UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

October 3, 2008

Reply to
Attn of: ECL-110

Mr. Todd Slater *Sent via email only*
Legacy Site Services, LLC
468 Thomas Jones Way
Exton, PA 19341

Re: Arkema CDF Evaluation

Dear Todd,

This letter responds to the questions posed and statements made in your July 25, 2008, letter and provides further details on the evaluation of a nearshore Confined Disposal Facility (CDF) alternative through the Arkema Engineering Evaluation/Cost Analysis (EE/CA), per the May 23, 2008, Opalski Dispute Decision. Please consider this information for development of the EE/CA and interim documents. We do not however consider this letter a schedule factor in revising the workplan addendum. The information provided herein represents additional clarification on issues that should be considered during the evaluation of a CDF; however this information should not be considered all inclusive as other criteria may require evaluation as part of the EE/CA.

This letter presents a discussion of the following items:

1. EPA's position regarding regulatory requirements for treatment of Arkema sediment.

2. EPA's position on in-situ treatment technologies as a removal action alternative component for Arkema sediments.

3. EPA's position on pre-treatment of sediments and stabilization technologies as removal action alternative components for Arkema sediments.

4. EPA's position on ex-situ thermal desorption as a removal action alternative component for Arkema sediments.

5. EPA's position regarding applicability of other CDF sites to the CDF proposed for the Arkema removal action.

6. EPA's position on applicability of performance standard expectations from the Port of Portland's Terminal 4 (T4) project during the Arkema removal action.

1. EPA's Position Regarding Regulatory Requirements for Treatment of Arkema Sediment

Overview of Regulatory Issues Regarding Requirement for Treatment

Legacy Site Services LLC (LSS) asserts in their July 25, 2008 letter that it is premature to assume that treatment is needed prior to placement of sediments into a CDF. LSS also asserts that land disposal restrictions (LDRs) and associated Universal Treatment Standards would not apply to dredged sediment because they believe the Arkema sediments would not be a federally designated hazardous waste.

EPA's position is that pesticide residue within the sediment will not be considered a listed hazardous waste. However there is the potential for contaminants within the sediment to be characteristically hazardous based on previous sampling performed by Arkema and testing will be required to verify whether sediments could be characteristically hazardous for disposal purposes. LDRs and associated treatment standards promulgated under 40 CFR Part 268 may be applicable if sediment is determined to have hazardous characteristics.

In addition, the pesticide residue within the sediment will be designated as a State listed hazardous waste under the Oregon Administrative Rules (OAR) for Identification and Listing of Hazardous Waste (OAR 340, Division 101). Under OAR 340-101, pesticide residue designated as a state listed hazardous waste does not need to meet the LDR requirements and associated treatment standards in 40 CFR Part 268. However, the pesticide residue within the dredged sediment will be classified as waste pesticide under the OAR for Management of Pesticide Waste (OAR 340, Division 109). Designation of the sediment as a waste pesticide requires management as authorized by the Oregon Department of Environmental Quality (ODEQ), which includes requirements for detoxification and volume reduction. Treatment of the sediment will likely be necessary to accomplish those requirements. More specific rationale for EPA's position follows.

Review of Applicability of Treatment to Arkema Sediment

<u>Regulations Affecting Waste Determination and Management Requirements for Sediment</u>

A formal determination of applicable or relevant and appropriate regulations (ARARs) for the removal action at the Arkema site has not been made. However EPA review of pertinent regulations affecting waste determinations and management requirements for Arkema sediment has been made using State of Oregon regulations within the scope of the authorized state hazardous waste program. Thus EPA's position is based on review of applicable State of Oregon regulations under the authorized state hazardous waste program.

It should be noted that OAR 340-100-0002 (Adoption of United States Environmental Protection Agency Hazardous Waste and Used Oil Management Regulations) adopts federal regulations governing management of hazardous waste, including but not limited to 40 CFR Parts 261 and 268 which are pertinent to this issue. In the context of this discussion, "federally regulated" means "within the scope of the authorized state program".

Determination Whether Arkema Contaminated Sediments are Hazardous Wastes Under Federal Regulations

According to OAR 340-101-0001(2), 40 CFR Part 261 (Identification and Listing of Hazardous Waste) must be consulted to determine whether the contaminated sediments would be classified as hazardous wastes under federal regulations.

There are several steps involved in determining whether Arkema sediments are hazardous wastes under the federal or state regulations. The first step involves determining whether the sediments contain listed wastes per 40 CFR 261 Subpart D. The second step is to determine whether the sediments exhibit a characteristic of hazardous waste per 40 CFR 261 Subpart C. If either of these determinations is made, then the sediment would be considered hazardous wastes under federal regulations. Finally, if it is determined that the sediment is not hazardous waste under federal regulations, then a determination is made whether contaminated sediment is considered hazardous waste by the State of Oregon.

The determination of whether the Arkema sediments contain listed hazardous waste under federal regulations is made by considering whether hazardous wastes from any of the listed sources in 40 CFR 261 Subpart D (specifically 40 CFR 261.31, 261.32, and 261.33) are present in the sediments. Based on a good-faith effort, EPA has not identified listed waste sources that may be considered with reasonable certainty to be the source of contamination in Arkema sediments. Therefore, EPA concludes that Arkema sediments do not contain listed hazardous wastes per federal regulations.

The next step in determining whether Arkema sediments are hazardous wastes under federal regulations requires a determination of whether the sediments exhibit hazardous characteristics. The determination of whether the Arkema sediments exhibit a hazardous characteristic are made based on 40 CFR 261 Subpart C. Per 40 CFR 261.20, Arkema sediment would be classified as characteristic hazardous waste if it exhibits any of the characteristics identified in 40 CFR 261.21 through 40 CFR 261.24. These characteristics include Ignitability, Corrosivity, Reactivity, and Toxicity. If the Arkema sediments exhibit any of these characteristics according to the criteria in the cited sections of 40 CFR 261, then they would be classified as characteristic hazardous waste under federal regulations.

It is unlikely that the Arkema sediments will exhibit the characteristic of Ignitability, Corrosivity, or Reactivity, since previous sediment investigations have not indicated physical or chemical properties of the contaminated sediment pertaining to these three criteria.

However sediment at Arkema may contain contaminants at concentrations that may cause the sediments to exhibit the toxicity characteristic. While DDx constituents (DDT, DDD, and DDE) are not included in Table 1 for Toxicity (40 CFR 261.24 (b)), other contaminants previously detected in Arkema sediment that exceeded screening levels are included on Table 1. These include but are not limited to cadmium, chromium, lead, selenium, chlordane, lindane, heptachlor epoxide, hexachlorobenzene, and hexachlorobutadiene (Integral 2006). It is unclear whether these contaminants (or other contaminants within the sediment not detected during previous investigations) after undergoing Toxicity Characteristic Leaching Procedure (TCLP) analyses would exceed the maximum concentrations given on Table 1. Thus there is a possibility that Arkema sediments could be classified as characteristically-hazardous due to Toxicity under federal regulations.

Thus contaminated sediments at Arkema do not contain listed hazardous wastes under federal regulations but may contain contaminants within the sediments that classify the wastes as characteristically-hazardous due to toxicity. This conclusion is based upon the best available information currently available, and data and other information collected during future investigations may indicate that further characteristic hazardous waste determinations are required.

Direct Applicability of Treatment Standards Under Federal Regulations

It has been determined by EPA that the Arkema sediment will not be designated as a listed hazardous waste as previously discussed. Thus, the treatment standards promulgated under 40 CFR 268 would not apply because of that reason. If the contaminated sediment is determined to be a characteristically-hazardous waste under 40 CFR 261 Subpart C, the treatment standards promulgated under 40 CFR 268 (Land Disposal Restrictions) could potentially apply under Federal regulations, including the requirement to identify and satisfy treatment standards for underlying hazardous constituents..

If the qualitative criteria and quantitative testing procedures outlined in 40 CFR 261 Subpart C determine that Arkema sediment is not a characteristically-hazardous waste then the treatment standards promulgated under 40 CFR 268 would not be applicable for sediments at the Arkema site under Federal regulations.

Determination Whether Arkema Sediments are Hazardous Wastes Under State-Only Regulations

The next step is to determine whether Arkema sediments are state-designated hazardous wastes per 340 OAR, Division 101 (Identification and Listing of Hazardous Waste). According to OAR 340-101-0033(6);

> *(6) Any pesticide residue, except residue listed in Table 1 of 40 CFR 261.24 and which passes the evaluation requirement of 40 CFR 261.24(a), is a hazardous waste and is added to and made a part of the list of hazardous waste in 40 CFR 261.31 until it is first managed in accordance with the standards in OAR 340-109-0010(2)(a).*

It should be noted that state regulation OAR 340-100-0002 (Adoption of United States Environmental Protection Agency Hazardous Waste and Used Oil Management Regulations) adopts federal regulations governing management of hazardous waste cited in OAR 340-101 and OAR 340-109, including but not limited to 40 CFR Parts 261 and 268 which are pertinent to this issue.

Contaminated sediments at Arkema contain pesticide residues. While some of the pesticide residues are listed on Table 1 of 40 CFR 261.24, it has not been demonstrated that the residues would pass the toxicity testing required by 40 CFR 261.24(a). In addition, the residues for DDT and DDD are not listed in Table 1 of 40 CFR 261.24. Thus, the DDx contamination would designate sediments from the Arkema site as a hazardous waste under state regulations and furthermore, would be made a part of the list of hazardous waste in 40 CFR 261.31 since the sediments have not been managed in accordance with the standards in OAR 340-109-0010(2)(a).

Applicability of Oregon Administrative Rules for Management of Pesticide Wastes

Mr. Matt McClincy from ODEQ provided EPA (Mr. Sean Sheldrake, EPA Remedial Project Manager (RPM)) an e-mail dated January 28, 2008 stating ODEQ's position with regards to classification of Arkema sediments. Mr. McClincy stated that if Arkema does not designate the DDx impacted sediment to be a "U" listed federal hazardous waste, it would be subject to the broader in scope state-only requirements of OAR 340, Division 109 ("Hazardous Waste Management – Management of Pesticide Waste") if generated and accordingly would be considered a State Listed Hazardous Waste.

According to OAR 340, Division 109 and the conclusions from Mr. McClincy as a representative of ODEQ, the Arkema sediments would be designated as waste pesticide. Per the following direct citations from OAR 340-109(4), the waste pesticide may be managed as follows:

(a) A RCRA Subtitle C hazardous waste facility meeting the requirements of Division 100 to 106 and 142; or

(b) A permitted RCRA Subtitle D facility meeting the requirements of OAR 340 Division 94 provided either the applicable land disposal concentration-based standards in ***40 CFR 268.40*** *are met for waste pesticide containing any pesticide active ingredient(s) listed in* ***40 CFR 261.33(e)*** *and* ***(f)****, or if standards do not exist, the wastes do not fail the "Department of Environmental Quality Aquatic Toxicity Test," whereby a representative sample of a pesticide residue exhibits a 96-hour aquatic toxicity LC 50 equal to or less than 250 mg/l; or*

(c) A facility having a Water Pollution Control Facility (WPCF) permit issued pursuant to OAR 340, Division 14; or

(d) As otherwise authorized by the Department. Such management shall be in conformance with the following performance standards:

(A) Containment by any one or combination of: physical means (e.g., natural or man-made liners), chemical means (e.g., adsorption-absorption layers), or other equivalent means, and

(B) Detoxification by any one or combination of: physical means (e.g., solar radiation), chemical means (e.g., hydrolysis), biological means (e.g., microbial degradation), or other equivalent means, and

(C) Volume reduction by any one or combination of: evaporation, evapo-transpiration, use for new product makeup, or other equivalent means, and

(D) Protection of groundwater and surface waters by any one or combination of: system design, construction materials, or a groundwater monitoring program.

Applicability of Treatment Standards Promulgated Under Federal Land Disposal Restrictions to Waste Pesticides Managed Under Oregon Administrative Rules

OAR 340-109(4) provides four options for management of waste pesticide. Arkema is proposing a CDF for management and disposal of the Arkema sediments, which are classified as waste pesticide as previously discussed. CDFs are not specifically mentioned in the regulation; thus a determination must be made as to which category applies. EPA and ODEQ have determined that OAR 340-109(4)(a), (b), and (c) are not likely management options for the Arkema sediments in a nearshore CDF.

The likely option for pesticide wastes managed in a CDF at the Arkema site would be OAR 340-109(4)(d). This waste pesticide management option would be an action as authorized by EPA and ODEQ, but required to meet the performance standards listed in OAR 340-109(4)(d). If this option were pursued then performance standards including containment, detoxification, volume reduction, and protection of groundwater and surface waters must be met. In order to meet the requirements of detoxification and volume reduction in this citation, treatment of the sediments would likely be required.

Conclusions

Based on review of Federal regulations in 40 CFR 261 pertaining to identification and listing of hazardous wastes and applicability of land disposal restrictions, EPA will not designate Arkema sediments as listed hazardous waste, and further testing will need to be done to determine whether Arkema sediments would be characteristically-hazardous waste under Federal regulations. If it is determined that the Arkema sediments are not characteristically-hazardous then they would not have to meet the treatment standards presented in the Federal LDR regulations.

As outlined above, the sediments would be considered a state-only hazardous waste if generated and would be made a part of the list of hazardous waste in 40 CFR 261.31 as incorporated by reference into OAR 340-101. The sediments would also have to be managed as waste pesticide under OAR 340-109. The option most applicable to the Arkema site was determined by EPA and ODEQ to be OAR 340-109(4)(d) – management action as authorized by ODEQ. Under management option 340-109(4)(d) it appears that sediments may also require treatment in order to meet performance standards including detoxification and volume reduction.

It should be noted that this discussion pertains to a regulatory determination regarding the applicability of treatment for the Arkema sediments. However, a risk evaluation could determine that treatment of the Arkema sediments is required to a lower standard than that required from a regulatory standpoint in order to be protective of human health and the environment.

2. EPA's Position on In-Situ Treatment Technologies as Removal Action Alternative Components for Arkema Sediments

Overview of In-Situ Treatment Issue

The July 25, 2008 letter states that information provided by LSS demonstrates that enhanced in-situ bioremediation and in-situ chemical oxidation are effective treatment alternatives for DDx in soil and sediments, if treatment is necessary at the Arkema site. The July 25, 2008 letter cites the use of Daramend® at the T.H. Agriculture & Nutrition (THAN) Superfund Site in Montgomery, Alabama as an example of a site where in-situ biological treatment was used successfully. For in-situ chemical reduction, the letter cites bench scale work on another LSS pesticide site in Texas using EHC® compound, and for chemical oxidation the letter cites a pilot scale demonstration from the uplands portion of the Arkema site. Finally, LSS states that "other pre-treatment technologies such as stabilization may be considered in conjunction with the CDF design concept".

EPA's position is that based on the information provided by LSS, in-situ treatment of the Arkema sediments is not appropriate for evaluation in this removal action due to lack of proven technology performance. More rational for EPA's position is as follows.

Overview of Limitations for In-Situ Treatment of Sediments

The *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA, 2005a) states that most techniques for in-situ treatment of sediment are in the early stages of development, and few methods are currently commercially available. Furthermore, in-situ remedies relying on the addition of required substrates and nutrients, reagents, or catalysts are limited because of problems developing an effective in-situ delivery system. The lack of an effective delivery and homogenization system has also hindered the application of in-situ stabilization systems as a treatment alternative for sediments (NRC, 2001). In-situ treatment poses numerous technical problems and has been used at very few contaminated sites (NRC 1997).

Some limitations to in-situ treatment of contaminated sediments include process control, dosage control, and water column impact (EPA 1994). Process control is contingent upon effectively monitoring conditions at the site, typically by performing sampling and analysis at appropriate frequencies, before and after treatment. The efficacy of in-situ treatment of sediments is difficult to determine because of the nonhomogeneous distribution of contaminants, sediment physical properties, and treatment chemicals (EPA 1994).

Dosage control is another limitation of in-situ treatment because of the difficulty in ensuring uniform dosages of chemical reagents or additives throughout the sediments to be treated. Areas of sediment within the site may receive varying levels of treatment, with some areas of sediment being untreated while others are overtreated relative to the intended treatment goal. In-situ treatment, if appropriately implemented, may be less cost effective than ex-situ treatment when these factors are considered (EPA 1994).

Among the most significant limitations to in-situ treatment is the impact of the process on the water column. Processes that would release contaminants, reagents, or heat, or produce other negative impacts on the overlying water column, are not likely to be acceptable for in-situ sediment remediation (EPA 1994).

Overview of In-Situ Chemical Treatment

In-situ chemical treatment involves the addition of chemical reagents to sediments to destroy organic contaminants. Theoretically, oxidants, such as ozone, hydrogen peroxide, and permanganate, could destroy organic contaminants. Presence of natural organic matter, oil and grease, and metal sulfide precipitates exhibit high oxygen demand which can affect performance of in-situ chemical treatment.

Chemical dechlorination under ambient temperatures and typical water contents is not likely to occur or to be controllable (NRC, 1997).

LSS presented information regarding in-situ chemical reduction (bench scale study) work on another LSS pesticide site in Texas via the use of EHC® compound. Per information obtained from the Adventus Group's website, EHC® uses both chemical and biological treatment mechanisms to reduce contaminant concentrations. These mechanisms are as follows: direct abiotic reduction, chemical reduction, and biostimulation through production of volatile fatty acids. LSS also presented information regarding in-situ chemical oxidation (pilot scale demonstration) work from the uplands portion of the Arkema site. EPA's position is that this information does not support the use of these technologies for demonstrated full-scale application under a removal action for in-situ chemical treatment of sediments at the proposed Arkema CDF. Both of the referenced sites did not involve full-scale application of in-situ chemical treatment and the data presented are not specifically for DDx-constituents potentially bound to the solid matrix in sediments.

The graphed data for the pilot scale demonstration of in-situ chemical oxidation at the uplands portion of the Arkema Portland site indicate they were for treatment of DDx migrating in shallow groundwater and shallow intermediate groundwater. DDT and its breakdown products (dichlorodiphenyl-chloroethane [DDE] and DDD) are highly persistent in the environment and have extremely low solubility in water, thus they adsorb strongly to soil particles and do not partition into the aqueous environment easily (ATSDR 2002, Extoxnet 1996, and EPA 1975). While in-situ chemical oxidation technology may show promise in reductions in concentrations of DDx in groundwater, it does not conclusively indicate that reductions would be achieved for DDx constituents that have adsorbed on sediment.

The bench scale study results provided for in-situ chemical reduction using EHC® compound indicated the data were for both soil and groundwater. However the data were reported in micrograms per liter, which again are indicative of performance in an aqueous matrix, not necessarily sediment.

EPA also believes this information demonstrates full-scale application of the in-situ technologies for use in a removal action at the Arkema site is not viable. With regards to in-situ chemical reduction using EHC, effectiveness in a bench-scale study using a controlled environment does not necessarily translate into an effective technology for full scale implementation. Furthermore, it appears from the data provided by LSS for both studies that they were not conducted for in situ treatment of contaminated sediment but rather for treatment of groundwater. Per the rationale previously provided, EPA does not believe either in-situ chemical oxidation or in-situ chemical reduction (EHC® compound) are directly applicable to contaminated sediments at the Arkema site due to lack of data for treatment of sediment and lack of demonstrated full-scale implementation of the technologies at sediment sites comparable to the Arkema site.

Overview of In-Situ Biological Treatment

Generally, bioremediation is the process in which microbiological processes are used to degrade or transform contaminants to less toxic or nontoxic forms (EPA 2005a). Numerous factors limit the use of biodegradative processes in sediment. The complexity of sediment-water ecosystems, the difficulty of controlling biodegradative processes (physical, chemical, and biological) in the sediment, and the need to adjust environmental conditions for various stages of biodegradative processes limit the effectiveness of in situ bioremediation (EPA, 1994). Additionally, effective in-situ bioremediation of fine-grained, saturated soils and sediments (as opposed to more porous groundwater aquifers or soils within the vadose zone) poses a major challenge. While delivery and transport of nutrient and electron acceptor amendments to and through groundwater aquifers is a demonstrated technology, movement of these materials through fine-grained sediments is difficult (EPA 1994).

In-situ bioremediation technologies are used in land-based soils to degrade many, but not all, contaminants. However, sufficient understanding to assess bioremediation as a viable treatment alternative of contaminated sediment is lacking and more research is needed at the pilot-scale and demonstration-scale levels in order to gain a better understanding of process kinetics, implementation scenarios and/or challenges, and overall technology costs (Myers, 2000). In addition, bioremediation technologies are still unproven with respect to freshwater sediments (NRC 1997).

A search of the Superfund Site Information Systems was conducted for sites with DDT contaminated sediments where in-situ biological treatment was used. The results indicated that there was one site where this technology had been implemented: the Ciba-Geigy Corporation (McIntosh Plant) Superfund Site located in McIntosh, Alabama. The Ciba-Geigy site had four Operable Units (OUs) involved in the clean up. OU3 involved the cleanup of pesticides (DDT, DDD, and DDE, [collectively known as DDTR]) from soil and sediments in wetlands. Per the EPA Record of Decision (ROD) issued in 1995, permission was granted by EPA to use bioremediation techniques to attempt the clean up of a portion of OU3 if these techniques could meet the EPA's cleanup standards (15 parts per million (ppm) for total DDTR in soil/sediment and a performance standard of less than 1.5 ppm in mosquito fish tissue). The Five Year Review Report completed in September 2006 stated that after an extensive treatability study the in-situ bioremediation alternative was not implemented because the treatment goals could not be met. All excavated soils, sediments and related materials containing concentrations of DDTR greater than 500 ppm from OU3 were then thermally treated with the OU2 and OU4 soils (EPA, 2006).

During the August 8, 2008 Arkema site visit, LSS indicated there is a site in Albany, Georgia where DDx-contaminated sediments were successfully treated using in-situ biological treatment. Per a conversation with David Livermore (Integral Consulting, Inc.) it was confirmed that the site being referred to by LSS is the THAN Superfund Site in Albany, Georgia. A search of the Superfund Site Information Systems was conducted for the THAN site in Albany and the documents found for the site revealed that while DDx constituents were contaminants of concern for soil and groundwater, they were not found in the sediments at the site. Soil contamination on the eastern parcel of the site (OU2) was treated on-site with low temperature thermal desorption. There was no reference to in-situ biological treatment of soil or sediment being done at the site; however, it was stated that a groundwater in-situ bioremediation pilot study was initiated for OU1. This study was designed to determine whether bioremediation was capable of remediating toxaphene, among other pesticides (including DDT, DDD, and DDE), which had accumulated near the water table. The EPA Region 4 Superfund site NPL Caliber Cleanup Site Summaries webpage for the THAN site in Albany stated that the final bioremediation report received by EPA in late 2007 concluded that in-situ bioremediation is not likely to be effective at the site (EPA 2008b).

LSS also indicated during the August 8, 2008 Arkema site visit that the Siltronic site in Portland, Oregon was using EHC® technology to treat groundwater. LSS stated the Siltronic site would be similar to the Arkema site because the treatment is applied to saturated soils. As discussed above, EHC® technology uses both chemical and biological treatment mechanisms to reduce contaminant concentrations.

A search of the EPA Region 10 Portland Harbor technical documents found several documents listed under the GASCO operable unit (OU3) for the Siltronic site. Based on a map of the Portland Harbor vicinity, it appears the Siltronic site is located northwest of the Arkema site and southeast of the GASCO site. A review of the Remedial Investigation Report prepared for the Siltronic Corporation indicated that the Siltronic property is part of the GASCO site (Maul Foster & Alongi, Inc. 2007a). A pilot study report for the Siltronic Corporation prepared in 2007 indicated a pilot study was completed within upland areas adjacent to the Portland Harbor Superfund site. The pilot study evaluated enhanced in-situ bioremediation (EIB) of trichloroethene (TCE) and its degradation products in groundwater using EHC® and anaerobic bacteria culture (KB-1™) (Maul Foster & Alongi, Inc. 2007b). The results of the pilot test indicated that EIB as tested is a viable remedy for reducing and potentially eliminating the plume of TCE and its degradation products in the upland and below the Willamette River. However, this pilot test targeted VOCs (specifically TCE) and did not evaluate treatment of DDx-constituents (Maul Foster & Alongi, Inc. 2007b). Additionally, it appears that a remedy has not been selected for the site as there are no RODs listed for any of the operable units at the Portland Harbor Superfund site. EPA could not find documentation regarding use of EHC® in the remediation of DDx-constituents at the Siltronic site. EPA requests that LSS provide documentation regarding treatment of DDx at the Siltronic site for EPA to review.

Per a review of the Adventus Group website (vendor for EHC®), there is only one site listed in their project descriptions where EHC® has been used for the treatment of organochlorine pesticides, but no information was presented as to which specific pesticide compounds were evaluated at the site. The site has a confidential client so the information presented was not extensive, but the treatment was only demonstrated using pilot-scale and bench-scale treatability studies, and treatment was for soil rather than sediments. The information is located at the following web address:

http://www.adventusgroup.com/adventus-group/portfolio/ehc-pesticides

EPA believes the use of EHC® at the Siltronic site is not directly applicable to the Arkema site as EHC® was used to treat TCE and its degradation products, not DDx constituents. In addition, this pilot test was for the treatment of groundwater; sediments are the impacted media under consideration at Arkema. Finally, per information obtained from the Adventus Group's website, EHC® has only been applied at one site for the treatment of organochlorine pesticides in soil.

Overview of DARAMEND®'s Applicability to the Arkema site

It is EPA's opinion that DARAMEND® would not be an appropriate in-situ biological treatment technology for the sediments at the Arkema site. As stated in Appendix B of the *Reference Guide to Non-Combustion Technologies for Remediation of Persistent Organic Pollutants in Stockpiles and Soil* (EPA, 2005b), DARAMEND® is a bioremediation technology that has been used to treat soils and sediments containing low concentrations of pesticides. Per a document released by the United Nations Environment Programme (UNEP), DARAMEND® is likely to be only applicable to contamination in soil at the ppm level due to toxicity of persistent organic pollutants (POPs) and significant research is necessary to determine its suitability for treating high strength POP wastes (UNEP 2004). It further states that it is unlikely that in-situ treatment itself will be suitable for treatment of high level wastes (UNEP 2004). Based on sampling performed at the Arkema site, the concentrations of DDx within portions of the in-place sediments are elevated in the range of parts per million. Furthermore, the treatment process for DARAMEND® requires the ability to cycle the sediments between anoxic and oxic conditions through tilling of the sediments. The conditions within a proposed Arkema CDF (depth of sediments in the proposed CDF, extraction of water to create an inward hydraulic gradient, etc.) would make it very difficult to control environmental conditions such that anoxic and oxic conditions could be maintained or cycled. Additionally, tilling of sediments within the CDF would present another set of difficulties as the typical depth achieved by standard tilling equipment is 2 feet and the placement of sediments in a proposed Arkema CDF would be much greater.

DARAMEND® has undergone full scale implementation at the THAN Superfund Site (OU2) in Montgomery, Alabama. Sampling results indicate that DDx-constituents in soil and sediment were decreased by an order of magnitude. However, final concentrations at the THAN site after treatment with DARAMEND® were still in the ppm range, which may not be low enough to achieve treatment standards at the site. Per the five year review issued in 2007 for the THAN Superfund Site, OU1 and OU2, it was stated that due to the presence of elevated levels of constituents (DDT, DDE, DDD, and toxaphene) that may have affected treatment time using the bioremediation process, some of the sediment was segregated from the treatment cells and disposed of off-site.

DARAMEND® was also implemented during a pilot scale test at a W.R. Grace site in South Carolina. The pilot scale testing also showed a decrease in DDT concentrations in soil; however, the final concentrations of DDT after the pilot scale test were higher than at the THAN site and final treated concentrations were in the tens of ppm.

It was also stated in Appendix B of the *Reference Guide to Non-Combustion Technologies for Remediation of Persistent Organic Pollutants in Stockpiles and Soil* that DARAMEND® technology may become technically or economically infeasible when treating soils with excessively high contaminant concentrations, which could be the case in an Arkema CDF. Further, it is stated that this technology cannot be applied to sites that are prone to seasonal flooding or have a water table that fluctuates to within 3 feet of the site surface.

Some of the limitations listed in this guidance document for DARAMEND® include:

- Tillage equipment depth limitation of 2 feet;
- Presence of other toxic compounds (heavy metals) may be detrimental to soil microbes;

- Soils with high humic content may slow down cleanup;
- Soil moisture must be controlled during treatment (i.e. the target moisture content at the beginning of each cycle for the THAN site was 33% (dry weight basis) or 90% of the soil's water holding capacity).

Per a review of the Adventus Group website (vendor for DARAMEND®) there were only four sites listed where DARAMEND® had been used for the treatment of pesticides. Of the four sites listed, three were pilot or laboratory-scale demonstrations for treatment of soil rather than sediments. The only full-scale project listed for this technology was the THAN site in Montgomery, Alabama. The information is located at the following web address:

http://www.adventusgroup.com/adventus-group/portfolio/daramend-pesticides

Based on the information presented above, DARAMEND® is considered by EPA to be an experimental technology with regard to pesticide treatment as it has only been implemented at four sites to date, three of which were only at the pilot- or bench-scale.

Conclusion

Based on the rationale outlined above, EPA believes that in-situ treatment of the Arkema sediments via in-situ chemical oxidation, in-situ chemical reduction, or in-situ biological treatment is not appropriate due to lack of proven technology performance at sites with contaminated sediments and difficulties inherent to in-situ treatment of contaminated sediment.

3. EPA's Position on Pre-Treatment of Sediments and Stabilization Technologies as Removal Action Alternative Components for Arkema Sediments

LSS states in the July 25, 2008 letter that "other pre-treatment technologies such as stabilization may be considered in conjunction with the CDF design concept, if it is determined that such pre-treatment would provide considerable benefit to the overall performance to the CDF".

EPA's position is that some degree of sediment pre-conditioning/pre-treatment will likely be required to facilitate treatment of sediment before placement in the proposed Arkema CDF. Stabilization of sediment may be one technology that can be used to meet this objective. More rational for EPA's position is as follows.

In-situ immobilization (solidification/stabilization) is a set of technologies used to immobilize and isolate sediment contaminants from the surrounding environment. Stabilization or chemical immobilization usually involves the addition of chemical reagents that reduce the solubility or mobility of the contaminants, with or without changing the physical characteristics of the treated material (NRC, 1997).

LSS has not provided specifics regarding the intended use or application of stabilization with regards to pre-treatment of sediments prior to placing in a CDF. For instance the type of stabilization material, method of application (in-situ or ex-situ), and performance standards or goals have not been indicated. Thus EPA cannot ascertain whether stabilization in the context LSS used in the July 25, 2008 letter will be acceptable for use on sediments prior to placement in the proposed Arkema CDF.

However as EPA has indicated in previous correspondence with LSS, pre-conditioning/pre-treatment will likely be required for dredged sediments prior to implementing ex-situ treatment technologies such as thermal desorption. As indicated in this letter, LSS will need to meet treatment standards prior to placement of contaminated sediment in the proposed Arkema CDF.

Stabilization may be one of several potential technologies that could be used for pre-treatment and EPA encourages LSS to further explore the use of proven ex-situ treatment technologies for sediments to meet treatment standards prior to placement in the proposed CDF. However, it should be noted that chemical reagents used in stabilization that do not affect the mass of contaminants in the sediments would likely not meet the treatment standards promulgated under the OAR 340-109 that would be required for the Arkema CDF.

Conclusion

Based on the rationale outlined above, EPA does not have enough information from LSS regarding the proposed use or intent of stabilization for pre-treatment of sediments to make a conclusion on its applicability to the proposed Arkema CDF. However, it should be noted that stabilization alone will likely not facilitate treatment of the contaminated sediment to meet treatment standards set for the site.

4. EPA′s Position on Ex-Situ Thermal Desorption as a Removal Action Alternative Component for Arkema Sediments

Overview of Ex-Situ Thermal Desorption Issue

LSS asserts in their July 25, 2008 letter that ex-situ treatment of dredged sediment using thermal desorption is not appropriate or relevant to a preliminary CDF screening evaluation. The letter also asserts that thermal desorption is not relevant or appropriate for treatment of sediment at the Arkema site due to moisture content and energy inefficiency issues. The letter further states that “low temperature thermal aeration (LTTA) and high temperature thermal desorption (HTTD) are dated and rarely, if ever, used”. In addition, the letter states “LTTA is technically impracticable for sediment remediation work” due to moisture content in excess of 20%. Finally, the letter states that a HTTD unit such as the SoilTech AOSTRA-Taciuk Processor used for treatment of PCB contaminated sediments at the Waukegan Harbor Superfund Site is neither relevant nor appropriate because thermal desorption of DDx constituents does not require high temperatures.

EPA’s position is that ex-situ thermal desorption is a viable technology type to consider for treatment of sediments at the Arkema site, especially since it appears in-situ treatment methods cannot be proven conclusively to be effective at treating contaminated sediments in a CDF. Thermal desorption technology is still currently used in the United States to treat PBT (persistent, bioaccumulative, and toxic) material, and there are methods available to lower the moisture content of sediments prior to treatment (i.e. passive, or active methods, including mechanical dewatering) to alleviate concerns about operational inefficiencies and performance due to excessive moisture. Furthermore, while the AOSTRA-Taciuk Processor unit may not be the preferred or best-suited treatment unit at the Arkema site due to the operating temperatures, the general theory and application of the treatment process is still relevant because low temperature thermal desorption (LTTD) operates using the same treatment theory (thermal desorption) as HTTD, just at a lower temperature range. More rational for EPA’s position is as follows.

Overview of Information Sources Used for Thermal Desorption Descriptions and Current Use of Thermal Desorption in the United States

LSS stated in a portion of the July 25, 2008 letter "From a purely technical standpoint, the information/evaluation performed by EPA/CDM is dated."

The technology descriptions were obtained from the Federal Remediation Technologies Roundtable (FRTR) Remediation Technologies Screening Matrix and Reference Guide, Version 4.0. The FRTR is one of the best publicly available resources for general remedial technology information, as the FRTR is composed of many of the leading Federal government agencies in hazardous waste remediation. These agencies are tasked with working together to promote interagency cooperation to advance the use of innovative technologies to cleanup hazardous waste contamination. The member-agencies of the FRTR include: U.S. Department of Defense, U.S. Department of Energy, U.S. Department of the Interior, U.S. EPA, and the National Aeronautics and Space Administrative. In addition, the FRTR member-agencies have developed partnerships with private technology companies and developers to demonstrate and develop remedial technologies including, but not limited to, the Interstate Technology and Regulatory Council (ITRC) and the National Research Council (NRC). The FRTR Remediation Technologies Screening Matrix was last updated in 2007, so the information regarding treatment technologies listed in the matrix appears to be current.

While there may be innovative developments in LTTD and HTTD and reduction in uses of selected specific applications of LTTD and HTTD due to economic or other factors not reflected in the information, the information provided by FRTR appears to be the current information regarding proven status and developments in these technologies

LSS also asserts in the July 25, 2008 letter that LTTA is a dated technology that is rarely, if ever used. The description of LTTA was obtained from the FRTR and was provided to LSS as only one example of a LTTD method of treatment. While LTTA may currently be infrequently used, other LTTD processes are in use today. One of the leading thermal desorption vendors in the United States (Maxymillian Technologies) was contacted. A representative of Maxymillian Technologies stated that they have used an indirect fired LTTD process more than 10 times in the last 5 years and are currently using it at an unnamed site for a confidential client. Thus, it appears that LTTD processes are currently in use and has been used recently at a number of sites for treating contamination.

Overview of Appropriateness of LTTD versus HTTD and of the AOSTRA-Taciuk Processor to the Arkema Site

As discussed in the memo from EPA to Mr. Daniel Opalski that was subsequently provided to LSS (herein referenced as the April 16, 2008 EPA memo), LTTD and HTTD use the same treatment theory to remediate contamination (volatilization of contaminants without oxidation). The operating mechanisms for both are similar except for operating temperatures, which can be adjusted according to the contaminant. LTTD is typically applied to contaminants with relatively low boiling points (i.e., below 600 degrees Fahrenheit [315 degrees Celsius]) while HTTD is typically applied to contaminants having boiling points higher than 600 degrees Fahrenheit (Naval Facilities 1998). In either case, the treated material essentially retains its physical properties. The operating temperatures cited for LTTD and HTTD systems tend to vary and the use of this terminology is not consistent within the industry, with some HTTD systems referred to as LTTD systems depending on the source of information. Regardless of the terminology used to describe a process (HTTD versus LTTD), thermal desorption technologies consist of the same basic steps: heating the contaminated material to volatilize contaminants and treating the exhaust gas stream to prevent emissions of the volatilized contaminants to the atmosphere. The differences between the systems lie in the way heat is transferred to the contaminated materials and the type of off-gas treatment system that is used (Naval Facilities 1998). Although HTTD may provide operating temperatures (and thus energy usage) beyond what is needed to treat DDx contamination, it would be an effective method of treating DDx. Therefore, the comparison made in the July 25, 2008 LSS letter to the Waukegan Harbor site is appropriate for evaluation of treatment operations at the Arkema site (FRTR, 2007).

The information concerning the SoilTech AOSTRA-Taciuk Processor at the Waukegan Harbor site was obtained from the *Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document* (EPA, 1994) and the ROD Amendment for Operable Unit 1 of Waukegan Harbor (EPA 1989). The ROD Amendment stated “the Taucik process is a low temperature thermal extraction process”. The ARCS document indicated that the preheat zone operates at temperatures of 200 to 340 degrees Celsius, the retort zone at 480 to 620 degrees Celsius, and the combustion zone from 650 to 790 degrees Celsius. If the system were operated under these conditions it could be functioning in both the LTTD (90 to 320 degrees Celsius) and the HTTD (320 to 560 degrees Celsius and 650 to 790 degrees Celsius) typical temperature ranges. Thus, the SoilTech AOSTRA-Taciuk Processor at the Waukegan Harbor site had four processing zones (preheat, retort, combustion, and cooling) with a different temperature range in each zone.

EPA concurs that there is conflicting information regarding the classification of this particular application of thermal desorption as solely LTTD or HTTD. Regardless of the operating ranges of this particular system, the underlying concept is that the treatment technology of thermal desorption would be relevant for treatment of contaminated sediment at the Arkema site even if the particular unit referenced was not selected for treatment.

Overview of Moisture Content and Energy Efficiency Impacts on Evaluation of Thermal Desorption

EPA disagrees with the assertion by LSS that moisture content of contaminated sediments at Arkema and the energy inefficiency of thermal desorption systems renders evaluation of thermal desorption as irrelevant or inappropriate. Dredged material removed from a contaminated sediment site normally requires preconditioning/pretreatment prior to full treatment and/or disposal. Preconditioning/pretreatment is performed to remove excess water to reduce volume and aid subsequent treatment or disposal or to provide a volume equalization basin to allow matching of dredging rates with subsequent treatment or disposal rates (NRC, 2001). As stated in the April 16, 2008 EPA memo, dewatering would likely be necessary to achieve acceptable soil moisture content levels for thermal desorption. The process of dewatering sediments before introducing them into a thermal desorption system is a common practice used in situations where the sediment has a moisture content above 20%. Most of the sediment at the Arkema site would likely require dewatering, but would still be treatable in a LTTD system after dewatering. In addition, when using an indirect fired LTTD system, treatment is efficient at moisture contents less than 60% (FRTR 2007, EPA 1993).

EPA is aware of the guidance document that LSS referenced in the July 25, 2008 letter regarding “green remediation” (*Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites*, EPA 542-R-08-002 (EPA 2008a)). The guidance document does not preclude the use of energy-intensive remedial technologies such as thermal desorption; rather it states that energy-intensive remediation systems should be optimized to reduce energy consumption and should look at use of natural, renewable energy sources to power energy-intensive remediation equipment. Thus evaluation of thermal desorption as a treatment technology is not precluded by the guidance. In addition, the guidance also states that optimization should be considered for in situ treatment methods as well.

Conclusion

Based on the rationale outlined above, EPA believes it is reasonable and appropriate to consider thermal desorption a viable remedial alternative component for treatment of contaminated sediments at the Arkema site once the sediments have been preconditioned/pretreated (e.g., dewatered).

5. EPA’s Position Regarding Applicability of Other CDF Sites to the CDF Proposed for the Arkema Removal Action

Overview of CDF Issue

LSS asserts that the nearshore CDFs implemented at other CDF sites (specifically Cascade Pole (Washington), Waukegan Harbor/Outboard Marine Corporation (Illinois), and New Bedford Harbor (Massachusetts)) are examples of sites where installation of CDFs have proven to be highly effective for containing and treating sediments contaminated by PBTs.

EPA’s position is that these CDFs are not entirely comparable to the CDF proposed at the Arkema site due to differences in the PBTs, locations of the CDFs (aquatic environments versus upland environments), the CERCLA process through which the CDFs were constructed (remedial process versus removal process), and the ultimate use of the CDFs (temporary sediment storage versus permanent sediment storage). EPA has researched three additional CDF locations in addition to those identified by LSS in the June 25, 2008 letter that support this position; these include Hylebos Waterway (Washington), Alcoa (Point Comfort)/Lavaca Bay (Texas), and Wyckoff-Eagle Harbor (Washington). Specific information supporting EPA’s position from the six referenced CDF locations are as follows:

Cascade Pole (Washington)

Cascade Pole is located at the north end of the Port of Olympia peninsula between the east and west bays of Budd Inlet in Olympia, Washington. This cleanup involved intertidal sediments (sediments that were covered during high tide and uncovered during low tide) and subtidal sediments. An April 2000 order between the Port of Olympia and the Washington State Department of Ecology (Ecology) required the construction of a 4.5-acre on-site upland cell to store around 35,000 cubic yards of sediment from Budd Inlet. In 2001, the Port of Olympia, under an agreed order with Ecology, removed 35,000 cubic yards of intertidal sediment contaminated with dioxins/furans and polynuclear aromatic hydrocarbons (PAHs) and placed it in an upland containment cell constructed over the contaminant “hot-spot” area of the uplands portion of the site. The current ground water monitoring system consists of fifteen wells, a horizontal drain, and one offsite well located in an adjacent former rail yard. Twelve wells monitor a shallow aquifer, and three wells monitor a deeper aquifer. These wells and the drain are scheduled to be sampled on an annual basis, subject to the regulatory requirements of Ecology. Groundwater at all sampling locations is analyzed for semi volatile organics , PAHs, arsenic, chromium, and copper. Groundwater is being pumped and treated from the site both inside and outside of the CDF. Per conversations with the Ecology site manager (Mohsen Kourehdar), the CDF was constructed using berms and the material used in the berms consisted of contaminated soil from the site. For the past five years plastic has been placed on top of the CDF while the material within the CDF was allowed to settle. The future plans for the CDF are to build a parking lot on top of it. Groundwater is monitored both inside and outside of a slurry wall surrounding the site; however, there is no way to assess the effectiveness of the CDF at preventing migration/leaching of contaminants outside of the CDF berms because groundwater and soil outside of the berms are already heavily contaminated, with free product present in some locations. There was no treatment of sediments prior to placement in the CDF; however, the sediments were dewatered. Site conditions that differ at Cascade Pole from the Arkema site include a marine aquatic environment, upland location of the CDF, and different contaminants (dioxins/furans, PAHs, and inorganic contaminants).

Ecology Site Manager: Mohsen Kourehdar [360-407-6256]
Site Information:

http://www.ecy.wa.gov/pubs/0409061.pdf
http://yosemite.epa.gov/r10/CLEANUP.NSF/7780249be8f251538825650f0070bd8b/cc222b8059fa7b3488256e0100668a31/$FILE/ATTVDMFR/WA8357.pdf

Waukegan Harbor/Outboard Marine Corporation (Illinois)

Details regarding the history and volume of sediments dredged at Waukegan Harbor were provided in the April 16, 2008 EPA memo. This site consists of three CDFs; one nearshore CDF was constructed with a perimeter double sheet-pile wall on the side in contact with the harbor while two upland CDFs were constructed with perimeter slurry walls. During a follow-up conversation with the EPA RPM (Kevin Adler), Kevin stated there are piezometers on each corner of the nearshore CDF (both inside and outside the walls) that are used to monitor water levels inside and outside of the CDF and the nearshore CDF is pumped to maintain an inward hydraulic gradient. The upland CDFs are also pumped to maintain an inward hydraulic gradient and have piezometers installed at the corners (both inside and outside the walls) to monitor water levels. Groundwater sampling is performed periodically inside and outside the CDFs; however, no monitoring is done on the harbor side of the sheet pile wall for the nearshore CDF. Samples have been collected from the CDFs to be used in bench-scale in-situ treatment technology studies; however, Kevin indicated that these bench-scale studies had not progressed past the initial sampling stage. The site was purchased by the City of Waukegan who has taken over the maintenance and monitoring of the CDFs at the site. The CDFs are monitored monthly for integrity (burrowing animals, ground cover, etc.).

Mr. Tim Harrington with HardHat Services (design and construction firm at the site) was also contacted to further discuss the nearshore CDF. The nearshore CDF was constructed with a double sheet pile wall with 20 feet of a soil-bentonite mixture placed between the two sheet pile walls. The sheet pile walls consist of 3/8 to ½ inch thick steel and has riprap piled against it for wave attenuation purposes. Piezometers located inside and outside the corners of the CDF are monitored quarterly to verify water levels inside the CDF are lower than water levels outside the CDF. The CDF is pumped every summer for approximately two to four months to maintain an inward hydraulic gradient. It was confirmed that no monitoring is done on the harbor adjacent to the sheet pile wall, but wells at the site are sampled at least once a year for PCBs. Sediments were dewatered prior to treatment and the biggest challenge during treatment was the treatment of condensate water which contained high concentrations of phenol. There were also challenges with the installation of the sheet pile walls for the CDF as the base of the wall had to be driven into a very hard clay formation (Chicago Hardpan Formation). The sheet pile was driven 7 feet into this formation and the equipment required up to 300 to 400 blows per foot in order to drive the sheet pile into the underlying formation. One problem discussed was the challenges associated with a remedy that needs perpetual operations and maintenance (O&M). The potentially responsible party (PRP) at this site originally assumed responsibility for the O&M, which included pumping water from the CDF to maintain an inward hydraulic gradient so that PCBs do not migrate through the walls of the CDF. The PRP ended up declaring bankruptcy. As a result the City of Waukegan ended up taking ownership of the site and is now in charge of funding and implementing O&M.

The Waukegan Harbor CDF appears to be the closest match to the Arkema site conditions out of the six CDFs evaluated since it included a CDF containing PBTs (in this case PCBs), and is located in a freshwater environment. However, the Waukegan Harbor CDF was constructed as a final remedy selected and implemented under a ROD and no monitoring is done on the harbor side of the nearshore CDF to verify whether contaminants are migrating through the sheet pile wall. Additionally, HTTD of sediments containing greater than 500 mg/kg of PCB was required, with a treatment target of less than 5 mg/kg in order to be placed in the nearshore CDF. Two upland CDFs required treatment of materials containing greater than 5,000 mg/kg of PCB via thermal treatment prior to placement in those CDFs.

EPA RPM: Kevin Adler [312-886-7078]

New Bedford Harbor (Massachusetts)

Details regarding the history and volume of sediments dredged at New Bedford Harbor were provided in the April 16, 2008 letter. Per discussions with the EPA RPM (Elaine Stanley) none of the proposed permanent CDFs (designated A, B, C, and D) have been constructed, so the assertion that this is a site where permanent CDFs have been demonstrated to be effective is not accurate. There is one CDF (designated the Sawyer Street CDF) where sediment is being stored for dewatering and transfer offsite to a licensed disposal facility; however, this is a temporary CDF used for staging of dredged material. The D CDF was eliminated due in part to costs and to engineering challenges associated with construction. According to the 2002 Explanation of Significant Differences (ESD) for the ROD, it would be more cost-effective to dispose of all site sediments at an offsite facility, thus eliminating construction of CDFs A, B, and C, in addition to D. No final determination has been made yet as to the status of proposed CDFs A, B, and C. Dredged sediments at the site are currently being dewatered and transported off-site via rail for disposal at a facility in another state. There is no treatment of sediments (other than dewatering) prior to transportation and disposal.

During a follow-up conversation with the other EPA RPM (Dave Dickerson), Dave stated that solidification and chemical destruction (solvent extraction) were tested during the Feasibility Study for the Hot Spot Area (Operable Unit 2). Neither of these alternatives was selected for the Hot Spot remediation due to concerns regarding reliability, implementability, and cost effectiveness. The remedy selecting CDFs as a remedial alternative at New Bedford Harbor was for a different operable unit at the site (Operable Unit 1); however, solidification and chemical destruction were also considered as alternatives but were not selected as part of the final remedy because they were cost prohibitive.

The April 16 letter indicated that although four CDFs were proposed at the site, one was later eliminated through a ROD modification in 2002, and the others have not yet been constructed. The RPM is of the opinion that the other three CDFs will also be eliminated as well. The CDFs at this location are not cost effective due to geotechnical/structural issues, and landfill disposal appears to be the most cost effective means to deal with PBT-contaminated sediment from this site.

EPA RPMs: Dave Dickerson [617-918-1329] and Elaine Stanley [617-918-1332]

Alcoa (Point Comfort)/Lavaca Bay (Texas)

Details regarding the history and volume of sediments dredged at Lavaca Bay were provided in the April 16, 2008 letter from EPA. Per a follow-up conversation with the EPA RPM (Gary Baumgarten), the CDF was constructed on a dredge disposal island in the middle of Lavaca Bay. The dredge disposal island already contained dredged material prior to the decision to construct a CDF. Investigations were conducted prior to the decision to construct a CDF to determine whether there was a potential for contaminants to migrate into groundwater. As a result of the investigations it was determined that there was no potential for contaminant migration in groundwater from the dredge disposal island. Physical monitoring of the structural stability of the CDF is conducted at the site for items such as water, drainage, and erosion with no major issues noted to date. There was no treatment done for sediments; however there were decant structures constructed within the CDF for dewatering of sediments after placement within the CDF. Treatability studies or pilot tests for potential treatment technologies were not conducted for sediment, and treatment targets/goals were not established for sediment within the CDF. The CDF is a permanent structure and will be capped when it is full. Per the Operations, Maintenance, and Monitoring (OM&M) Plan, the CDF and overall dredge island disposal location are scheduled for quarterly inspections with additional inspections required after storms. During the 2007 OM&M inspections, the following issues were noted related to the CDF: moderate to severe dike erosion was observed on the internal side slopes on the northern half of the CDF, seeps along the external CDF dike on the east side were observed, and decant structures were noted to have substantial rust and corrosion on the north structure.

The April 16 letter indicated that the conditions at this CDF are different than those at the Arkema site in that this CDF is located in an offshore marine environment, performance of work was through the CERCLA remedial process, there is a different contaminant of concern (low-level mercury), and the CDF is part of a larger dredge island measuring approximately ½-mile by 1 mile. In addition, it was determined through investigations that there was no potential for contaminant migration in groundwater from the dredge disposal island.

EPA RPM: Gary Baumgarten [214-665-6749]

Hylebos Waterway (Washington)

Details regarding the history and volume of sediments dredged at treated at this site were provided in the April 16, 2008 letter. Sediment placed within the Hylebos CDF was contaminated with PCBs, PAHs, arsenic, hexachlorobenzene, hexachlorobutadiene, and other organics and metals. A portion of the dredged sediments from this site were treated through aeration and thermal desorption to facilitate removal of volatile organic compounds (VOCs). The treatment standards or goals for this site were based in part on contaminant concentrations in sediment being required to meet marine water quality criteria if contaminants leach through the CDF berms and enter the waterway. Per follow-up discussion with the EPA RPM (Jonathan Williams), the groundwater monitoring system has not been installed but will be used to determine if concentrations of contaminants in groundwater exiting through the berms of the CDF and into the biologically active zone are below marine water quality criteria and whether they are expected to partition onto sediments at concentrations above cleanup criteria. One of the difficulties noted regarding O&M of this CDF is that it is located on a multiple use site where the surface of the cap is used for container cargo shipments. If modifications are needed to the CDF or if additional monitoring points are required, there are potential access issues. The outside berm of the CDF has partially deteriorated due to tidal activity and storms, but the overall integrity of the CDF is intact at this time. Material handling issues encountered during construction of the CDF involved spillage of dredged sediment which necessitated re-dredging around the sediment loading/unloading area. This CDF was not designed to be an impermeable structure, but rather to allow water to flow through the berms of the CDF and into the waterway.

The April 16 letter indicated that the conditions at this CDF are different than those at the Arkema site as it is located in a marine environment with an off-channel location, performance of work was through the CERCLA remedial process, and there are different contaminants of concern (treated VOCs and untreated PCBs and metals). Additionally, the effectiveness of this CDF cannot be determined with certainty as the groundwater monitoring system has not been installed. One other difference identified between this CDF and the CDF proposed for the Arkema site is that the berms were designed to be permeable structures that allow groundwater to flow through the CDF and into the bay.

EPA RPM: Jonathan Williams [206-553-1369]

Wyckoff-Eagle Harbor (Washington)

Details regarding the history and volume of sediments dredged at Wyckoff-Eagle Harbor were provided in the April 16, 2008 letter. Per a review of publicly available documents for this site, it was found that a tidal barrier was constructed at the site in 2006 between the CDF sheet pile wall and the adjacent estuary due to seepage issues. The following observations were made during the CERCLA 5 year review conducted in 2007: corrosion on areas exposed to wave/tidal actions, seepage at joints and in areas that had a blistered appearance, and surfaces of some sections appeared to have rusted and pitted to a depth of approximately 1/8 inch.

Per a discussion with Ken Scheffler (the representative for EPA's contractor at the site), the sheet pile wall at the CDF was driven 90 to 100 feet deep. The sheet pile used in construction of the wall was ¾ to 7/8 inch thick and the design life was estimated at 30 years. According to Mr. Scheffler it was originally thought that the wall would be temporary and only remain in place for around 20 years at which time it would be removed; however this intent has changed and the wall now is considered a permanent structure. The biggest issue faced at this CDF is corrosion of the sheet pile wall. Corrosion protection was not installed concurrently with the wall so severe corrosion has occurred, especially at the mudline. One factor at this CDF that may affect the corrosion rate of the sheet pile wall is the passage of ferries by the site at approximately 30 minute intervals. As the ferries pass, they generate waves which impact the wall and the waves contain abrasive suspended materials such as sand and gravel. The corrosion observed at the CDF is considered to be severe and modifications are currently being explored for reducing the corrosion rate of the wall. Another concern expressed regarding the structural integrity of the steel sheet pile wall is the outward pressure exerted by the materials confined within the CDF. There is an elevation difference of 10 to 15 feet between the inside of the sheet pile wall and the beach outside the wall. There is concern that the corrosion observed on the wall coupled with the outward pressure due to the confined soil may cause the wall to buckle. One proposed modification currently being evaluated to address these concerns is the installation of a "fiberglass" sheet pile wall outside the existing sheet pile wall with concrete and riprap installed between the walls to support the existing steel sheet pile wall and keep water from reaching the steel sheet pile wall.

The effectiveness of this CDF is mainly empirical and is based on visual observations, as stated by Mr. Scheffler. He indicated that they are planning to install additional monitoring wells inside and outside the CDF and sheet pile wall to more accurately monitor the effectiveness of the CDF at containing dissolved and free-phase contaminants at the site. Monitoring of the effectiveness of the wall currently is performed through visual identification of seeps on the beach. The monitoring consists of flagging observed seeps on the beach, surveying the seeps, and estimating a rough approximation of the size of the seeps. There were approximately four inspections for seeps prior to installation of the sheet pile wall and one to two inspections after the wall was installed. The effectiveness of the sheet pile wall is currently evaluated by comparing the size of the seeps observed prior to installation of the wall to the size of the seeps after the sheet pile wall was installed.

A pilot study of in-situ steam injection was started at the CDF, but was abandoned due to mechanical issues so the technology was not fully tested or evaluated. It was determined that this technology was not cost effective for the site, which was another factor in the decision to abandon the pilot test.

The April 16 letter stated that site conditions that differ at the Wyckoff-Eagle Harbor CDF from the Arkema site include a nearshore marine environment, performance of the work through the CERCLA remedial process rather than the removal process, and different contaminants (mercury). Per the conversation with Ken Scheffler there are several issues that need to be taken into consideration regarding the use of sheet pile at a site. These issues include the following:

- Composition of the subsurface needs to be determined to see if sheet pile can be effectively driven into the subsurface;

- If fill is present at the site, the presence of debris needs to be evaluated as debris (logs, etc) can cause installation issues when driving sheet pile; and

- The thickness of the aquitard keyed into with sheet pile, as fracturing of the aquitard can occur depending on aquitard thickness.

EPA RPM: Mary Jane Nearman [206-553-6642]

Representative for EPA's Contractor at the Site: Ken Scheffler [206-465-3913]

Conclusion

Based on the discussion outlined above, EPA believes that there are no closely comparable CDFs identified in the United States that have been constructed with all of the factors present at the Arkema site including but not limited to DDx-contaminated sediment as the PBT interred, location within a freshwater fluvial aquatic environment, and implementation as part of a CERCLA removal action.

6. EPA's Position on Applicability of Performance Standard Expectations from the Port of Portland's T4 Project During the Arkema Removal Action

Overview of T4 Performance Standards Issues Relating to the Arkema CDF

LSS asserts in the July 25, 2008 letter that T4 performance criteria cited by EPA are not relevant or appropriate to the nearshore CDF design concept for the Arkema site, specifically for criteria pertaining to the "CDF berm" and the "sediment acceptance criteria".

EPA's position is that the terminology used within the T4 performance criteria (i.e. "CDF berm" and "sediment acceptance criteria") does not eliminate their appropriateness to the Arkema site because the underlying concepts and rationale presented for the T4 performance standards are still relevant for the removal action at the Arkema site. More specific rationale for EPA's position follows:

Overview of T4 Performance Standards Regarding the "CDF Berm"

EPA does not agree with the assertion by LSS that criteria pertaining to the "CDF berm" are not applicable to the Arkema CDF. While it is true that a berm retention system is not proposed for the Arkema CDF, the underlying conceptual criteria from the T4 performance standards still apply. The "CDF berm" criteria outlined in the June 19, 2008 letter from EPA to LSS are restated below, with explanations following as to how they are applicable to the proposed Arkema CDF.

- Construct the CDF in a manner that minimizes impacts to fisheries and wildlife by removing fish to the extent practicable from the Slip 1 area before and after berm construction, and by implementing BMPs to minimize wildlife exposures to contaminated sediments within the CDF prior to placement of the CDF cover layers.
    - An Arkema CDF should be constructed in a manner that minimizes impacts to fisheries and wildlife, and if applicable at the location of the CDF, fish shall be removed to the extent practicable, and BMPs shall be implemented to minimize wildlife exposures to contaminated sediments within the CDF prior to placement of the CDF cover layers.

- Construct the CDF berm with material that meets requirements established in the December 2003 Technical Plans and Specifications (Ecology and the Environment 2003) for the McCormick & Baxter sediment cap located within the Willamette River. Specifically, the cap material to be used for construction of the sediment cap will be imported clean granular material free of roots, organic material, contaminants, and all other deleterious and objectionable material. Chemical contaminant concentrations in cap material shall be below TEC criteria or other pre-established criteria for chemicals that do not have TEC values.
    - An Arkema CDF cap must still be designed in accordance with this T4 performance standard.

- The CDF berm shall meet the following project-specific criteria: a static safety factor of 1.5 or greater and a seismic safety factor of 1.1 or greater. The design seismic event shall correspond to a 10 percent probability of exceedance in 50 years.
  - An Arkema CDF must still be designed such that the construction materials used meet the static safety factor, seismic safety factor, and design seismic event as outlined for the T4 CDF.

- The CDF berm face shall be resistant to erosive forces by the largest of 100-year flood flow, 100-year waves, vessel-induced waves from typical passing vessels, and anticipated propeller wash from vessels that operate in the area.
  - An Arkema CDF must still be designed such that the construction materials used are resistant to erosive forces as outlined for the T4 CDF.

Overview of T4 Performance Standards Regarding the "Sediment Acceptance Criteria"

Additionally, EPA does not agree with the assertion by LSS that the "sediment acceptance criteria" are not applicable to the Arkema CDF. It is acknowledged that the Arkema CDF would be designed to accommodate sediment from this site only and Arkema does not intend to accept sediment for disposal from other sites. Although the criteria presented in the Sediment Acceptance Criteria Memorandum for the T4 CDF (Anchor 2006) were prepared for a different purpose (i.e. acceptance of off-site sediments), they are still reasonable criteria for the disposal of dredged sediments from the Arkema site into an Arkema CDF. The general requirements outlined in the memorandum for acceptance of sediment within a CDF and appropriate for the Arkema site include, but are not limited to:

- No untreated sediments that may be designated as hazardous waste (whether listed or characteristic) or contain free-phase oil will be accepted.

- Sediments must be of acceptable geotechnical character such that they do not impact the long-term performance of the CDF. As such the following apply;
  - No large debris will be allowed within the CDF
  - Dredged material shall be free of significant organic debris, such as peat, wood chips, etc.

- Sediments must be of acceptable geochemical character (i.e. bulk sediment and leachability) such that they are protective of surface water quality in the Willamette River via groundwater transport. Acceptable geochemical character shall be determined in consideration of the following;
  - Bulk sediment chemical concentrations,
  - Pancake Column Leaching Test (PCLT) concentrations, and
  - Predicted groundwater dilution and attenuation factors.

Overview of Additional T4 Performance Criteria Appropriate for an Arkema CDF

In addition to the performance standards discussed above, the following standards as listed in the June 19, 2008 EPA letter are also still considered by EPA to be appropriate for the Arkema CDF:

- Construct the CDF in a manner that minimizes to the extent practicable water quality exceedances within the construction zone and achieves compliance with water quality criteria/standards at and beyond the specified point of compliance.

- The CDF will meet Applicable or Relevant and Appropriate Requirements (ARARs) and final Portland Harbor ROD requirements. Final sediment and surface water cleanup standards will not be established for the Portland Harbor Superfund Site until the ROD is issued. ARARs have been identified for this removal action given current information. To ensure that the CDF meets ARARs and increase the probability that it will meet the future ROD standards, the CDF shall be designed as follows:

    - Such that the CDF can meet ARARs when filled with the specified design volume of sediment meeting the CDF sediment acceptance criteria, considering representative sediment contaminant concentrations and contaminant mobility data obtained from, or estimated for, sediments from T4 and other potential Portland Harbor sites where dredging is a reasonably anticipated remedial action that would generate sediments meeting the CDF sediment acceptance criteria.

    - Such that the final upper surface elevation of contaminated sediment in the CDF will be below the groundwater surface (so that the sediment remains saturated), considering reasonably anticipated seasonal and long-term cyclical groundwater levels, and considering zero recharge from the overlying ground surface.

    - Such that the CDF will achieve confinement of all hazardous substances so that the facility does not contribute any discharge and/or release of contaminants above ARARs for surface water or sediment in the lower Willamette River. In order to meet this design criteria, the CDF shall be designed such that the quality of groundwater exiting the CDF will meet EPA's national recommended chronic water quality criteria for both aquatic organisms and fish consumption by humans (17.5 grams per day [g/day]), more stringent Oregon water quality standards, Region 9 tap water Preliminary Remediation Goals (PRGs), and Maximum Contaminant Levels (MCLs). It should be noted however, that since the June 19, 2008 letter, EPA Region 10 no longer uses the Region 9 PRGs. The Region 9 PRGs have been superseded by national EPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (EPA, 2008c). These EPA Regional PRGs should be used instead of those from Region 9 until the early RI sediment PRGs are available. In addition, EPA Region 10's Human Health Screening Memo (EPA, 2007) has language that is Region-specific and shall complement or supersede the EPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites.*

    - Such that the releases of 303(d) listed contaminants will be minimized to the extent practicable.

Water Quality Monitoring

In addition to the performance standards outlined above, it is expected that water quality monitoring will be performed during removal action construction activities to confirm that water quality standards are met. At a minimum, water quality monitoring will occur during the following construction activities: structure demolition (i.e. docks and piers), construction of the CDF, dredging and transport of the dredged material to the CDF if necessary, capping, and CDF effluent discharge. Monitoring requirements will include visual monitoring (high turbidity, sheens or other visible contamination in the water, and distressed or dying fish), conventional field parameters (turbidity, pH, temperature, and dissolved oxygen [DO]) and laboratory parameters (total suspended solids [TSS] and contaminants of concern [COCs]). Water quality monitoring shall be conducted at both upstream and downstream locations at multiple depths within the water column (i.e. top, middle, and bottom).

Furthermore, long-term water quality monitoring will be conducted to monitor the integrity of the cap placed over the CDF, the concentrations of sediments both inside and outside the boundaries of the CDF, the structural stability of the CDF, and the groundwater quality both inside and outside of the CDF. The long-term monitoring will include a comparison of groundwater concentrations inside and outside the CDF to chronic water quality criteria or ambient background water quality in the Willamette River adjacent to the CDF. Long-term monitoring will be used to confirm whether groundwater exiting the CDF meets USEPA's national recommended chronic water quality criteria for both aquatic organisms and fish consumption by humans (17.5 g/day), Oregon water quality criteria, Regional PRGs, and relevant, promulgated drinking water criteria (otherwise known as MCLs).

EPA believes the T4 performance standards are appropriate for a CDF at the Arkema site and will be used to ensure the long-term structural integrity of the CDF is maintained and to verify contaminants are adequately contained in the CDF. The performance standards should be measured inside and outside of the CDF boundary, regardless of hydraulic control and the use of sheet pile wall, in order to evaluate potential releases from the CDF into the river. The performance standards can be measured through the use of either piezometers or perimeter wells both inside and outside the boundary of the CDF.

Conclusion

Based on the rationale outlined above, EPA believes it is reasonable that the proposed Arkema CDF will be required (at a minimum) to follow similar design expectations and performance criteria as was used at the T4 site. Please let me know if you have any questions or concerns about this letter at (206) 553-1220 or via email at Sheldrake.sean@epa.gov.

Sincerely,

Sean Sheldrake, RPM

Cc:

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