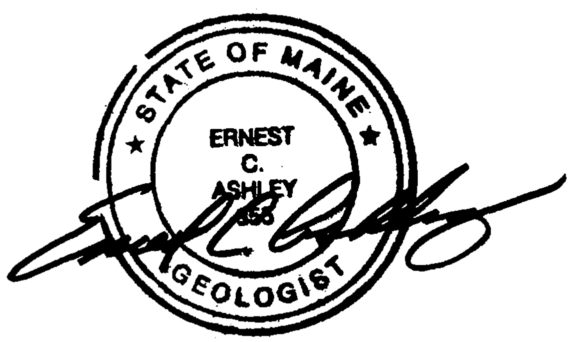
CDM

Mallinckrodt Inc.

HoltraChem Manufacturing Site
Orrington, Maine
Corrective Measures Studies
Field Investigation Report

May 27, 2003

Revised September 19, 2003



Report

CDM

One Cambridge Place, 50 Hampshire Street
Cambridge, Massachusetts 02139
tel: 617 452-6000
fax: 617 452-8000

September 24, 2003

Mr. Scott Whittier
Division of Oil and Hazardous Waste Facilities Regulation
Bureau of Remediation and Waste Management
State of Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

Mr. Ernest R.P. Waterman
United States Environmental Protection Agency – Region I
RCRA Corrective Action Section
One Congress Street
Boston, Massachusetts 02140-2023

Subject: HoltraChem Manufacturing Site, Orrington, Maine
Revised Corrective Measures Study Field Investigation Report

Dear Mr. Whittier and Mr. Waterman:

On behalf of Mallinckrodt Inc., we are forwarding to you four copies of the Corrective Measures Study Field Investigation (CMSFI) Report, dated September 19, 2003. The report has been revised in response to the comments contained in the Maine Department of Environmental Protection's (MEDEP's) letter dated July 23, 2003.

To assist in your review of this document, a response to each of MEDEP's comments and a discussion of the changes to the report is attached.

Very truly yours,

Ernest C. Ashley, P.G.
Project Manager
Camp Dresser & McKee Inc.

cc: Patricia Hitt Duft
James K. Grant
Walter T. Chaffee
J. Andrew Schlickman
Dennis Harnish
Amelia Katzen

\\Camsvr03\PRV\Mallinckrodt\com_resp\Sept19\Sept 24 2003 Fltr2.doc

CMS Field Investigation Report
Comments and Responses

<u>General</u>

Comment:

The areal extent and depth of soil contamination has not been bounded in many of the investigated locations. Estimates of volumes requiring treatment and disposal will, accordingly, be imprecise, compounding the possible error in remediation cost estimates. The costs estimated in the CMS for certain soil treatment alternatives are very volume-sensitive while others are less so. Actual costs could vary by a much larger margin than the "plus fifty percent to minus 30 percent" desired, complicating an objective evaluation of alternatives.

Response:

The CMS Field Investigation delineated the vertical and lateral extent of soil contamination in most all areas sufficiently for CMS/conceptual design purposes. The CMS FI work plan was developed and executed based on PMPS discussions with the MEDEP and EPA, which at that time had tentatively identified a PMPS' for soil and sediment of 3.2 mg/kg with additional considerations for soil above 10 mg/kg. The onsite analytical laboratory was used to determine if additional characterization samples were needed to define the limits of soil or onsite sediment above the PMPS (at that time 3.2 mg/kg). In some instances, soil/sediment concentrations in peripheral samples exceed the PMPS. However, based on consistent concentration attenuation trends or geologic considerations (presence of clay or bedrock), CDM is confident in the adequacy of the data for the CMS. Conservative assumptions have been applied as necessary to account for the uncertainties that remain in the characterization data.

Comment:

The significance of the 10 mg/kg criterion, which is cited often, is not clear. A 2.2 mg/kg PMPS has been chosen for mercury in soils and sediments.

Response:

As stated above, 10 mg/kg was a concentration criteria that was considered applicable by EPA, MEDEP, and Mallinckrodt for assessing the disposition of soil at the time the CMS FI was implemented and tabulated. This was based on data developed during the SI that demonstrated that soil below 13 mg/kg would not be likely to leach mercury at concentrations greater than the PMPS for groundwater (also the MCL, or drinking water standard).

Comment:

Data quality for this project is unknown. It is unclear what laboratory analyzed samples for this investigation, and what the quality control specifications were. There is no presentation of data quality issues, nor is any original laboratory data associated with the report. This may be due to the lack of a Quality Assurance Project Plan [QAPP] for the field investigation. A QAPP is recommended for any future site work that includes sampling and analysis. Documentation of data quality for this field investigation may still be possible, and is recommended. Laboratories should be identified for all analyses, and any quality control information, such as sample handling and *laboratory QC [method blanks, instrument calibrations, laboratory control samples and duplicates] should be evaluated and presented.*

Response:
All analyses used for contaminant distribution characterization were performed by a MEDEP-certified laboratory, Alpha Analytical Labs of Westborough, Massachusetts, which as been used as an approved laboratory throughout the SI and is currently the laboratory specified in the Quality Assurance Project Plan for cell process dismantling. Sampling quality control requirements were the same as those specified in the SI Work Plan and were described in the Corrective Measures Studies Field Investigation Work Plan and the plan for Test Pit Excavations of the Industrial Sewer. A data consistency and data useability review was performed by the project manager prior to compilation of the CMS FI Report. A data quality assessment is provided as Appendix E of the revised CMS FI Report.

Comment:
It would be helpful to have chemical data included on a map such as Figure 2-1 to review contaminant distribution.

Response:
Through the combination of plans and profiles in the CMS Field Investigation Report, CDM has endeavored to portray the lateral and vertical distribution of contamination at the site. Because data have been collected at many depth intervals and many discrete areas it is not feasible to represent the distribution of chemical data on one figure. For this reason, the CMS report presents representations of the areas where soil concentrations exceed the soil PMPS'.

Specific Comments

Comment:
It is difficult to reconcile the mercury concentrations shown in Figure 2-9 for SB3-1A with the values in Table 2-1. From the borehole log, refusal was encountered at shallow depth on the first try and a second borehole was put in a few feet away. It appears that Figure 2-9 is meant to show only the first boring, but the Table 2-1 values for certain intervals are either missing or incorrectly entered.

Response:
After reaching refusal at 13 feet below ground surface, Boring SB3-01 was continued 10 feet to the west. There was no recovery in the 15 –17' interval and sample characterization continued from 17 to 29.5' bgs. The mercury concentrations and depth intervals presented in Table 2-1 are correct. A revised Figure 2-9, which shows the complete analytical data set available for the cross section, is included in the revised CMS FI Report.

Comment:
Table 2-8 includes "totals" for VOC. However these total results do not include values listed as >2000 or >1

Response:
Table 2-8 has been revised.

Comment:
2.1 - Retort Building [Area 1]
It is unclear how we know that the mercury did not infiltrate the underlying till. Were any samples taken in the till to confirm this?

Response:
The cross sections presented as Figures 2-3 through 2-7 illustrate the vertical and lateral extent of mercury in the vicinity of the Retort Building. These figures also depict the soil types encountered in the borings. It is apparent from the distribution of mercury in the various soil types that mercury concentrations are below the PMPS of 2.2 mg/kg in the samples collected of the till beneath the area of the Retort Building.

Comment:
Both the HCM on-site lab and Alpha Analytical Laboratories analyzed a split sample. RPD for the results is calculated to be 106%. In subsequent split samples RPD is lower, but there is a trend toward higher results at Alpha Analytical as compared to HMC lab. Has an overall evaluation of results/ analytical methods been done? It would be important to make sure all labs performing analyses do comparable analyses.

Response:
A review of the results of the test pits conducted for evaluation of elemental mercury around the industrial sewer and the retort building identified that the HMC lab results appeared to be biased low. However the results are generally comparative and corrective action to address the potential bias was addressed as part of a subsequent audit of the HMC lab. The vast majority of samples from the Retort Building assessment were analyzed at the offsite contract laboratory, Alpha Labs. A quality assessment of laboratory data is provided in the revised CMS FI Report.

2.2 - Former Equipment Storage Area [Area 2]
Comment:
In this section and elsewhere throughout the report, mercury in soil results are characterized as "less than 10 mg/Kg." This does not appear to be a useful characterization since the PMPS is 2.2 mg/Kg.

Response:
The CMS FI work plan was developed and executed based on PMPS discussions with the MEDEP and EPA, which at that time had tentatively identified a PMPS' for soil and

sediment of 3.2 mg/kg with additional considerations for soil above 10 mg/kg. The SI Report also documented that soils unimpacted by large brine releases would not leach mercury at concentrations above the groundwater PMPS if their total mercury concentration was below 13 mg/kg. Comparisons of soils concentrations to 10 mg/kg are still useful. Comparisons to PMPS of 2.2 are also provided.

2.3 - Landfill Ridge Area [Area 3]

Comment:

The site of the interim stabilization measures in the Landfill Ridge Area noted in Section 2.3 (and identified in Table 2-1 by soil samples ISMSS 1 through 7) are not located on Figure 2-8.

Response:

Figure 2-8 has been revised to provide the information.

2.4 & 2.5 - Scrap Metal and Coal Filter Storage Areas [Areas 4 & 5]

Comment:

Describe the observations and conditions that drove the variance from the work plan. Explain how conditions in the field were used to select sample locations? Explain why no samples were collected of the peat. The high organic content of the peat might be expected to retain mercury that had traveled through sandier overlying materials. Samples of the peat will be required in the project design phase.

Response:

The original approach for Area 4 proposed the excavation of five test pits as trenches extending into the scrap metal area. The first test pit, TP4-A, was excavated as a trench. It became apparent during the excavation of that trench that discrete test pits would allow better coverage of the area to be investigated (there were may obstacles such as tanks to work around), limit the amount of excavation open at any one time, and permit more accurate documentation of soil conditions and sampling locations. During the CMS field investigation, five additional test pits were excavated to better define the extent of mercury containing soils in the area.

The CMS work plan originally proposed the advancement of direct push soil borings in the area of fill. Instead soil borings were advanced in this area using hollow stem augers because of the potential that fill material would result in poor recoveries or refusal with the Geoprobe unit. Additionally, three direct push borings were advanced to the west of the fill area to evaluate the vertical extent of mercury containing soils where surface soil sampling had identified mercury during the SI.

Analytical soil samples were collected based on conditions encountered in the field to most accurately characterize the material and the area. For example, samples were collected of a horizon of dark or stained soil if observed and of the soil below it. Samples were collected of the peat (TP4-B3, 2.4 mg/kg Hg; TP4-D3, 1.1 mg/kg Hg; and, SB4-2 sample from 8-10 feet, 1.2 mg/kg Hg). The peat deposit is interpreted to represent the pre-filling soil horizon. Sampling documented that it is lower in mercury than portions of the overlying fill. The existing data are sufficient for the CMS.

2.6 - Nitromethane Building [Area 6]
Comment:
Are the results for the graphite samples collected in the building, the same graphite materials that appeared to have mercury vapors associated with them as evidenced by Lumex data collected by DEP staff on 7/19/01?

Response:
We assume so. Samples were collected of each of the three storage container types observed in the Nitromethane Building at the time of sampling.

2.8 - Cell Building [Area 8]
Comment:
The high mercury detections in till at SB8-02 suggest that soil characteristics will not be a consistently reliable guide to where mercury has, and has not, migrated. The detailed design of any remedy involving excavation of plant area soils needs to consider what field screening guides and confirmation sampling are necessary to guide excavation work.

Response:
The location of SB8-02 is adjacent to a sump structure that may have contributed to the amount of mercury recorded at depth there. The boring log indicates the sample was collected at the interface of the base of sand and the top of dense silt. This interface may be the place where mercury accumulated. Significant attenuation is apparent between the 7.5 to 9.5 sample interval and the 9.5 to 11 interval. In addition, significant attenuation is apparent between the overlying intervals and the till sampled in borings SB8-3, 7, & 8. Based on these observations, it is reasonable to assume that the top of the till is an appropriate conceptual design criterion for excavation of soils in the vicinity of the Cell Building. Development of an appropriate field screening and post-excavation sampling program will be part of remedial design.

2.9 - Southerly Stream [Area 9]
Comment:
Sampling of stream sediments do indicate that the Southerly stream is generally cleaner upgradient of the manufacturing area but there is no clear vertical or horizontal gradient to the sampling transects sufficient to pre-guide excavation. The detailed design of any remedy involving excavation of plant area soils needs to consider what field screening guides, confirmation sampling and site conditions (e.g. bedrock) are necessary to guide excavation work.

Response:
The Corrective Measures Implementation design process will consider the method of confirming removal of the sediment exceeding the PMPS.

2.10 - Southern Cove [Area 10]

Comment:

Clarify whether the sediment sampling results expand the anticipated footprint of active remediation or change the perception of sporadic distribution of mercury in the sedge beds?

Response:

Ten Southern Cove sediment samples contained concentrations greater than or equal to 2.2 mg/kg. These samples were located in the same general area as the SI sample, which contained 41 mg/kg. Concentrations less than 2.2 mg/kg were documented in the sedge deposits closer to the shore. These results did not change the anticipated area of sediment removal and confirmed the perception that the sedge beds do not contain more than sporadic sediment concentrations above the PMPS.

2.11 - Northern Ditch [Area 11]

Comment:

Sampling work does not appear to have bounded the horizontal or vertical limits of mercury contamination in the area of the Northern Ditch. This does not appear to be a significant enough error to invalidate the comparison of remedy options in the CMS Report but will need to be resolved to support detailed design work on the selected remedy.

Response:

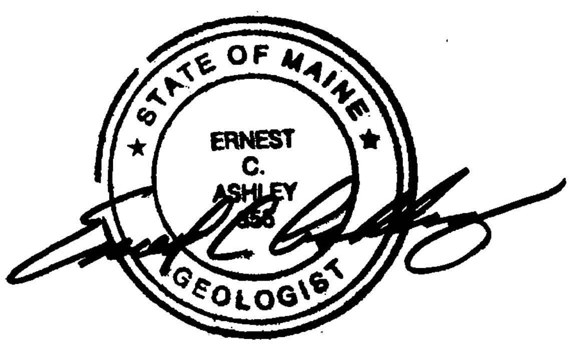
Hand augered sampling on the North Ditch alone did not identify the vertical and lateral extent of elevated mercury concentrations. Additional characterization was performed with test pit excavation. Fill material was documented adjacent to the lower portions of the North Ditch. The CMS conservatively estimated the volume of material associated with the North Ditch and adjacent fill and post-excavation confirmation sampling can be used to document the adequacy of remediation efforts.

Mallinckrodt Inc.

HoltraChem Manufacturing Site
Orrington, Maine
Corrective Measures Studies
Field Investigation Report

May 27, 2003

Revised September 19, 2003



Report

Contents

Figures

Tables

Section 1 Introduction

1.1 Document Intent

This Corrective Measures Studies Field Investigation Report documents the methodology and results of field investigations conducted as part of the Corrective Measures Study (CMS) for the HoltraChem Manufacturing site, located in Orrington Maine. The data obtained from this investigation will supplement existing data and support the evaluation and implementation of corrective action measures at the site. The investigation was performed in accordance with the Work Plan for Corrective Measures Field Investigation submitted to EPA and MEDEP on October 19, 2001. MEDEP provided approval and comments in a letter dated November 2, 2001. EPA provided approval with comments in a letter dated November 14, 2001. Copies of these letters are provided as Appendix A.

1.2 Purpose

The purpose of this investigation was to further delineate the horizontal and vertical extent of soil and sediment contamination to support evaluation of the proposed corrective measures. Groundwater sampling was conducted to monitor groundwater quality and to provide supplemental data to evaluate treatment requirements. Geotechnical evaluations were performed where necessary to evaluate potential corrective measures such as a slurry wall and siting of a Corrective Action Management Unit (CAMU) for consolidation of excavated soil and sediment and building demolition debris.

Previous investigations have identified mercury as the primary contaminant of concern (COC) in site soil, sediment, and groundwater. Chlorinated volatile organic compounds (VOCs) are also present in site groundwater. The potential presence of polychlorinated biphenyls (PCBs) in the vicinity of electrical equipment was also evaluated as part of this investigation.

1.3 Investigation Areas

Soil and sediment sampling was conducted in 17 areas. These included those areas for which MEDEP requested additional characterization and areas where delineation of contamination greater than PMPS is required for corrective measures studies. The areas were numbered as follows, starting at the northwestern side of the plant, moving in a clockwise direction:

- <u>Area 1 - Retort Building</u>: Located in northern corner of the central plant area, to the south of the Chloropicrin Building.

- <u>Area 2 - Former Equipment Storage Area</u>: Located in the northern corner of the central plant area, near monitoring well MW-403-01.

- <u>**Area 3 - Landfill Ridge Area**</u>: Located north of the central plant area, and north of Landfills 3 and 4.
- <u>**Area 4 - Scrap Metal Area**</u>: Located to the east of the central plant area, adjacent to the Coal Filter Storage Area.
- <u>**Area 5 - Coal Filter Storage Area**</u>: Located north and east of the central plant area and south of Landfill 4.
- <u>**Area 6 - Nitromethane Building**</u>: Located southeast of the plant area.
- <u>**Area 7 - Transformer Area**</u>: Located within the plant area, south and east of the Cell Building.
- <u>**Area 8 - Cell Building**</u>: Located in the central area of plant, south of the Sodium Chlorate Building.
- <u>**Area 9 - Southerly Stream**</u>: Stream begins in the northeastern area of the site where the flooded gravel pit is located. The stream flows west and south and ultimately discharges to the Southern Cove via the Southerly Stream Outfall.
- <u>**Area 10 - Southern Cove**</u>: Located south of the central plant area; receives discharge from the Southerly Stream.
- <u>**Area 11 - Northern Ditch**</u>: Located north of the Southerly Stream and flows east to west; the northern ditch ultimately discharges to the Penobscot River via the Northern Stormwater Outfall.
- <u>**Area 12 – Former Equipment Storage/End of Railroad Loading Area**</u>: Located west of the end of the railroad car loading area and south of the paved sump.

In addition to the contaminant delineation sampling of the areas described above, geotechnical investigations were performed in three areas of the site.

- <u>**Area 13 - Proposed Slurry Wall Alignment**</u>: Located at the base of Landfill Area 1 extending from the bedrock outcrop adjacent to the MW-401 cluster to southeast of the B-316 cluster.
- <u>**Area 14 - Potential CAMU Site**</u>: Located north of the Nitromethane Building and south of Landfill 2.
- <u>**Area 15 - Potential CAMU Site**</u>: Located north of the plant office building and west of the Nitromethane Building.
- <u>**Area 16 - Industrial Sewer**</u>: Located within the manufacturing plant area between the Cell Building and the Southerly Stream.

- <u>Area 17 – Landfill 2</u>: Located northeast of the manufacturing plant adjacent to the southerly stream.

Groundwater sampling was conducted at wells downgradient of known and potential source areas and in those areas where groundwater collection and treatment is anticipated. Groundwater samples were analyzed for parameters, which may impact groundwater treatment. The list of monitoring wells to be sampled was communicated to MEDEP and U.S. Environmental Protection Agency (EPA) during the development of a Memorandum of Understanding between MEDEP, EPA and Mallinckrodt, Inc., the former owner/operator of the Orrington facility, upon the dissolution of the HoltraChem Manufacturing Corporation (HMC).

1.4 Document Organization

The field program methodology, procedures, sampling locations, quantities and results are discussed in Section 2. Tables and Figures are presented at the end of the section. MEDEP and EPA work plan approval letters are provided as Appendix A. Soil boring logs are provided as Appendix B. Test pit excavation logs are provided as Appendix C. Geotechincal testing results are provided as Appendix D. A data Quality Assessment is provided in Appendix E.

Section 2
Investigation Methodology and Results

This section presents the field sampling methodology and results of the field sampling activities. The subsections are arranged by the area investigated and organized with the following structure: objectives, methodology, variances from the work plan, and analytical results. Tables and figures are provided at the end of the section.

2.1 Area 1 - Retort Building

Objectives

Investigate the potential presence of mercury in soil surrounding the former mercury retort building. If mercury is found, determine the vertical and lateral extent. Evaluate the contents of, and backfill around, an abandoned drain line that reportedly extends from the Retort Building to the Lined Process Lagoon.

Methodology

A total of eighteen soil borings (SB1-1 through SB1-18) were advanced in the area surrounding the Retort Building. The soil borings were advanced in a grid pattern on the east and west sides of the building. The locations of the soil borings are presented on **Figure 2-1**. Five soil borings were advanced to the east of the building (SB1-1 through SB1-5) and thirteen soil borings (SB1-6 through SB1-18) were advanced to the west of the building. The soil borings were advanced using direct push technology and advanced until till was encountered or until refusal.

Continuous soil samples were collected as the soil borings were advanced. The samples were screened for organic vapors and mercury vapors using an organic vapor monitor (OVM) and a Jerome mercury vapor analyzer, respectively. Upon completion of field screening, the soil samples were visually classified and jarred for analytical testing. Analytical samples were collected from 2-foot intervals and submitted for laboratory analysis for total mercury.

Variances from the Work Plan

The originally proposed approach for Area 1 called for the excavation of two test pits, one on each side of the retort building where doors are located and one additional test pit between the retort building and the lined process lagoon. To more accurately define the horizontal and vertical extent of mercury containing soils, a series of Geoprobe soil borings were advanced on the sides of the building where the doors were located. The work plan also anticipated the excavation of a section of drain line pipe. If the pipe was encountered, the pipe was to be removed and samples of its contents collected. Geoprobe borings were advanced in the vicinity of the drain line pipe, but the pipe was not encountered during the field activities. One test pit was excavated immediately west of the Retort Building in November 2002 at the same time that test pits were excavated to investigate the industrial sewer.

Results

The overburden materials encountered during soil boring advancement were described as medium to fine sand and silt underlain by till. Till was encountered in ten of the eighteen soil borings at depths ranging from 4 feet below ground surface (bgs) to 8 feet bgs. Bedrock was not encountered in any of the soil borings. The soil boring logs are presented in Appendix B. Stratigraphic cross sections of the soil borings were developed to provide visual representations of subsurface soil conditions. The cross section location plan and cross sections are presented as **Figures 2-2** through 2-7.

A total of 66 analytical soil samples were collected from the soil borings advanced at the Retort Building. Five duplicate samples were also collected. The analytical results are presented on **Table 2-1**. Mercury concentrations and sampling intervals are also presented on the cross sections.

Total mercury was present at detectable concentrations in 57 of the 66 samples. The three highest detected mercury concentrations were in samples collected from soil borings SB1-09 (4-6 feet) at 150 mg/kg, SB1-11 (0-2 feet) at 110 mg/kg, and SB1-04 (0-2 feet) at 77 mg/kg. Of the 57 samples with detectable concentrations of mercury, 31 contained mercury above 2.2 mg/kg and 14 contained mercury at concentrations above 10 mg/kg. In general, the highest mercury concentrations were found in the surficial soil samples and concentrations decreased with depth. As shown in the cross sections, it appears that the vertical extent of mercury containing soils was identified in all of the soil borings. The greatest depth at which mercury was detected above 2.2 mg/kg was in soil boring SB1-08 in the sample collected from 5.5 feet to 7.5 at a concentration of 11 mg/kg. The horizontal extent of mercury at concentrations greater than 10 mg/kg was delineated. As illustrated in cross sections A-A′ and E-E′ mercury was not detected above 10 mg/kg in any of the samples collected from the easternmost and westernmost soil borings.

One test pit was excavated west of the Retort Building on November 19, 2002 (HMC – ISTP-9). This test pit was excavated to visually inspect the soil beneath the asphalt paving and to look for a pipe that might lead from the Retort Building to the Lined Process Lagoon. Test pit logs are provided in Appendix C. An approximately 3-inch layer of asphalt was underlain by approximately 6 inches of wet, brown fine-medium sand. Free, elemental mercury was not observed in soil beneath the asphalt. The excavation was continued to approximately three feet below grade but no pipe was located. At approximately 1 foot below grade the stratigraphy changed to dense fine sand, some silt and gravel. The CDM and MEDEP geologists present at the time agreed that the soil appeared to be native and did not appear disturbed. Samples were collected for mercury analysis from immediately below the asphalt (HMC-ISTP-9-3″) and from a depth of 2 feet. The sample from 3 inches analyzed by Alpha Analytical Laboratories contained 8.1 mg/kg Hg and the split of this sample analyzed at the HoltraChem Lab contained 2.5 mg/kg Hg. The sample collected at 2 feet was analyzed by the HoltraChem Lab and contained 0.056 mg/kg Hg.

2.2 Area 2 - Former Equipment Storage Area

Objectives

Evaluate the potential presence of mercury in soil associated with a used equipment storage area. Investigate to a depth of low permeability or natural soil horizon. If mercury is found, determine the vertical and lateral extent.

Methodology

Four test pits (TP2-A through TP2-D) were excavated in the used equipment storage area. The test pits were excavated along the edge of the pavement. The locations of the test pits are presented on Figure 2-1. The test pits were excavated using a Liebherr R914 rubber tire excavator to depths of approximately 2 to 6 feet bgs.

Analytical soil samples were collected from the test pits based on observations made by the field geologist. The soil samples were submitted to Alpha Analytical Labs (Alpha) of Westborough, Massachusetts for analysis of total mercury.

Variances from The Work plan

The approach for Area 2 originally proposed the excavation of three test pits. A total of four test pits were excavated during the CMS field investigation to better characterize the extent of mercury containing soils and provide coverage of the entire area. The work plan originally proposed the collection of three soil samples per test pit for mercury analysis. During the CMS field program only two samples were collected from test pits TP2-B and TP2-C as this sampling program was considered to be adequate and appropriate based on the conditions encountered in the field.

Results

Test pit logs are presented in Appendix C. A total of ten analytical soil samples were collected from the test pits based on field observations. Two duplicate samples were also collected. The analytical results are presented in Table 2-1.

Soil stratigraphy encountered in the test pits varied across the used equipment storage area. In TP2-A, asphalt was underlain by approximately five feet of compact, narrowly graded fine sand which, based on its very loose appearance after excavation, appeared to be a mechanically compacted fill. A dark brown, medium to coarse sand with gravel, which was interpreted to be native soil, was encountered at 5 feet. No lower permeability layer was encountered. Samples were collected immediately below the asphalt, at two feet below ground surface and of the native soil at 5 feet.

TP2-B was excavated north of the edge of asphalt paving adjacent to the B-315 monitoring well cluster. This excavation was limited in depth to two feet to avoid damaging the monitoring wells. To provide additional characterization of the presence or absence of mercury, Mr. John Beane of MEDEP surveyed the area using a Lumex mercury vapor analyzer prior to, during and at the maximum extent of excavation. Mr. Beane did not record elevated mercury readings with the Lumex. Soils encountered in this excavation appeared to be native.

TP2-C was excavated through interbedded sand and silt to a depth of four feet where bedrock was encountered. Samples were collected of the surficial soil (0-6"), which contained some organic material, and at one foot below ground surface. The interbedded sand and silt layers were interpreted to constitute low permeability layers. Mercury was detected at a concentration of 2 mg/kg in the surficial soil sample but was non-detect in the sample from one foot bgs.

TP2-D was excavated through interbedded fine to coarse sand to a depth of five feet where bedrock was encountered. A low permeability silt was noted at four feet below ground surface. Samples were collected of the surficial soil (0-6"), at one foot below ground surface and immediately above the silt at four feet. Mercury was detected at a concentration of 24 mg/kg in the surficial soil sample but was non-detect in both of the deeper samples.

As described above and shown in Table 2-1, total mercury was observed at detectable concentrations in just two of the soil samples. Total mercury was detected at a concentration of 2 mg/kg in the 0.5-foot sample collected from test pit TP2-C and 24 mg/kg in the 0.5-foot sample collected from TP2-D. As mercury was not detected in any of the deeper soil samples collected from the test pits, the vertical extent of mercury containing soils was delineated at the used equipment storage area.

The area where mercury may be present in soil above 2.2 mg/kg appears to be very limited. Three test pits were also excavated in the vicinity of the used equipment storage area during the Site Investigation (SI) to investigate an abandoned leach field. Soil samples collected during those excavations contained low concentrations of mercury (less than 10 mg/kg). The leach field, which was reportedly constructed of hemlock planks, was not located and is assumed to have been excavated when utility work was performed in this area. This information serves to limit the potential extent of mercury containing soils to the south. The presence of the exposed bedrock limits the extent of to the north.

2.3 Area 3 - Landfill Ridge Area

Objectives

Evaluate the vertical and lateral extent of fill placed in a former gravel pit on the north side of the landfill ridge and determine the mercury concentrations in the soil of that fill.

Methodology

The portion of the CMS field program conducted at the landfill ridge area included the advancement of two soil borings (SB3-01 and SB3-02), the excavation of three test pits (TP3-A through TP3-C), and the collection of ten surface soil samples (SS3-1 through SS3-10). A description of each of the investigation methods is presented below.

Soil Borings

The soil borings were advanced through the northern side of the fill where it was expected to be thickest to determine the extent of fill and mercury containing soils. The locations of the soil borings are presented on Figure 2-1 and on **Figure 2-8**. The soil borings were advanced using hollow stem augers to depths of 29.5 feet bgs (SB3-01) and 22 feet bgs (SB3-02).

Continual soil samples were collected as the soil borings were advanced. The soil samples were screened for organic vapors and the presence of mercury vapor using an OVM and a Jerome mercury vapor analyzer, respectively. Upon completion of field screening, the soil samples were visually classified and jarred for analytical testing. Analytical samples were collected at two-foot intervals and submitted for total mercury analysis.

Test Pits

Three test pits were excavated on the southern side of the fill to locate the vertical and lateral limits of the fill material. Observations of large trees and tree stumps, which pre-existed the former gravel pit excavation and filling were also used to help delineate the southern extent of fill. Test pits were excavated using a Liebherr R914 rubber tire excavator to depths of 8 feet bgs (TP3-A), 3 feet bgs (TP3-B), and 6 feet bgs (TP3-C). The locations of the test pits are shown on Figure 2-1.

Soil samples were collected from each of the test pits and submitted to Alpha for laboratory analysis for total mercury.

Surface Soil Samples

Surface soil samples were collected in an area where the embankment had slumped toward the Penobscot River to evaluate the presence (or absence), and extent of mercury containing soil. Ten surface soil samples were collected based on field observations and submitted for total mercury analysis.

An Interim Stabilization Measure was performed in July 2002 to move fill material from the top of the slope. Upon the completion of earthwork, seven surficial soil samples were collected to measure mercury concentrations in the soil that was relocated.

Variances from The Work plan

The approach for Area 3 did not originally include the collection of surface soil samples. As described above, soil samples were collected to evaluate the presence of mercury in the material that had slid towards the Penobscot River.

Results

Soil Borings

Two soil borings were advanced in the landfill ridge area. The soil boring logs are presented in Appendix B. The overburden materials encountered during soil boring advancement were generally described as medium to fine silt and sand. Based on field observations made during soil boring advancement the extent of fill materials was identified. A stratigraphic cross section was prepared using new and existing soil borings. The location of the cross section is shown on Figure 2-8, and the cross section detail is presented on **Figure 2-9**.

Soil samples were collected at two-foot intervals and analyzed for total mercury. A total of 25 analytical samples were collected from the two soil borings. Three duplicate samples were also collected. Table 2-1 presents the analytical results.

Total mercury was observed at detectable concentrations in 14 of the 25 samples. Of the 14 soil samples with detectable concentrations only four contained mercury at levels above 10 mg/kg. Total mercury was detected in soil boring SB3-01 at concentrations of 12 mg/kg (0-2 feet bgs) and 14 mg/kg (12-12.7 feet bgs) and at SB3-02 at concentrations of 72 mg/kg (4-6 feet bgs) and 39 mg/kg (8-10 feet bgs). In general, the highest mercury concentrations were found at shallow depths. The greatest depth at which mercury was observed above the method detection limit was in the sample collected from 12 to 12.7 feet bgs (14 mg/kg) at SB3-01 and in the sample collected from 14 to 16 feet bgs (0.93 mg/kg) at SB3-02.

Test Pits

Three test pits were excavated in the landfill ridge area to evaluate the extent of fill and mercury containing soils. The test pit logs are presented in Appendix C. The fill materials encountered during the test pit excavations were described as brown, fine to coarse sand and silt with little to some gravel and little to some clay. Test pit TP3-B is included in the stratigraphic cross section presented on Figure 2-9. This test pit encountered native material along the west edge, which was described as dry, brown, medium to coarse sand, some gravel. Based on visual observations, it appears that the extent of fill materials was encountered at test pit TP3-A at a depth of 6 feet bgs, in the eastern half of test pit TP3-B at 3 feet bgs, and at 6 feet bgs at TP3-C.

Soil samples were collected from the test pits and submitted for laboratory analysis for total mercury. A total of 8 analytical samples were collected. One duplicate sample was also collected. The results of the soil sampling are presented in Table 2-1.