment and groundwater at the Site, if not addressed by implementing the response actions selected in this Action Memorandum, will continue to pose a threat to human health and the environment.. EPA has negotiated an Administrative Order on Consent for implementation of the actions described herein. In the event that the Potentially Responsible Party (the Respondent) does not perform the actions as directed in the Order, EPA is prepared to undertake the work on a fund-lead basis, pending availability of funding. There are no nationally significant or precedent-setting issues associated with this Site, and there has been no use of the OSC's $200,000 warrant authority.

II. SITE CONDITIONS AND BACKGROUND

CERCLIS ID# : RID981203755
SITE ID# : 016P
CATEGORY : Time-Critical

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A. Site Description

1. Removal site evaluation

There have been several previous investigations at the Site by EPA Removal Program and the Remedial Program and several removal actions documented in a series of Action Memorandums. Please refer to previous Action Memorandums of May, 1999; September, 1999; June, 2000; September, 2003; and June, 2005. (note: all references in this document to "*previous Action Memorandums*" include all of these documents.)

On January 31 and February 05, 2008 groundwater monitoring wells were installed at the site as part of the Remedial Investigation/Feasibility Study (RI/FS) for the EPA Remedial Program. Samples of the soil borings were analyzed and revealed elevated levels of dioxin in surface and subsurface soils. EPA has determined that dioxin is migrating to the adjacent Woonasquatucket River. Though dioxin is not soluble in water, migration may be facilitated by elevated levels of volatile organic compounds found in the same samples.

EPA has evaluated this data and other data found in the Interim Final Remedial Investigation, June 2005. A Preliminary Assessment (PA) was initiated by OSC Bazenas on March 26, 2009 and updated on June 26, 2009. The Site Investigation Closure Memorandum dated July 13, 2009 documents the determination that a Removal Action is appropriate at this Site.

2. Physical location

The Site encompasses the soil, surface water, sediment and flood plain of the Woonasquatucket River from the bridge at Route 44 in North Providence, downstream to the Lyman Mill Dam, including all contaminated areas within this area and any other locations where contamination from this area has come to be located; and the Brook Village and Centredale Manor Apartment properties which are located at 2072 and 2074 Smith Street in North Providence, Providence County, Rhode Island. The geographic coordinates for the Site are 41° 51' 29.5" north latitude and 71° 30' 28.5" west longitude.

Please refer to the previous Action Memorandums for additional information.

3. Site characteristics

The Centredale Manor Site encompasses the following:

- The Brook Village Apartment property (Brook Village), located at 2072 Smith Street, North Providence, Providence County, Rhode Island

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- The Centredale Manor Apartment property (Centredale Manor), located at 2074 Smith Street, North Providence, Providence County, Rhode Island

- The flood plain of the adjacent Woonasquatucket River, as defined in the Federal Emergency Management Agency Flood Insurance Rate Map of the 100 year flood plain, from Route 44 southerly, up to and inclusive of the Allendale Dam and its associated structures, including the tailrace of the Allendale Dam, in North Providence, Providence County, Rhode Island.

Brook Village and Centredale Manor are zoned for residential occupancy and encompass a total of 9.7 acres of land. Centredale Manor was constructed in 1983. It is an eight-story apartment building for elderly and handicapped. There are two paved parking lots located to the north and west of the building.

Brook Village was constructed in 1977. It is an eleven-story apartment building for elderly and handicapped residents. A series of parking lots extend to the south of the building. The area around both buildings is landscaped with grass ground cover.

Both properties are privately owned and are currently active apartment buildings, providing subsidized housing for several hundred elderly residents.

The approximate area population is :

1,091 people within ¼ mile
3,334 people within ½ mile
13,516 people within 1 mile

Also within 1 mile of the site are two other elderly care facilities, three public schools, three private day schools, and six daycare facilities.

According to the EPA Region 1 Environmental Justice Mapping Tool, the Site is not in an environmental justice area.

4. **Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant**

The compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin or TCDD) is a hazardous substance as defined in Section 101(14) of CERCLA and is listed at 40 CFR 302.4. Analytical data from the samples collected at this area of the Site indicate dioxin concentrations up to 33ppb in surficial and sub-surface soils. The conceptual site model describes migration of dioxin facilitated by VOCs such as

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tetrachloroethylene and trichloroethylene, via groundwater to the surface water of the Woonasquatucket River.

Dioxin has also been identified in samples collected from surface soils in wetlands and flood plain areas downstream of the Site. These areas will be addressed in the long term remedy for the Site. The past use of the Site as a chemical manufacturing company and a barrel reclamation facility is not inconsistent with the presence of dioxin. EPA has established that hexachlorophene was manufactured at the Site; dioxin is a well-documented byproduct of hexachlorophene production.

5. NPL status

The Site and associated impact areas were added to the National Priorities List on March 06, 2000.

B. Other Actions to Date

1. Previous actions

EPA and RIDEM have undertaken several previous actions at the Site including time-critical removals, non-time-critical removals and remedial actions to characterize the extent of contamination, remove contaminated soils from adjacent residential properties, construct earthen caps over contaminated areas, and reconstruct a dam on the Woonasquatucket River. Please refer to previous Action Memoranda and the Administrative Record for additional information.

2. Current actions

The EPA and the United States Army Corps of Engineers have been conducting a RI/FS for the Centredale Manor Restoration Project Superfund Site since 2000. Several studies have been performed to characterize the nature and extent of contamination in soil, groundwater, sediment, surface water and biota at the site. As warranted by the data collection and evaluation efforts, several areas warranting removal actions were identified. This removal action will address a source of loading and/or leaching of contaminants from the source area into the Woonasquatucket River.

EPA has released the Interim Final Remedial Investigation Report in June 2005, followed by Interim Final Baseline Human Health Risk and Ecological Risk Assessment Reports, and Interim Final Preliminary Remedial Goals Report in November 2005. A report on the FS is expected in the summer of 2009. The FS will evaluate a range of remedial alternatives to address remaining soil, sediment

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and groundwater contamination at the site, including Allendale and Lyman Mill reaches of the Woonasquatucket River which pose an unacceptable risk to human health or the environment.

C. State and Local Authorities' Roles

1. State and local actions to date

EPA has held Dialogue Group meetings with interested stakeholders, including the Towns of North Providence and Johnston, the Woonasquatucket River Watershed Council, the Audubon Society, the Natural Resources Trustees, and the Potentially Responsible Parties (PRPs). These meetings provide a forum to exchange ideas, make the involvement process accessible and give stakeholders input into EPA's cleanup selection process.

Representatives from the Town of North Providence, Brook Village and Centredale Manor properties have been advised of this Removal Action and the property managers have discussed ways in which they can accommodate the displacement of residents' vehicles and assist in the dissemination of information to their residents.

Since the first Removal Actions in 1999 and subsequent designation of the Site to the National Priorities List, the State of Rhode Island has been a partner with EPA in making decisions related to investigations and cleanup actions at the Site.

2. Potential for continued State/local response

EPA and RI DEM will continue to coordinate site activities in regard to state regulations. RI DEM is coordinating wetlands issues with its state counterparts.

North Providence local government and elected officials have pledged the Town's assistance and cooperation in providing local information and personnel when appropriate. The Town will continue to provide access to meeting rooms, historical documents and other support services. EPA may seek other non-monetary contributions to support the Removal Action from the Town of North Providence

The Brook Village and Centredale Manor property managers have stated their willingness to continue to assist EPA in keeping their residents well informed throughout the Removal Action. Such assistance will include meeting notifications, access to meeting rooms, and helping to communicate the accommodations made for residents with displaced vehicles.

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III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants; [§300.415(b)(2)(i)];

The primary contaminant, dioxin, is migrating from contaminated soils via groundwater to the Woonasquatucket River where humans, animals and the food chain may be negatively impacted. Unless addressed through these actions, sediments throughout the river floodplain will continue to accumulate dioxins.

Actual or potential contamination of drinking water supplies or sensitive ecosystems [§300.415(b)(2)(ii)];

The Woonasquatucket River and its associated floodplain is a sensitive ecosystem that will continue to be negatively impacted by the migration of dioxins into sediments and the food chain.

High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate [§300.415(b)(2)(iv)];

The primary contaminant, dioxin, is migrating from contaminated soils largely at or near the surface via groundwater to the Woonasquatucket River where humans, animals and the food chain are negatively impacted.

The availability of other appropriate Federal or State response mechanisms to respond to the release [§300.415(b)(2)(vii)];

If the Respondent fails to complete these actions, there are no other available funds from the State of Rhode Island or other sources to address this ongoing release.

Contaminant specific information

Dioxin[1] has been identified at the Site at levels up to140ppb in soils samples collected in 2000. Samples collected from the groundwater impact area in 2008 have identified dioxin in soil up to 33ppb.

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[1] Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services, Public Health Service, *Toxicological Profile for Chlorinated Dibenzo-p-dioxins (CDDs), December, 1998*

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Dioxin occurs as a contaminant in the manufacturing process of certain chlorinated organic compounds, especially chlorinated phenols such as hexachlorophene, and herbicides such as 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). Use of hexachlorophene and 2,4,5-T is currently restricted in this country. Currently, dioxins are primarily released to the environment during combustion of fossil fuels (coal, oil, and natural gas) and wood, and during the incineration processes (municipal and medical waste, and hazardous waste incineration). Uncontrolled burning of many materials that contain chlorine, such as plastics, wood treated with PCP, pesticide-treated wastes, other polychlorinated chemicals, and even bleached paper, can produce dioxins.

Dioxin has a tendency to persist in the environment. It can bind to soil particles and bioaccumulate in the food chain, especially in foods such as meats, dairy products, and fish. Dioxin can enter the human body through ingestion, inhalation, and dermal absorption. Human exposure to very high levels of dioxin causes a skin condition called chlor-acne and is suspected of causing immunological problems and liver impairment.

The EPA considers dioxin to be a probable human carcinogen. Dioxin has been shown to cause biochemical alterations; thyroid, reproductive and immune toxicity; and cancer in animals. It is suspected of causing cancer in humans.

Animal studies have shown that dioxin is highly toxic although there are a wide variety of responses among the various species tested. Adverse health effects in animals tested include reproductive and developmental toxicity, hepatotoxicity (liver), immunotoxicity, and carcinogenicity.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.[2]

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[2]In accordance with OSWER Directive 9360.0-34, an endangerment determination is made based on relevant action levels, cleanup standards, risk management guidance, or other relevant information published and relied upon by the State of Rhode Island.

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V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

Impacts to the Woonasquatucket River and groundwater can be effectively reduced by excavation and disposal of contaminated soils in the area near the eastern bank of the river at the southern end of the Brook Village parking lot. The subsequent installation of an impermeable cap will prevent percolation of precipitation through underlying soils and further mitigate the migration of any residual contamination. The cap also provides a physical barrier that minimizes the possibility of direct exposure to residual levels of dioxin in soils. The excavation/cap area will be approximately ¼ acre in surface area and impact approximately 150 feet of the eastern bank of the Woonasquatucket River.

Specific removal activities will include the following:

- conduct a site walk with the cleanup contractor;
- install steel sheeting on the riverbank to control surface water
- perform limited excavation to the specified lines and grades as negotiated in the Administrative Order and described in the Work Plan, pending EPA approval, sufficient to remove primary source dioxin contaminated soils
- conduct dewatering and water treatment as necessary
- provide off-site disposal of primary dioxin contaminated source soils
- backfill and re-grade excavations to existing grades and slopes
- install an engineered impermeable cap to control percolation of precipitation and prevent direct contact with any remaining contaminated soils
- install groundwater/pore water monitoring points near the groundwater/surface water interface
- conduct at least one round of ground water/ pore water sample collection and analysis to evaluate the effectiveness of the engineered impermeable cap
- construct erosion control armoring on the river bank
- repair any response-related damages, including landscaping, pavement and walkways

The Respondent has a proposal and schedule for these specific actions that include a work plan, a safety plan, a traffic management plan, and other plans as needed. The EPA OSC will review all aspects of the proposal and provide comments before approval.

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2. Community relations

EPA and the RIDEM have committed to a series of meetings, letters and press releases to ensure that the residents of the two elderly housing complexes and all of North Providence are kept informed and up to date on activities at the Site.

3. Contribution to remedial performance

The cleanup actions proposed in this Action Memorandum will mitigate the remaining primary source of dioxin migration to the Woonasquatucket River. The FS will consider several alternative remedies for addressing contaminated sediments, none of which can be implemented until the migration of dioxin into the river and sediments has been mitigated to minimize re-contamination. The actions have been developed in concert with the EPA Remedial Program to be consistent with long term remedies and will not impede any future response actions.

3. Description of alternative technologies

Alternative technologies have been employed in investigation of the extent of contamination and migration of organic contaminants in groundwater. [3]

5. Applicable or relevant and appropriate requirements (ARARs)

Federal ARARs:

40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste:

Subpart B - The Manifest
262.20 : General requirements for manifesting
262.21 : Acquisition of manifests
262.22 : Number of copies of manifests
262.23 : Use of the manifest

Subpart C - Pre-Transport Requirements
262.30 : Packaging
262.31 : Labeling
262.32 : Marking

Subpart D - Recordkeeping and Reporting
262.40 : Recordkeeping

40 CFR Part 264 Hazardous Waste Regulations - RCRA Subtitle C:
268-270 : Hazardous and Solid Waste Amendments Land Disposal Restrictions Rule

40 CFR Part 300.440 Procedures for Planning and Implementing Off-Site Response Actions (Off-Site Rule)

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[3] United States Geologic Survey, September , 1999. *Distribution of Selected Volatile Organic Compounds Determined with Water-to-Vapor Diffusion Samplers at the Interface Between Groundwater and Surface Water, Centredale Manor Site, North Providence, Rhode Island.*

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State ARARs:

The OSC will coordinate with State officials to identify additional State ARARs, if any. In accordance with the National Contingency Plan and EPA Guidance Documents, the OSC will determine the applicability and practicability of complying with each ARAR which is identified in a timely manner.

6. Project schedule

Mobilization to the Site is expected to occur in August, 2009. Field excavation and construction activities are expected to be completed within three months. Site restoration and documentation may require several additional months. All activities are to be completed within one year from mobilization.

B. Estimated Costs

The OSC's independent estimate for the costs associated with this action are summarized below and provided in the event that EPA must initiate or complete the removal action in lieu of the Respondent. This action memo addendum does not obligate funds from the removal budget. Actual funding will be dependent on funds available at the time of the request and other factors.

COST CATEGORY		CEILING
REGIONAL REMOVAL ALLOWANCE COSTS		
ERRS Contractor		$1,500,000.00
Interagency Agreement		$ 0.00
OTHER EXTRAMURAL COSTS NOT FUNDED FROM THE REGIONAL ALLOWANCE		
START Contractor		$60,000.00
Extramural Subtotal		$1,560,000.00
Extramural Contingency	10%	$156,000.00
TOTAL, REMOVAL ACTION CEILING		**$1,716,000.00**

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Dioxin contamination will continue to migrate to the Woonasquatucket River, perpetuating contamination of the sediments and floodplains. Unacceptable risks to human health from contact with these media will remain unaddressed.

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VII. OUTSTANDING POLICY ISSUES

Until the agency's reassessment of the toxicity of dioxin is complete, EPA/ OSWER Directive 9200.4-26, Memorandum - Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites, April 13, 1998 provides guidance for setting starting points for remediation goals at dioxin sites. The proposed actions are consistent with the guidance document. OSWER concurrence for this Nationally Significant Removal Action was signed on May 05, 1999.

There are no other precedent-setting policy issues associated with this site.

VIII. ENFORCEMENT ... For Internal Distribution Only

See attached Enforcement Strategy.

The total EPA costs for this removal action based on full-time accounting practices that will be eligible for cost recovery are estimated to be $1,716,000 (extramural costs) + $ 80,000 (EPA intramural costs) = $1,796,000 X 1.361 (regional indirect rate) = **$2,444,356** [4].

IX. RECOMMENDATION

This decision document represents the selected removal action for the Centredale Manor Restoration Project Site in North Providence, Rhode Island, developed in accordance with CERCLA, as amended, and is not inconsistent with the National Contingency Plan. The basis for this decision will be documented in the administrative record to be established for the Site.

Conditions at the Site meet the NCP Section 300.415 (b) (2) criteria for a removal action due to the following:

Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants [§300.415(b)(2)(i)];

Actual or potential contamination of drinking water supplies or sensitive ecosystems [§300.415(b)(2)(ii)];

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[4]Direct Costs include direct extramural costs $1,716,000 and direct intramural costs $80,000. Indirect costs are calculated based on an estimated indirect cost rate expressed as a percentage of site specific costs [36.1% x $ 1,796,000] consistent with the full accounting methodology effective October 2, 2000. These estimates do not include pre-judgement interest, do not take into account other enforcement costs, including Department of Justice costs, and may be adjusted during the course of a removal action. The estimates are for illustrative purposes only and their use is not intended to create any rights for responsible parties. Neither the lack of a total cost estimate nor deviation of actual total costs from this estimate will affect the United States' right to cost recovery.

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High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate [§300.415(b)(2)(iv)];

The availability of other appropriate Federal or State response mechanisms to respond to the release [§300.415(b)(2)(vii)];

Other situations or factors that may pose threats to public health or welfare of the United States or the environment [§300.415(b)(2)(viii)].

I recommend that you approve the proposed removal action. The total removal action project ceiling if approved will be $1,796,000.

APPROVAL: _____ DATE: 7-17-09

DISAPPROVAL: _____ DATE: _____

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