

Appendix H  
RM 10.9 Removal Action Sediment-Washing Bench-  
Scale Testing Report

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September 17, 2012

Ms. Stephanie Vaughn  
ATTN: Lower Passaic River Remedial Project Manager  
Emergency and Remedial Response Division  
U.S. EPA, Region 2  
290 Broadway, 19th Floor  
New York, New York 10007

**Via Electronic & US Mail**

**Re: RM 10.9 Removal Action – Sediment Washing Bench-Scale Testing Report, Lower Passaic River Study Area - CERCLA Docket No.02-2012-2015**

Dear Ms. Vaughn:

Pursuant to paragraph 20 of the “Administrative Settlement Agreement and Order on Consent for Removal Action,” captioned “In the Matter of Lower Passaic River Study Area portion of the Diamond Alkali Superfund Site,” CERCLA Docket No. 02-2012-2015 (AOC), de maximis, inc is writing on behalf of the Cooperating Parties Group (CPG) to provide the results of the sediment washing bench-scale pilot results and the CPG’s decision on whether to conduct sediment washing pilots with RM 10.9 Removal Action sediment.

The Sediment Washing bench-scale tests were not able to achieve the degree of removal required to meet residential soil clean-up standards or provide cost-effective contaminant reductions for disposal at landfills (RCRA Subtitle D versus Subtitle C) for dioxins/furans, PCBs, and PAHs in the RM 10.9 Removal Area sediments. Therefore, the CPG will not be conducting pilot-scale treatment of RM 10.9 Removal Action sediment.

### **Introduction**

This letter report presents unvalidated laboratory results from the bench-scale Sediment Washing technology testing conducted with representative aliquots of sediment collected from River Mile (RM) 10.9 of the Lower Passaic River. These studies were performed at the request of the U.S. Environmental Protection Agency (USEPA) to evaluate the potential effectiveness and implementability of Sediment Washing as a treatment and beneficial reuse option for RM 10.9 Removal Action sediment.

In August 2012, bench-scale treatability tests were performed by two Sediment Washing technology vendors (BioGenesis and Pear Technology) using bulk sediment samples collected in accordance with the *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addenda A* (AECOM, 2012) and *B* (CH2M HILL, 2012). Preliminary results for key site constituents are summarized herein.

**Privileged & Confidential – Prepared At The Request Of Counsel**

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### **Bench-Scale Study Objectives**

Bench-scale treatability tests were performed by the two vendors as a first step towards evaluating potential ex-situ treatment and beneficial reuse options for impacted sediments that could be generated from environmental dredging in the Lower Passaic River Study Area (LPRSA). The primary objectives of the bench-scale treatability tests were:

- determine the technical efficacy and cost-effectiveness of the Sediment Washing process for removing site-specific chemicals of potential concern (COPCs) from the RM 10.9 Removal Action sediment; and,
- provide a basis for the Sediment Washing technology vendors to develop cost estimates for pilot-scale implementation using RM 10.9 sediment, if the technology can meet applicable site-specific performance standards.

The bench-scale testing activities were designed and performed to produce information and data to answer the following questions:

- Will the selected sediment treatment technology provide a technically feasible, implementable, and cost-effective solution to the handling of the sediments in LPRSA?
- Will the treated sediment quality satisfy New Jersey Department of Environmental Protection (NJDEP) soil cleanup criteria for residential use and 1,000 parts per trillion (ppt) or less total dioxin toxicity equivalents (TEQ)?
- Will the selected treatment technology reduce the cost of disposal of the impacted sediment?

### **Collection of RM 10.9 Removal Area Sediment**

In May 2012, RM 10.9 Removal Area sediment was collected for use in the bench-scale treatability studies as detailed in the *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum A* (AECOM, 2012). A total of approximately 100 gallons of sediment was composited from five locations within the RM 10.9 Removal Area. The bulk composite sample was then split and placed into two 55-gallon drums for transport to the Sediment Washing technology vendors. Before shipping, analytical samples were collected from each 55-gallon drum to characterize the untreated sediment for select COPCs.

Sediment collected from the five sediment core locations (Figure 1) was composited to generate the bulk sediment sample. These core locations were chosen based on a review of the RM 10.9 analytical results for PCDDs/PCDFs as represented by 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD], total PCBs, mercury, and PAHs. These core

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locations were identified as having relatively elevated concentrations of these COPCs in comparison to the other sediments in the RM 10.9 Removal Area.

### **Bench-Scale Sampling and Analytical Methods**

The bench-scale sampling and analytical methods summarized in this section were conducted in accordance with the *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum B* (CH2M HILL, 2012). To evaluate each vendor's Sediment Washing technology, the following samples were collected during the bench-scale treatability tests:

- Untreated sediment,
- Treated sediment, and
- Wash water

Both untreated and treated sediment samples were analyzed for the RM 10.9 Group A analytes to estimate percent removal. Additionally, Toxicity Characteristic Leaching Procedure (TCLP) analyses were conducted on the treated sediment for waste disposal purposes. Wash water generated during the Sediment Washing process was analyzed for select discharge to surface water permit equivalent analytes. Duplicate samples were collected for QA/QC from both the untreated sediment and waste water holding tank at one vendor (BioGenesis). USEPA and CPG representatives were present during the bench-scale testing to observe the process and to collect samples.

### **Summary of Analytical Results**

A summary of analytical results for four primary COPCs (total dioxin TEQ, total PCBs, benzo(a)pyrene, and mercury) measured in untreated and treated sediments collected during the bench-scale treatability studies is presented in Table 1. The results indicate that the Sediment Washing technologies implemented by BioGenesis and Pear Technology were not able to achieve NJDEP residential soil direct contact criteria for total PCBs or benzo(a)pyrene during the bench-scale testing. In addition, total dioxin TEQ concentrations in the treated sediment (7,680 to 9,090 ppt TEQ) were well above residential cleanup standards established by USEPA, which include concentrations up to approximately 1,000 ppt TEQ (USEPA 2009; USEPA, 2012b). Although mercury concentrations in the treated sediment were below the applicable NJDEP residential soil standard, it should be noted that mercury concentrations in the untreated sediment composite sample were already below this criterion.

The treated sediment concentrations presented in Table 1 represent sediment that was run through each vendor's treatment technology one time. During this single pass, the maximum dioxin removal was 27% and benzo(a)pyrene removal ranged between 13% and 58%. Though removal of total PCBs was not observed under the Pear Technology process, approximately 62% of the total PCBs were removed with BioGenesis' Sediment

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Washing Technology. Notwithstanding, in order to produce a final sediment product that could be considered a candidate for beneficial reuse, the Sediment Washing technologies would have to ultimately achieve greater than 90% and 95% removal for benzo(a)pyrene and total PCBs, respectively. In addition, total dioxin TEQ concentrations in the untreated sediment would need to be reduced by one to two orders of magnitude to meet applicable USEPA risk-based criteria. The CPG understands the results of USEPA's split samples are consistent with the CPG's results.

### **Pilot Scale Test Proposals**

Following completion of the bench-scale testing effort the CPG requested that the sediment washing vendors (BioGenesis and Pear Technology) provide proposals to implement a full-scale pilot operation to treat RM 10.9 Removal Action sediment. The proposals were to include the proposed technical approach as well the associated costs for the treatment of 9,000 to 18,000 CY of dredged sediments. Given the uncertainty associated with the dioxin cleanup criteria the vendors were requested to provide costs to meet three dioxin TEQ levels (1,000 ppt, 500 ppt and 100ppt) and to meet NJDEP residential soil levels for all other contaminants.

The technical proposal was to include pilot-scale treatability costs on a unit price basis (\$/CY) to achieve the following treatment criteria for dioxin TEQ:

- 1,000 ppt
- 500 ppt
- 100 ppt

Pear Technology chose not to provide a proposal at this time; however, Pear Technology did request an extension of 60-days to conduct additional bench-scale tests. The extension has not been approved at this time.

BioGenesis met the proposal deadline and submitted a proposal to implement a full-scale pilot operation that requires a minimum of 15,000 CY of RM 10.9 Removal Action sediment.. The costs provided by BioGenesis were aggregated and then divided by 18,000 CY to provide a unit cost per dioxin TEQ treatment target:

- 1000 ppt - \$558 / CY
- 500 ppt - \$597 / CY
- 100 ppt - \$695 / CY

These unit rates do not include the costs for transportation and disposal of the sediment and associated debris.

The CPG's RM 10.9 Basis of Design includes information that allows for cost estimates of sediment stabilization and dewatering technologies to be compared to the sediment

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washing costs. A cost comparison of the three treatment technologies along with the associated transportation and landfill disposal costs is provided below in Table 2.

### **Conclusions**

The bench-scale tests were performed to evaluate the potential effectiveness and implementability of Sediment Washing as a treatment and beneficial reuse option for RM 10.9 Removal Action sediments. In order to qualify for beneficial reuse, the treated sediment is expected to meet residential criteria for dioxins/furans, PCBs, PAHs, and other constituents. The Sediment Washing bench-scale tests were not able to achieve the degree of removal required to meet the stringent beneficial reuse concentration objectives for dioxins/furans, PCBs, and PAHs in the RM 10.9 Removal Area sediments. Therefore, the treated sediment would not be eligible for beneficial reuse and would need to be further treated or disposed of at a permitted landfill, resulting in an estimated unit cost of \$723/CY to \$860/CY.

Sediment washing without the benefit of an economical reuse or disposal option (Subtitle D versus Subtitle C landfills) is not a cost effective approach to treat and dispose of RM 10.9 Removal Action sediments. Sediment Washing technology will not be pursued by the CPG for the RM 10.9 Removal Action sediments. The CPG has determined that both stabilization and mechanical dewatering are significantly more cost effective treatment alternatives for the RM 10.9 Removal Action sediments than sediment washing (Table 2) and both will be further evaluated as part of the remedial design.

The CPG will submit the complete data set for the sediment washing bench-scale when validation is complete.

Please contact Willard Potter or me, if you have any questions or comments.

Very Truly Yours,  
**de maximis, inc.**

Robert H. Law, Ph.D.  
CPG Project Coordinator

cc: Ray Basso, EPA  
CPG Members  
William Hyatt, CPG Coordinating Counsel  
Willard Potter, CPG Project Coordinator

Enclosures: Tables, Figure and References

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**Table 1 - Summary of Percent Removal for Select Constituents (unvalidated data)**

*Bench Scale Testing of Sediment Washing Technologies for RM 10.9 Sediments, Lower Passaic River Study Area*

	<b>Total Dioxin TEQ (ppt)</b>	<b>Total PCBs (mg/kg)</b>	<b>Mercury (mg/kg)</b>	<b>Benzo(a)pyrene (mg/kg)</b>
<b>NJDEP Residential Direct Contact Criteria</b>	NA	0.49	14	0.66
<b>BioGenesis</b>				
Untreated	7,700, 7,980, 10,300 <sup>a</sup>	11.1, 11.4	8.4, 9.2	4.0, 6.5
Treated	7,680	4.3	2.9	3.5
Removal	<1-25%	61–62%	65–68%	13–46%
<b>Pear Technology</b>				
Untreated	12,500	12.3	10.7	5.2
Treated	9,090	14.5	4.8	2.2
Removal	27%	None	55%	58%

<sup>a</sup> The dioxin/furan TEQ value of 10,300 ppt TEQ presented for BioGenesis untreated sediment is from the bulk aliquot sample collected prior to shipment to BioGenesis. The untreated sediment samples analyzed the day of the bench-scale testing (7,700 and 7,980 ppt TEQ) had uncharacteristically low concentrations for this constituent, likely due to particle size segregation within the 55-gallon drum during shipment and subsequent inadequate mixing of the bench-scale aliquot prior to sampling.

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**Table 2 - Treatment Technology Cost Comparison**

*Bench Scale Testing of Sediment Washing Technologies for RM 10.9 Sediments, Lower Passaic River Study Area*

Treatment Technology	Treatment Cost	Water Treatment Cost	Transportation and Disposal Costs	Unit Cost (cubic yard )
Sediment Washing (1000 ppt) BioGenesis	\$10,051,675	\$0 included in treatment unit cost	\$2,969,015	\$723
Sediment Washing (100 ppt) BioGenesis	\$12,505,675	\$0 included in treatment unit cost	\$2,969,015	\$860
Dewatering	\$4,915,000	\$2,972,286	\$2,969,015	\$603
Stabilization	\$4,809,323 (includes T&D RCRA Subtitle C Landfill)	\$1,524,585	Included in treatment	\$352



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**References**

AECOM. 2011. Low Resolution Coring Characterization Summary, Lower Passaic River Study Area RI/FS. Fort Collins, Colorado. July.

AECOM. 2012. *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum A. Sediment Collection for Bench-Scale Testing of Sediment Treatment and Dewatering Technologies and for Additional Delineation, Rev 0.* Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. May 2012.

CH2M HILL. 2012. *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum B. Bench-Scale Testing of Sediment Treatment Technologies, Rev 1.* Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. July 2012.

USEPA. (U.S. Environmental Protection Agency). 2005. "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites." *EPA-540-R-05-012 OSWER 9355.0-85.* December.

USEPA. 2009. "Review of State Soil Cleanup Levels for Dioxin." December.

USEPA. 2012a. Diamond Alkali, Lower Passaic River Study Area—River Mile 10.9 Administrative Settlement Agreement and Order on Consent for Removal Action. May 21 (effective June 15).

USEPA. 2012b. "EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS comments, Volume 1." *EPA-600-R-10/038F.* February.