URS

October 20, 2003

Cecilio S. Felix
California Regional water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: **Supplemental Mercury Treatability Study**
Subunit 2A, Meade Street Operable Unit, Order # 01-102
Richmond Field Station, Richmond, CA

Dear Mr. Felix,

This letter report provides the results of the supplemental treatability study performed by URS Corporation (URS) from March through July 2003 on the stabilization of mercury in impacted sediments, cinders, and soil (sediment/cinders) located at the University of California Berkeley Richmond Field Station (RFS) in Richmond, CA.. This study follows an earlier benchscale treatability study performed by Wilder Construction Company (Wilder) from July through October 2002. The results of the benchscale treatability study were submitted to the California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) in a report titled *Remedial Design Details – Addendum 2, Mercury Treatability Study Results* (RDDR Addendum 2) on November 6, 2002. The scope of work for the supplemental treatability study was based on the *Mercury Treatability Study Work Plan* (Work Plan) dated April 1, 2003.

The purpose of this supplemental treatability study is to confirm the results of the treatability study conducted in 2002 and to demonstrate the effectiveness of the stabilization treatment in reducing the leachable concentration of mercury to below 0.25 ug/L (ten times the USEPA Ambient Water Quality Criteria). The results of the treatability study were used to select the reagent and dosage to stabilize the mercury contained in the sediment/cinders to the prescribed leachate level. The treated sediment/cinders excavated from the RFS will then be further treated for cinder related metals, placed, and capped on the adjacent Subunit 1 property, as described in the RDDR submitted to the RWQCB by LFR on behalf of Zeneca, Inc. on January 31, 2002.

1.0 INTRODUCTION

A discussion of the site and mercury treatability study background was provided in the Work Plan. As discussed in the Work Plan, three criteria were developed for the treatment of sediment/cinders from the RFS site that will be placed on Subunit 1: 1) total mercury concentration must be below 260 mg/kg, 2) treated sediment/cinders must have a pH between 6.0 and 9.5, and 3) leachate from the treated sediment/cinders must have a mercury concentration

URS Corporation
500 12th Street, Suite 200
Oakland, CA 94607-4014
Tel: 510.893.3600
Fax: 510.874.3268

less than 0.25 ug/L. The results of the benchscale treatability study performed in 2002, as described in RDDR Addendum 2, indicated that 5 percent Powdered Activated Carbon (PAC) by weight was effective at reducing the mercury in leachate to less than 0.25 ug/L within the acceptable pH range. During this supplemental mercury treatability study, several rounds of treatment were performed on sediment/cinders from the RFS to assess different activated carbon treatment reagents and dosages as well as to evaluate the effectiveness of the Ecobond reagent. Additional testing with Ecobond, a proprietary reagent, also showed potential success during the initial study. However, additional testing was required to fully evaluate its effectiveness.

2.0 MERCURY TREATABILITY STUDY RESULTS

Round 1: Sample Selection

The *Remedial Design Details – Addendum, Subunit 2A, Meade Street Operable Unit* (RDDR Addendum), prepared by URS on August 16, 2002, identified areas containing concentrations greater than 50 mg/kg as requiring stabilization treatment for mercury prior to transport and placement on the Subunit 1 property. As described in the Work Plan, representative sediment/cinder samples for the supplemental treatability study were collected from six test pits: five in the upland area (TTP-1, TTP-2, TTP-5, TTP-6, and TTP-7) and one in the marsh area (TTP-4). Approximately 25 gallons of sediment/cinders from each sample location were collected, homogenized, and analyzed by Curtis and Tompkins, Ltd., a state certified laboratory, for mercury, pH, and percent moisture in March 2003. The results of the sediment/cinder sample analyses are presented in Table 1. An 8-day distilled water leach test (8-day leach test) was performed on sediment/cinder samples from locations containing greater than 50 mg/kg mercury. The 8-day leach test procedure is described in the Work Plan, and results of the test are also presented in Table 1.

Sediment/cinders from location TTP-1 were selected for the supplemental treatability study because the mercury concentration was 190 mg/kg (between 50 mg/kg and 260 mg/kg) and the leachate from this sample contained the highest mercury concentration (4.0 ug/L). Thus, sample TTP-1 had the greatest leaching potential of all the samples collected. Sediment/cinders from TTP-1 represent a reasonable worst-case scenario for sediment that would be treated during the full-scale mercury treatment because the majority of the sediment/cinders that will be excavated and treated for mercury will contain less total and leachable mercury based on previous sampling events.

Round 2: Activated Carbon Selection

A series of leachate tests were performed on sediment/cinders from location TTP-1 in efforts to select the type and dosage of activated carbon that would most effectively reduce the concentration of mercury in the sample leachate. Three types of activated carbon were used including PAC, Fine Activated Carbon (FAC), and Granular Activated Carbon (GAC). In Round 2A, performed on April 15 and 16, sediment from TTP-1 was treated with 2.5 percent, 5 percent, and 7.5 percent (by weight) PAC, FAC, and GAC. A 1-day leach test was performed in

duplicate on the treated sediment/cinders and untreated control samples to determine the most effective treatment. Field-filtered leachate samples were sent to STL Chromalab (STL), a state certified laboratory, for total mercury analysis. GAC and FAC treatment reduced the leachable concentrations of mercury, but not to the required level. GAC and FAC results are presented in Tables 2 and 3, respectively. PAC treatment most consistently reduced the concentrations of mercury to the required level. PAC results are presented in Table 4. Although the FAC results indicated that it was not quite as effective as the PAC, it was carried through the study due to the ease of use during full scale implementation. Based on the results of Round 2A, FAC and PAC were selected for further evaluation.

Round 2B was performed on April 29 to compare the effectiveness of the field filtering procedures to filtering procedures at the laboratory. A 1-day leach test was performed on sediment/cinder samples from TTP-1 treated with 5 percent PAC. Four samples (two field-filtered and two laboratory-filtered) were sent to STL for analysis. The mercury concentrations in the leachate samples that were filtered in the field were equivalent to the mercury concentrations in the leachate samples that were filtered in the laboratory (see Table 4), indicating that the field filtering procedures and laboratory filtering procedures were equivalent. Based on the results from Round 2B, the leachate samples collected during subsequent rounds of sampling were filtered in the laboratory.

Round 2C of the treatability study, performed from April 29 to May 7, was an 8-day leach test performed on selected samples based on the results of Round 2A. Sediment/cinders from TTP-1 were treated with 2.5 percent and 5 percent PAC and 2.5 percent, 5 percent, and 7.5 percent FAC. Sediment/cinders treated with 7.5 percent PAC were not evaluated because, during Rounds 2A and 2B, 5 percent PAC had reduced leachable concentrations to below the required level. Unfiltered samples from the 8-day leach test performed in duplicate on the treated sediment/cinders and untreated control samples were sent to Frontier Geosciences (Frontier) for dissolved mercury analysis and STL for pH analysis (STL was less expensive than Frontier for analyses). FAC treatment did not reduce the leachable concentrations of mercury to the required levels (Table 3). Thus, FAC was eliminated from further evaluation. PAC at 2.5 percent was also eliminated from further evaluation since it did not consistently reduce the leachable concentrations to the required level (Table 4). Based on Round 2C, 5 percent PAC was selected as the most effective reagent and dosage and was retained for further evaluation in Round 3, the 30-day oxidation study.

Round 3: Oxidation Study

During Round 3 of the supplemental mercury treatability study, sediment/cinders from location TTP-1 were treated with 5 percent PAC and placed in piles, approximately 6 inches tall. The piles of untreated sediment/cinders and treated sediment/cinders were kept undisturbed at ambient conditions and allowed to dry and potentially oxidize for 33 days (from May 28 to June 30). After 33 days, 1-day and 8-day leach tests were conducted on the samples in duplicate. Unfiltered leachate samples were sent to Frontier for dissolved mercury analysis, and pH was measured in the field using a pH meter. The results of the oxidation study indicated that 5

percent PAC treatment reduced the concentration of mercury to the required level in both the 1-day and 8-day leach tests; three samples contained mercury concentrations well below 0.25 ug/L, and one sample contained a mercury concentration of 0.272 ug/L. The pH in the treated samples ranged from 8.2 to 8.3 (below the maximum of 9.5). The results of the oxidation study are presented in Table 4.

Ecobond Study

Two different Ecobond mercury stabilization agents were investigated. The first reagent Ecobond Hg-1 was not successful in reducing the mercury in the samples to less than 0.25 ug/L mercury. The pH for the tests ranged from 5.2 to 8.3 and the lowest mercury concentration was 2.9 ug/L. Fifteen tests were completed for this additive.

The second additive, Ecobond Hg-2, was successful in reducing the mercury to less than 0.25 ug/L but not consistently. Fourteen tests were performed at different dosages and six tests were successful. There was some indication that there may have been a contaminant at the Ecobond labs. However, due to the construction schedule and potential Ecobond reagent costs, additional studies were terminated.

Summary/Recommendation

Based on the results of the activated carbon testing, 5 percent PAC is the reagent and dosage that most effectively reduces the concentration of mercury in the sample leachate. 1-day and 8-day leach tests on treated sediment/cinder samples from location TTP-1 indicated that 5 percent PAC will reduce the concentration of mercury in the leachate to the required level. Of the 12 leachate samples that were collected from sediment/cinder treated with 5 percent PAC, the mercury concentrations in 10 of the samples were treated to below the 0.25 ug/L level. The mercury leachate concentrations ranged from 0.0309 ug/L to 0.163 ug/L, and the mercury concentration in one of the samples was just slightly above the level at 0.272 ug/L. Table 5 summarizes the results of the leach tests that were performed using 5 percent PAC.

3.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLING AND PROCEDURES

To ensure that the material in the field is adequately treated and meets the criteria specified for the stabilization (pH between 6.0 and 9.5 and leachable mercury concentration less than 0.25 ug/L), quality assurance/quality control (QA/QC) testing will be performed on the treated sediment/cinders. Three types of QA/QC testing will be performed: PAC and limestone application rate measurements, pH testing, and mercury testing.

PAC and Limestone Application Rate

To determine the proper weight of PAC to be added, the contractor will perform a direct weight measurement of the sediment/cinders by bucket loader. The bucket loader will be specially equipped with a scale that measures the weight of material as it is added to the mixing bin. Each

bucket will be recorded until the specified weight is achieved. The limestone and PAC will be added at the specified weight percentage of 7.5% and 5.0%, respectively. The bucket scale will be calibrated daily. An alternate method that may be performed by the contractor is calculation of weight by the density method. A representative area (the mixing bin size) will be stockpiled on the treatment pad. Three samples will be collected and density tests performed. The volume of soil will be calculated by a set level within the bin. The weight of soil will be calculated based on the volume of the bin multiplied by the average density and adjusted for moisture content. The contractor will obtain the densities of the limestone and the PAC from the manufacturers and will verify by onsite density tests. The volume of the bucket used to load the bin will be calculated and multiplied by the density. All density measurements and equipment sizes (bucket volumes) will be recorded and verified by the QA/QC oversight staff everyday. The application rates will also be compared to the total measured carbon sack as provided by the manufacturer. The application rate of PAC and limestone will be measured for each 30-ton bin of treated sediment/cinders.

pH Sample Collection

Visual observations of the mixing procedures will be performed to ensure that the mixing is thorough and the final mixture is homogenous. The pH will be tested at an initial frequency of one sample collected for each 30-ton bin for the first 10 bins treated (1 sample per 20 yards). Upon successful pH results during the initial sampling period, the sampling rate will be reduced to a frequency of one 5-point composite sample per 500 cubic yards of mixed material. One sample will be collected from every 5th bin for a total of 25 bins and composited into one sample. The pH must be greater than 6.0 with an average of 4 samples with no one sample being less than 5.5.

Soil pH testing will be performed by a URS or BBL representative and will follow a modified version of EPA Method 9045 as follows:

1. Collect treated sediment/cinders in a sample jar;
2. Add distilled water in a 1:1 ratio by volume;
3. Shake for 30 seconds;
4. Let site for 10 minutes; and
5. Measure pH of slurry with calibrated portable digital pH meter (calibrated daily).

Mercury Leachate Sample Collection

The mercury leachate will be tested at an initial frequency of one sample collected for each of the first five 30-ton bins and composited for analysis. This procedure will be performed on the first 15 bins treated. The soil/sediment will be analyzed for total mercury and the 24-hour leachate samples will be analyzed for pH and mercury by a state certified laboratory. The laboratory pH value will be used to confirm the field pH data. Leachable mercury concentration must be less than 0.25 ug/L and the pH must be greater than 6.0. If the leachate concentration is

significantly greater than 0.25 ug/L, the material will be remixed or retreated. Upon successful analytical results during the initial sampling period, the sampling rate will be reduced to a frequency of one 5-point composite sample per 3,000 tons (2,000 cubic yards) of mixed material.

Material containing less than 50 mg/kg will be transported to Subunit 1 while waiting analytical and approval by Subunit 1. Once the analytical results show that the treatment has reduced mercury leaching to levels that are protective of the underlying groundwater and nearby surface water, the material will be capped at Subunit 1.

4.0 CONCLUSIONS

Based on the treatability study results, the elevated mercury concentration in the contaminated sediment/cinders at the RFS site can be stabilized to levels that will protect water quality when the material is treated and transported to the neighboring Subunit 1. The stabilization agent and dosage that results in acceptable pH and mercury concentrations in leachate from treated sediment/cinders is PAC at 5 percent by wet weight.

Please call Corinne De Voe at (510) 874-3028 or Diane Mims of BBL at (925) 274-1100 if you have questions or need any additional information.

Sincerely,

URS CORPORATION

Corinne De Voe, P.E.
Senior Civil Engineer

Mary Esper, P.E.
Project Manager

Attachments:

Tables
Table 1: Sample Selection
Table 2: Granular Activated Carbon
Table 3: Fine Activated Carbon
Table 4: Powdered Activate Carbon
Table 5: Summary 5% Powdered Activated Carbon Results

cc: Michael Hryciw, Capital Projects, University of California, Berkeley
Karl Hans, Environment, Health, & Safety, University of California, Berkeley
Anna Moore, Environment, Health, & Safety, University of California, Berkeley
Patrick Schlesinger, UC General Counsel, University of California, Berkeley
Diane Mims, BBL, Inc.

John D. Edgcomb, Law Office of John D. Edgcomb
Jane Anderson, de maximis, Inc
William Carson, Levine Fricke
File

Table .
Richmond Field Station Mercury Treatability Study
Sample Selection

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate
							Hg	pH	% Moisture	Hg
First Round - Sample Selection **Laboratory: Curtis and Tompkins; Date: March 14, 2003**										
TTP-1	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	190 mg/kg	6.2	21%	4.0 ug/L[1]
TTP-2	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	160 mg/kg	6.9	23%	0.50 ug/L
TTP-3	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	Sample not able to be collected because the marsh sample location was not accessible.			N/A
TTP-4	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	12 mg/kg	N/A	74%	N/A[2]
TTP-5	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	66 mg/kg	N/A	33%	< 0.20 ug/L
TTP-6	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	210 mg/kg	6.6	42%	2.1 ug/L[3]
TTP-7	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	18 mg/kg	N/A	24%	N/A[2]

Notes:

[1] One of two duplicate samples did not settle. Therefore, unfiltered leachate for the initially unsettled sample was collected and sent to the laboratory to filter after settling the wee
The leachate filtered after weekend mercury concentration was 9.7 ug/L.

[2] Did not analyze due to low total mercury.

[3] Sample did not settle, therefore, unfiltered leachate was collected and sent to the laboratory to filter after settling the weekend.

Table 1

Richmond Field Station Mercury Treatability Study
Granular Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate
							Hg	pH	% Moisture	Hg
First Round - Sample Selection										
Laboratory: Curtis and Tompkins; Date: March 14, 2003										
TTP-1	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	190 mg/kg	6.2	21%	4.0 ug/L[1]
Round 2A - 1-Day Granular Activated Carbon Treatability Study										
Laboratory: STL Chromalab; Date: April 15 and 16, 2003										
Control Samples										
TTP-1-UNTREATED-1DAY-041603-1	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	6.2 ug/L
TTP-1-UNTREATED-1DAY-041603-2	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	3.3 ug/L
2.5% GAC (ACNS)										
TTP-1-2.5%GAC-1DAY-041603-1	1-day Leachate	2.5% GAC	520 grams	13 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	2.1 ug/L
TTP-1-2.5%GAC-1DAY-041603-2	1-day Leachate	2.5% GAC	520 grams	13 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.8 ug/L
5% GAC (ACNS)										
TTP-1-5%GAC-1DAY-041603-1	1-day Leachate	5% GAC	520 grams	26 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	1.8 ug/L
TTP-1-5%GAC-1DAY-041603-2	1-day Leachate	5% GAC	520 grams	26 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	1.8 ug/L
7.5% GAC (ACNS)										
TTP-1-7.5%GAC-1DAY-041603-1	1-day Leachate	7.5% GAC	520 grams	39 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	2.2 ug/L
TTP-1-7.5%GAC-1DAY-041603-2	1-day Leachate	7.5% GAC	520 grams	39 grams GAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	5.4 ug/L

Notes:

[1] One of two duplicate samples did not settle. Therefore, unfiltered leachate for the initially unsettled sample was collected and sent to the laboratory to filter after settling the weekend. The leachate filtered after weekend mercury concentration was 9.7 ug/L.

Table _
Richmond Field Station Mercury Treatability Study
Fine Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate	
							Hg	pH	% Moisture	Hg	pH
First Round - Sample Selection											
Laboratory: Curtis and Tompkins; Date: March 14, 2003											
TTP-1	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	190 mg/kg	6.2	21%	4.0 ug/L[1]	N/A
Round 2A - 1-Day Fine Activated Carbon Treatability Study											
Laboratory: STL Chromalab; Date: April 15 and 16, 2003											
Control Samples											
TTP-1-UNTREATED-1DAY-041603-1	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	6.2 ug/L	N/A
TTP-1-UNTREATED-1DAY-041603-2	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	3.3 ug/L	N/A
2.5% FAC (30NS)											
TTP-1-2.5%FAC-1DAY-041603-1	1-day Leachate	2.5% FAC	520 grams	13 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.069 ug/L	N/A
TTP-1-2.5%FAC-1DAY-041603-2	1-day Leachate	2.5% FAC	520 grams	13 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	3.1 ug/L	N/A
5% FAC (30NS)											
TTP-1-5%FAC-1DAY-041603-1	1-day Leachate	5% FAC	520 grams	26 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	1.6 ug/L	N/A
TTP-1-5%FAC-1DAY-041603-2	1-day Leachate	5% FAC	520 grams	26 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	1.4 ug/L	N/A
7.5% FAC (30NS)											
TTP-1-7.5%FAC-1DAY-041603-1	1-day Leachate	7.5% FAC	520 grams	39 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.97 ug/L	N/A
TTP-1-7.5%FAC-1DAY-041603-2	1-day Leachate	7.5% FAC	520 grams	39 grams FAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.81 u/L	N/A

Table _

Richmond Field Station Mercury Treatability Study
Fine Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate	
							Hg	pH	% Moisture	Hg	pH
Round 2C - 8-Day Carbon Treatability Study											
Laboratory: Frontier Geosciences for Mercury, STL for pH; Date: Mixed Samples on April 29, 2003 and May 6, 2003; Extracted Samples on May 7, 2003											
Control Samples											
TTP-1-UNTREATED-8DAY-050703-1	8-day Leachate	None	1000 grams	None	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.228 ug/L	6.9
TTP-1-UNTREATED-8DAY-050703-2	8-day Leachate	None	1000 grams	None	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.337 ug/L	6.9
2.5% FAC											
TTP-1-2.5%FAC-8DAY-050703-1	8-day Leachate	2.5% FAC	1000 grams	25 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	1.05 ug/L	7.8
TTP-1-2.5%FAC-8DAY-050703-2	8-day Leachate	2.5% FAC	1000 grams	25 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	1.13 ug/L	7.8
5% FAC											
TTP-1-5%FAC-8DAY-050703-1	8-day Leachate	5% FAC	1000 grams	50 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.531 ug/L	8
TTP-1-5%FAC-8DAY-050703-2	8-day Leachate	5% FAC	1000 grams	50 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.599 ug/L	7.8
7.5% FAC											
TTP-1-7.5%FAC-8DAY-050703-1	8-day Leachate	7.5% FAC	1000 grams	75 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.265 ug/L	8.3
TTP-1-7.5%FAC-8DAY-050703-2	8-day Leachate	7.5% FAC	1000 grams	75 grams FAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[2]	N/A	N/A	N/A	0.41 ug/L	8.2

Notes:

[1] One of two duplicate samples did not settle. Therefore, unfiltered leachate for the initially unsettled sample was collected and sent to the laboratory to filter after settling the weekend. The leachate filtered after weekend mercury concentration was 9.7 ug/L.

[2] Samples sent to Frontier Geosciences for dissolved mercury analysis were filtered and preserved upon arrival at the lab.

Table
Richmond Field Station Mercury Treatability Study
Powdered Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate	
							Hg	pH	% Moisture	Hg	pH
First Round - Sample Selection											
Laboratory: Curtis and Tompkins; Date: March 14, 2003											
TTP-1	Soil/8-day Leachate	None	500 grams	None	500 grams (mL)	4-oz/125 mL filtered leachate in preserved container and 125 mL in unpreserved container	190 mg/kg	6.2	21%	4.0 ug/L [1]	N/A
Round 2A - 1-Day Powdered Activated Carbon Treatability Study											
Laboratory: STL Chromalab; Date: April 15 and 16, 2003											
Control Samples											
TTP-1-UNTREATED-1DAY-041603-1	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	6.2 ug/L	N/A
TTP-1-UNTREATED-1DAY-041603-2	1-day Leachate	None	520 grams	None	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	3.3 ug/L	N/A
2.5% PAC (BHNS)											
Mix reagent with soil in beakers, each with 520 grams soil. Collect leachate from each beaker after 1 day.											
TTP-1-2.5%PAC-1DAY-041603-1	1-day Leachate	2.5% PAC	520 grams	13 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	180 mg/kg [2]	N/A	33% [2]	0.14 ug/L	N/A
TTP-1-2.5%PAC-1DAY-041603-2	1-day Leachate	2.5% PAC	520 grams	13 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	150 mg/kg [2]	N/A	34% [2]	0.13 ug/L	N/A
5% PAC (BHNS)											
Mix reagent with soil in beakers, each with 520 grams soil. Collect leachate from each beaker after 1 day.											
TTP-1-5%PAC-1DAY-041603-1	1-day Leachate	5% PAC	520 grams	26 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	140 mg/kg [2]	N/A	37% [2]	3.5 ug/L	N/A
TTP-1-5%PAC-1DAY-041603-2	1-day Leachate	5% PAC	520 grams	26 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	150 mg/kg [2]	N/A	37% [2]	0.071 ug/L	N/A
7.5% PAC (BHNS)											
Mix reagent with soil in beakers, each with 520 grams soil. Collect leachate from each beaker after 1 day.											
TTP-1-7.5%PAC-1DAY-041603-1	1-day Leachate	7.5% PAC	520 grams	39 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.33 ug/L	N/A
TTP-1-7.5%PAC-1DAY-041603-2	1-day Leachate	7.5% PAC	520 grams	39 grams PAC	520 grams (mL)	125 mL filtered leachate in preserved container	N/A	N/A	N/A	0.049 ug/L	N/A

Table

Richmond Field Station Mercury Treatability Study
Powdered Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate	
							Hg	pH	% Moisture	Hg	pH
Round 2B - Testing Filtration Technique - 1-Day Test on 5% PAC[3]											
Laboratories: STL Chromalab; Date: April 29, 2003											
TTP-1-5%PAC-"field"filtered-STL-1	1-day leachate	5% PAC	2,000 grams in one beaker - all these samples come from one beaker	100 g PAC in one beaker - all these sample come from one beaker	2,000 grams in one beaker - all these samples come from one beaker	125 mL filtered leachate in preserved container	120	N/A	35%	0.047 ug/L	N/A
TTP-1-5%PAC-"lab"filtered-STL-1	1-day leachate	5% PAC				125 mL unfiltered leachate in unpreserved container		N/A		< 0.040 ug/L	N/A
TTP-1-5%PAC - "field"filtered-STL-2	1-day leachate	5% PAC	2,000 grams in one beaker - all these samples come from one beaker	100 g PAC in one beaker - all these sample come from one beaker	2,000 grams in one beaker - all these samples come from one beaker	125 mL filtered leachate in preserved container	130	N/A	37%	< 0.040 ug/L	N/A
TTP-1-5%PAC-"lab"filtered-STL-2	1-day leachate	5% PAC				125 mL unfiltered leachate in unpreserved container		N/A		< 0.040 ug/L	N/A
Round 2C - 8-Day Carbon Treatability Study											
Laboratory: Frontier Geosciences for Mercury, STL for pH; Date: Mixed Samples on April 29, 2003 and May 6, 2003; Extracted Samples on May 7, 2003											
Control Samples											
TTP-1-UNTREATED-8DAY-050703-1	8-day Leachate	None	1000 grams	None	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.228 ug/L	6.9
TTP-1-UNTREATED-8DAY-050703-2	8-day Leachate	None	1000 grams	None	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.337 ug/L	6.9
2.5% PAC											
Mix reagent with soil in beakers, each with 1000 grams soil. Mix beakers again after 7 days. Collect leachate from each beaker after 8 days.											
TTP-1-2.5%PAC-8DAY-050703-1	8-day Leachate	2.5% PAC	1000 grams	25 grams PAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.516 ug/L	8.3
TTP-1-2.5%PAC-8DAY-050703-2	8-day Leachate	2.5% PAC	1000 grams	25 grams PAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.102 ug/L	8.3
5% PAC											
Mix reagent with soil in beakers, each with 1000 grams soil. Mix beakers again after 7 days. Collect leachate from each beaker after 8 days.											
TTP-1-5%PAC-8DAY-050703-1	8-day Leachate	5% PAC	1000 grams	50 grams PAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.163 ug/L	8.5
TTP-1-5%PAC-8DAY-050703-2	8-day Leachate	5% PAC	1000 grams	50 grams PAC	1000 grams (mL)	125 mL unfiltered leachate in each of two unpreserved containers[4]	N/A	N/A	N/A	0.0309 ug/L	8.4

Table 4
Richmond Field Station Mercury Treatability Study
Powdered Activated Carbon

Sample Name	Matrix	Treatment	Soil Volume	Reagent Volume	Water Volume	Sample Volume	Soil Analyses			Leachate	
							Hg	pH	% Moisture	Hg	pH
Round 3 - Oxidation Study											
Laboratory: Frontier Geosciences; Date: Mixed Soil and PAC on May 28, 2003. Mixed Soil/PAC with water on June 30, 2003. Extracted 1-Day Leachate Samples on July 1, 2003. Extracted 8-Day Leachate Samples on July 8, 2003. pH was measured in the field with a pH meter on July 11, 2003.											
Round 3A - Oxidation Study With 1-Day Leachate Test											
Control Samples											
TTP-1-CONTROL-1DAY-OXIDIZED-1a	1-day leachate	None	1000 grams[5]	None	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	19.2 ug/L	5.8
TTP-1-CONTROL-1DAY-OXIDIZED-1b	1-day leachate	None	1000 grams[5]	None	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	49.2 ug/L	5.9
5% PAC											
Mix reagent with soil in piles, each with 2000 grams soil. Let piles sit for 33 days. Split each pile in half, place each half in a beaker, and mix with water. Collect leachate from each beaker after 1 day.											
TTP-1-5%PAC-1DAY-OXIDIZED-1a	1-day leachate	5% PAC	1000 grams[6]	50 grams PAC	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	0.094 ug/L	8.2
TTP-1-5%PAC-1DAY-OXIDIZED-1b	1-day leachate	5% PAC	1000 grams[6]	50 grams PAC	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	0.272 ug/L	8.2
Round 3B - Oxidation Study With 8-Day Leachate Test											
Control Samples											
TTP-1-CONTROL-8DAY-OXIDIZED-2a	8-day leachate	None	1000 grams[5]	None	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	4.68 ug/L	5.4
TTP-1-CONTROL-8DAY-OXIDIZED-2b	8-day leachate	None	1000 grams[5]	None	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	3.38 ug/L	5.5
5% PAC											
Mix reagent with soil in piles, each with 2000 grams soil. Let piles sit for 33 days. Split each pile in half, place each half in a beaker, and mix with water. Collect leachate from each beaker after 8 days.											
TTP-1-5%PAC-8DAY-OXIDIZED-2a	8-day leachate	5% PAC	1000 grams[6]	50 grams PAC	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	0.112 ug/L	8.3
TTP-1-5%PAC-8DAY-OXIDIZED-2b	8-day leachate	5% PAC	1000 grams[6]	50 grams PAC	1000 grams (mL)	250 mL unfiltered leachate in unpreserved container[4]	N/A	N/A	N/A	0.121 ug/L	8.3

Notes:

[1] One of two duplicate samples did not settle. Therefore, unfiltered leachate for the initially unsettled sample was collected and sent to the laboratory to filter after settling the weekend. The leachate filtered after weekend mercury concentration was 9.7 ug/L.

[2] An additional soil sample was collected from the sediment after the leaching procedure was performed to determine the potential for heterogeneity of the total mercury concentration to determine the difference in the duplicate sample. Wet weight concentration.

[3] Frontier did not perform analytical procedure designated on COC. Laboratory filtered the wrong sample and analytical sample results were rejected.

[4] Samples sent to Frontier Geosciences for dissolved mercury analysis were filtered and preserved upon arrival at the lab.

[5] Weight of soil prior to oxidation. Weight of each soil sample in each beaker (after oxidation) was approximately 820 grams.

[6] Weight of soil prior to oxidation. Weight of each mixed soil/carbon sample in each beaker (after oxidation) was approximately 875 grams.

Table 5
Richmond Field Station Mercury Treatability Study
Summary 5% Powdered Activated Carbon Results

Sample Name	Matrix	Treatment	Leachate	
			Hg	pH
Round 2A - 1-Day Powdered Activated Carbon Treatability Study				
Control Samples				
TTP-1-UNTREATED-1DAY-041603-1	1-day Leachate	None	6.2 ug/L	N/A
TTP-1-UNTREATED-1DAY-041603-2	1-day Leachate	None	3.3 ug/L	N/A
5% PAC				
TTP-1-5%PAC-1DAY-041603-1	1-day Leachate	5% PAC	**3.5 ug/L**	N/A
TTP-1-5%PAC-1DAY-041603-2	1-day Leachate	5% PAC	**0.071 ug/L**	N/A
Round 2B - Testing Filtration Technique - 1-Day Test on 5% PAC				
TTP-1-5%PAC-"field"filtered-STL-1	1-day leachate	5% PAC	**0.047 ug/L**	N/A
TTP-1-5%PAC-"lab"filtered-STL-1	1-day leachate	5% PAC	**< 0.040 ug/L**	N/A
TTP-1-5%PAC - "field"filtered-STL-2	1-day leachate	5% PAC	**< 0.040 ug/L**	N/A
TTP-1-5%PAC-"lab"filtered-STL-2	1-day leachate	5% PAC	**< 0.040 ug/L**	N/A
Round 2C - 8-Day Carbon Treatability Study				
Control Samples				
TTP-1-UNTREATED-8DAY-050703-1	8-day Leachate	None	0.228 ug/L	6.9
TTP-1-UNTREATED-8DAY-050703-2	8-day Leachate	None	0.337 ug/L	6.9
5% PAC				
TTP-1-5%PAC-8DAY-050703-1	8-day Leachate	5% PAC	**0.163 ug/L**	8.5
TTP-1-5%PAC-8DAY-050703-2	8-day Leachate	5% PAC	**0.0309 ug/L**	8.4
Round 3 - Oxidation Study				
Round 3A - Oxidation Study With 1-Day Leachate Test				
Control Samples				
TTP-1-CONTROL-1DAY-OXIDIZED-1a	1-day leachate	None	19.2 ug/L	5.8
TTP-1-CONTROL-1DAY-OXIDIZED-1b	1-day leachate	None	49.2 ug/L	5.9
5% PAC				
TTP-1-5%PAC-1DAY-OXIDIZED-1a	1-day leachate	5% PAC	**0.094 ug/L**	8.2
TTP-1-5%PAC-1DAY-OXIDIZED-1b	1-day leachate	5% PAC	**0.272 ug/L**	8.2
Round 3B - Oxidation Study With 8-Day Leachate Test				
Control Samples				
TTP-1-CONTROL-8DAY-OXIDIZED-2a	8-day leachate	None	4.68 ug/L	5.4
TTP-1-CONTROL-8DAY-OXIDIZED-2b	8-day leachate	None	3.63 ug/L	5.5
5% PAC				
TTP-1-5%PAC-8DAY-OXIDIZED-2a	8-day leachate	5% PAC	**0.112 ug/L**	8.3
TTP-1-5%PAC-8DAY-OXIDIZED-2b	8-day leachate	5% PAC	**0.121 ug/L**	8.3