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AUG 08 2006

DNCS-E

IN REPLY
REFER TO

U.S. Nuclear Regulatory Commission
 Region 1, Nuclear Materials Safety Branch
 Division of Nuclear Materials Safety
 ATTN: Ms Betsy Ullrich
 475 Allendale Road
 King of Prussia, PA 19406-1415

Q-9
MS-16

04000341

SUBJECT: License STC-133 response to NRC comments on DNCS/DLA document
 "PRELIMINARY SITE-SPECIFIC DERIVED CONCENTRATION
 GUIDELINE LEVELS FOR THE CURTIS BAY DEPOT, CURTIS BAY,
 MARYLAND", CONTROL NO. 138458

Dear Ms. Ullrich,

Thank you for your letters of June 12, 2006 and June 19, 2006 requesting additional information from the DNCS/DLA regarding the document *Preliminary Site-Specific Derived Concentration Guideline Levels for the Curtis Bay Depot, Curtis Bay, Maryland*. This letter provides our response to each set of NRC comments. To aid your evaluation, we have repeated each NRC Comment by number and content along with the DNCS response.

The net result of incorporating the NRC comments is that the proposed soil DCGL value changes from 3.3 pCi/g to 2.9 pCi/g for Th-232. There is effectively no change to the U-238 DCGL or the proposed building surface DCGL values.

DNCS requests a conference call with the NRC to discuss these comment responses as soon as possible. We would greatly appreciate NRC concurrence and notification that the DCGL review for the Curtis Bay Depot site will resume quickly. This would assist us with our current project decommissioning and remediation schedule. Please call our project manager, Michael Pecullan, at (703) 767-7620.

Sincerely,

F. Kevin Reilly
 Director, Directorate of Environmental
 Management and Safety

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Attachments: (1) Response To NRC Comment Set One, (2) Response To NRC Comment Set Two, (3) Topographical Map, (4) Preliminary Assessment, (5) Site Investigation Report

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138458
 NMSS/RGNI MATERIALS-002

**RESPONSE TO NRC COMMENT SET ONE ON DNSC/DLA DOCUMENT
“PRELIMINARY SITE-SPECIFIC DERIVED CONCENTRATION GUIDELINE
LEVELS FOR THE CURTIS BAY DEPOT, CURTIS BAY, MARYLAND”,
CONTROL NO. 138458**

In reply to the NRC’s June 12, 2006 review of the document “Preliminary Site-Specific Derived Concentration Guideline Levels for the Curtis Bay Depot, Curtis Bay, Maryland”, the DNSC/DLA provides the following responses. To assist the NRC, each of the agency’s comments is repeated as originally provided to the DNSC along with the DNSC response to that comment.

1. **Comment:** Submit a map that shows the detailed topography of the site using contour interval as described in NUREG 1757, Volume 1, Rev. 1, “Consolidated NMSS Decommissioning Guidance – Decommissioning Process for Materials Licenses”, section 16.3.1.

DNSC Response: A topographical map of the Curtis Bay Depot site is enclosed with this response. DNSC is providing the best available map, however the contour details are limited due to the relatively flat landscape of the area.

2. **Comment:** In 1992, Oak Ridge Institute for Science and Education did a survey of the L and M lines which had been sold to Ann Arundel County titled “Radiological Survey of Portions of the Curtis Bay Depot, General Services Administration, Baltimore, Maryland”. Thorium levels greater than 10 pCi/gram were found in 15 of 27 subsurface soil samples taken at the L and M lines. These findings of subsurface thorium nitrate contamination were verified in the “Final Radiological Status Report for Decommissioning, Curtis Bay Depot Facility – January 4, 1996” submitted to NRC by DLA. The buildings on the L and M lines were used to store thorium nitrate which is the same use as some of the buildings which exist/existed in the current areas of decommissioning. Also, the levels of 10 pCi/g are greater than the 3.3 pCi/g requested as the site specific DCGL’s.

According to the documents submitted, the only subsurface soil samples taken in the recent scoping survey were collected in the disposal area. Due to the close proximity of the L and M lines to the current areas of decommissioning provide additional information justifying the lack of subsurface soil sampling for other potentially contaminated areas.

DNSC Response: Oak Ridge Institute for Science and Education (ORISE) investigated subsurface soil at several representative locations around the site during characterization. Initial data results indicate the presence of subsurface contamination below 15 cm and in isolated locations to 30 cm. ORISE has performed additional surveys at these locations to determine if contamination extends below 30 cm. Preliminary field screening indicates it does not. The final characterization survey report is expected in August 2006, and will be provided to the NRC when available.

However, as noted in the DNSC response to the second set of NRC comments on the Curtis Bay dose modeling report, submitted concurrently with this response, all identified contaminated areas will be targeted for remediation.

3. **Comment:** In the Historical Site Assessment, you state in section 6.1.15 that no thorium was stored in the three buildings located north of Kulig Road, and in the same section, you list those buildings as J-522, J-622 and K-511. Figure 2 of the Historical Site Assessment indicates that the buildings north of Kulig Road are J-521, J-522 and K-511. Confirm which three buildings have no history of thorium storage.

DNSC Response: The statement that the referenced buildings were north of Kulig Road was in error. The building numbers as listed in the text of HSA Section 6.1.15 are correct; the buildings with no history of thorium storage are J-522, J-622 and K-511. The buildings are located as indicated in Figure 2 of the HSA.

4. **Comment:** In section 6.1.1 of the Historical Site Assessment, you state that an allegation was brought “by Eric H. Reber, a former employee at the CBD”. Eric H. Reber was not a former employee at the CBD, he was the NRC inspector who investigated the allegation to which you are referring. Confirm that you will reexamine the history of the allegation and any ramifications it may have for the current decommissioning.

DNSC Response: DNSC acknowledges the editorial error regarding the name of the employee who brought the allegation. This error will be corrected in the revised DCGL report. However, the information concerning the allegation was appropriately considered and used in all survey designs and investigations.

5. **Comment:** In section 2.0 of the Historical Site Assessment, you state, “A dump on the south side of the site near where the former Ordinance Depot Incinerator was located is potentially contaminated”. Submit a map showing the exact location of the dump referenced above.

DNSC Response: Detailed information about the referenced dump is not available, as it was created by the U.S. Army as a medical waste dump, and was not associated with DNSC activities.

The best available map of the location is from the Parsons 2003 report, page 4-3, and is enclosed with this response.

**RESPONSE TO NRC COMMENT SET TWO ON DNSC/DLA DOCUMENT
“PRELIMINARY SITE-SPECIFIC DERIVED CONCENTRATION GUIDELINE
LEVELS FOR THE CURTIS BAY DEPOT, CURTIS BAY, MARYLAND”,
CONTROL NO. 138458**

In reply to the NRC’s June 19, 2006 review of the document “Preliminary Site-Specific Derived Concentration Guideline Levels for the Curtis Bay Depot, Curtis Bay, Maryland”, the DNSC/DLA provides the following responses. To assist the NRC, each of the agency’s comments is repeated as originally provided to the DNSC along with the NRC’s suggested action to satisfy that comment.

1. **Comment:** The assumption that residual radioactivity in soil is limited to the top 15 centimeters requires additional justification.

Action: Provide additional information to justify the assumption that contamination is limited to surface soils or provide additional information regarding the intended approach for addressing subsurface contamination.

DNSC Response: DNSC acknowledges the basis for the NRC concern that the *scoping survey report (Vitkus 2006)* indicated a broad area of subsurface contamination at the former radiological waste disposal site. This area and all other identified areas of contamination have been targeted for remediation by the DNSC. The remaining areas of the site are consistent with classification as a surface contaminated site. Classification as a surface contaminated site is supported by historical site and process knowledge, as well as extensive data from the ORISE characterization survey.

Existing process and historical knowledge of the Curtis Bay site document the absence of underground tanks, spills, or other release mechanisms that would generate subsurface contamination beyond the contaminated areas identified in the scoping and characterization survey results. All identified contaminated areas have been targeted for remediation by means of soil removal.

Data from the ORISE characterization survey confirms that soil contamination is limited to isolated locations near buildings and roadways, with the noted exception of the former radiological waste disposal site. There are an estimated 600 m² of land area contaminated compared to the total site area of 1.9 million m². The remaining areas (over 99% of the site) show no evidence of either surface or subsurface contamination. These findings are consistent with classification as a surface contaminated site.

Characterization survey findings will be provided to the NRC in support of these statements upon issuance of the ORISE characterization survey report. The report is expected to be issued in August 2006.

2. **Comment:** Sufficient justification for the external gamma shielding factor used in RESRAD is lacking.

Action: Perform additional research, modeling, and/or field experiments to justify the selection of the external gamma shielding factor used in RESRAD for the constituents and building materials present at the Curtis Bay Depot Site.

DNSC Response: Additional justification for the selected value (0.55) is available in NUREG/CR-5512, Volume 3, pages 6-22 to 6-26. These pages detail the use of Microshield to estimate shielding factors for several building construction scenarios. For the scenario of a 3.5" concrete slab foundation, noted as the minimum thickness allowed by the uniform building code, the estimated shielding factor over a wide range of photon energies is consistently below 0.55 (Page 6-24, Table 6.16).

Based on this information in the NUREG document, DNSC believes that continued use of the selected value of 0.55 is justified. Moreover, selection of this shielding factor follows NRC preference for consistency with NUREG/CR-5512 as noted in Comments No. 3 and No. 6. *Therefore, the DNSC requests the NRC authorize continued use of the shielding factor (0.55) as provided in the dose modeling report.*

3. **Comment:** The indoor fraction used in the RESRAD is not consistent with the outdoor fraction selected based on NUREG/CR-5512, Volume 3.

Action: Confirm that you will use an indoor fraction of 0.66.

DNSC Response: The NRC recommended value of 0.66 (actually 0.6571), was verified from NUREG/CR-5512, Volume 3. The RESRAD code was then re-run with the indoor fraction (IF) set at the NUREG value (0.6571). The results are shown in Table 1 below and indicate that use of the NUREG/CR-5512 value, rather than the default RESRAD value of 0.5, when introduced into RESRAD with no other changes, reduces the DCGL by 12 percent for the thorium-232 decay chain, with no change for the uranium-238 decay chain.

Table 1: Modified DCGL values for Indoor Fraction (IF) at 0.6571

Decay chain	Proposed DCGL (pCi/g) (IF at 0.5)	Modified DCGL (pCi/g) (IF at 0.6571)
Th-232	3.3	2.9 (-12%)
U-238	2.2	2.2 ----

Based on NRC comments and additional RESRAD modeling, the DNSC believes it can adequately implement the reduced DCGLs of 2.9 pCi/g (Th-232) and the proposed DCGL of 2.2 (U-238) during remediation activities. *Therefore, an indoor fraction of 0.66 will be used.*

4. **Comment:** Additional justification for the distribution coefficients used in the RESRAD analysis is needed.

Action: Provide documentation that shows how you will reduce the uncertainty, or at a minimum consider and manage the uncertainty in the DCGL calculation, due to the variability of the distribution coefficients and plant transfer factors used in the analysis.

DNCS Response: A detailed justification of the chosen K_d parameters follows below, in which the concerns in the NRC comment basis are discussed point by point. However, in summary, uncertainty in model parameters, such as the distribution coefficients, has already been accounted for by executing the code in the sensitivity analysis mode and looking for correlation, confounding factors, etc. The results of the sensitivity and uncertainty analyses are discussed in the dose modeling report on page 31.

As noted, the thorium DCGL is insensitive to the K_d parameter over a wide range of reasonable values. Uncertainty and variability in the thorium K_d is inherently managed in the model, as verified by sensitivity and uncertainty analysis.

As noted, the uranium DCGL is sensitive to the K_d parameter. The effects of uncertainty and variability in this parameter are appropriately managed as follows:

- The uranium K_d value was based on the best available information. Further investigation and consultation with ORNL and ORISE confirms that there is no new or compelling evidence that the chosen values are not appropriate.
- Uranium is a contaminant, but comprises a small fraction of the previously stockpiled source material relative to the predominant thorium contaminant. For example, the vast majority of the source material was thorium nitrate, which by direct measurement contains a U-238 concentration on the order of $6E-06$ that of the Th-232 concentration. From Table 6 in the citation below, the mean Th-232 concentration from 22 samples of the thorium nitrate was reported as 45,818 pCi/g. Similarly from Table 7, the mean U-238 concentration was reported as 0.29 pCi/g, yielding the cited ratio of $6E-6$. Other limited sources of uranium exist, such as from monazite sands. However the quantities are minimal compared to the thorium nitrate contribution. Thorium is by far the predominant, driving contaminant. Therefore, any variation in the K_d parameter, and thus the uranium DCGL, will not significantly impact the total DCGL.

Reference: “*Technical Basis for Radiological Characterization of the Thorium Nitrate Waste Stream*,” Oak Ridge National Laboratory, ThN-TB-1 Rev.1, May 2004.

Point by point discussion of NRC Comment 4:

4.1 Justification for the generic distribution coefficients (K_ds) used in the analysis (Table 3, page 31) appears warranted, e.g., the natural variability in the sorption capacity of subsurface materials and the lateral extent of the clay layer needs to be considered to demonstrate the distribution coefficients selected are reasonable or conservative.

The K_d values selected initially were not generic, but were based on extensive investigation into appropriate values for the specific conditions at the Curtis Bay site. Page 31 of the dose modeling report explains that K_d selection was based on knowledge of the site's hydraulic conductivity, soil types, and derived "b" parameters. This site knowledge was, in turn, based on a number of geophysical reports specific to Anne Arundel County and the Curtis Bay site, listed in the reference section of the dose modeling report.

Based on this site-specific knowledge, K_d values were chosen as the geometric mean values from Table 32.1 of the RESRAD Data Collection Handbook (Yu 1993). These values are approximately a factor of 20 less than the RESRAD default values for thorium.

To further address NRC concerns regarding the chosen K_d values, DNSC, with the assistance of ORNL and ORISE, investigated additional references regarding selection of site-specific K_d values. These references provide detailed explanations of experimentally determined K_d values, the effect of pH, soil composition variations, and chemical properties of the contaminants, as well as the observed variability of K_d values across multiple environments.

These references include, in part,

U.S. EPA, 1999. *Understanding Variation in Partition Coefficient, K_d Values; Volume II: Review of Geochemistry and Available K_d Values for Cadmium, Cesium, Chromium, Lead, Plutonium, Radon, Strontium, Thorium, Tritium (³H), and Uranium, Office of Air and Radiation, EPA 402-R-99-004B*

Based on this investigation, DNSC believes the proposed values are still the most appropriate. DNSC has found no new, more reliable or compelling evidence to contradict this conclusion.

4.2 Information provided in Section 3.3.2.3 "Groundwater" does not present a compelling argument regarding the potential for groundwater contamination. The Parsons report should be provided (1999). Additionally, analytical data from the groundwater wells and information regarding future groundwater sampling should be provided to support the statement on page 18 of the DCGL report that "no evidence of groundwater contamination has been identified..."

Section 3.3.2.3 provided available information regarding potential or known contaminated media. The purpose of the section is to document that the groundwater is not known to be nor likely to be currently contaminated, and thus is not included as an initial source term in the DCGL calculations. Groundwater was included as a modeled exposure pathway. The potential for future exposure via the groundwater pathway is therefore considered in the DCGL calculation.

DNSC is providing the Parsons report (1999) as an enclosure with this response. However, the only radiological analytical data available is from a single monitoring well (CB-GW-04) presented in the Parsons 2000 report on page 3-14. The monitored well is located near the radiological waste disposal site, and demonstrated thorium levels consistent with natural background (0.3 pCi/l). The Parsons 2000 report is also enclosed with this response.

With regard to the purpose of Section 3.3.2.3 of the dose modeling report, there is no reasonable potential that the groundwater is contaminated in quantities that would constitute a source term in the RESRAD calculations. This conclusion is supported by process and historical knowledge, as well as the nature of the source term, i.e. above ground storage of containerized thorium nitrate. DNSC respectfully disagrees that information regarding future groundwater sampling is pertinent to the selection or justification of DCGL values.

4.3 The selection of distribution coefficients significantly impacts the dose from natural uranium and associated daughters [...] the DCGL is less than 1 pCi/g if the default distribution coefficients in RESRAD are used.

DNSC acknowledges the impact of the default RESRAD uranium K_d value. As indicated in the RESRAD Data Collection Handbook (Yu 1993), the default value is provided as a single value to use in absence of site specific data. A site-specific value, if available, should always be used for risk assessment (Section 32.3 of Yu 1993). DNSC has site-specific data regarding the composition and thicknesses of the various soil types at the Curtis Bay site, and has followed the referenced guidance by applying the site-specific K_d values to each subset of the soil.

4.4 The uncertainty with the plant transfer factors should also be investigated particularly if the depth of contamination is found to be greater than 15 cm and the plant ingestion pathway becomes more important.

In the response to Comment 1, DNSC believes that the 15 cm depth assumption is appropriate and justified. Therefore, the original statement that the ingestion pathways are minimal compared to the driving external gamma dose contribution remains valid. DNSC believes the selected plant transfer factors, based on NUREG and RESRAD default values, remain the most appropriate values.

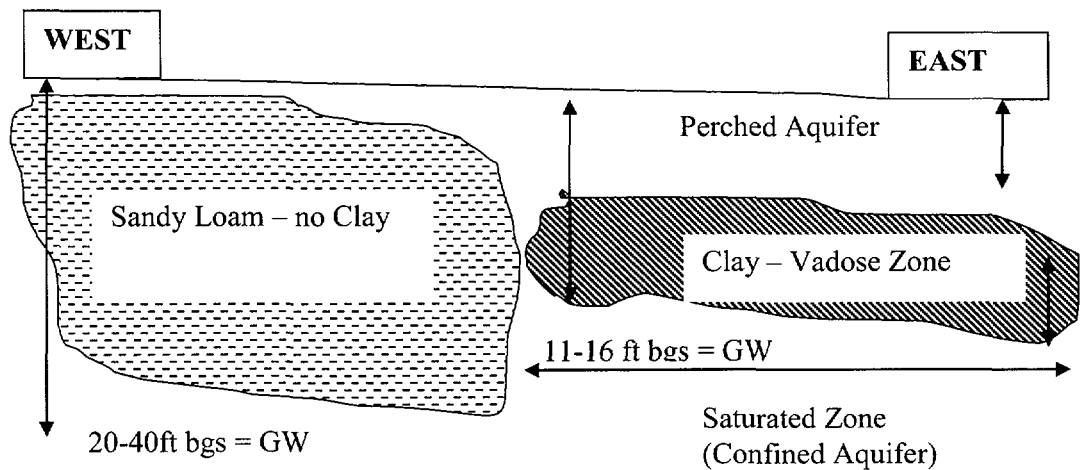
5. **Comment:** Clarify the hydrogeologic conceptual model for the site.

Action: Provide additional information regarding the lateral extent of the clay layer, the hydrostratigraphy, and the range in the depth to groundwater at the Curtis Bay site which is needed to determine an appropriate vertical discretization for the contaminated and unsaturated zones in the RESRAD modeling. If this information is unknown, the uncertainty in these parameter values should be evaluated and justification for the parameter values chosen should be provided.

DNCS Response: The basis for the NRC comment notes a discrepancy between the site model described in the text on page 29 and the parameter values listed in Appendix B. DNCS acknowledges the discrepancy, and will ensure consistent parameter values in the revision of the dose modeling report. The original discrepancy resulted from the sensitivity analysis process, when the last modeled parameter values were saved into the RESRAD file. However, as discussed below, the inconsistency between parameter values and the text description had no measurable effect on the preliminary DCGL values.

The hydrogeology of the Curtis Bay site is complex. According to the information from the Parsons series of reports, the vertical soil profile of the site is generally as described and shown below.

- The east side of the site has a loam layer, the top 15 cm of which is the contaminated zone. Within the loam, resting on top of a 1 to 5 m thick clay layer is a variable, intermittent perched aquifer. Below the clay layer is the permanent groundwater at depths of 11 to 16 feet below ground surface (bgs).
- The west side of the site lacks the clay layer with its perched aquifer, and has sandy loam throughout the entire profile to the groundwater depth of 20-40 ft bgs.



The lateral extent of the clay layer from the east side extending into the west side is not understood in great detail. The soil profile is based on a small number of monitoring wells, from which generalizations about the overall site geology are drawn. The geology can best be described as an east to west differentiation trend as shown in the diagram.

The RESRAD code lacks the ability to model complex, variable geologies such as the situation at the Curtis Bay Depot. However, the results can be bounded by running RESRAD calculations with the most extreme combinations of layer thickness and groundwater discussed in the Parsons reports. The results in Table 2 demonstrate that the reasonable variation in the parameters has minimal effect on the uranium DCGL. Since the primary exposure route for the thorium contaminant is external gamma exposure, soil layer thicknesses have no impact on the thorium DCGL.

Table 2: DCGL Variation with Clay Layer Depth to Groundwater

Scenario / filename	Contaminated Zone Thickness (m) (loam)	Loam (below cont. layer) (m)	Clay (m)	Depth to Groundwater (m)	Depth to Groundwater (ft)	Peak dose (mrem/pCi/g)	Uranium DCGL (pCi/g)	Represents
a	0.15	5.95	-----	6.1	20	23.5	1.1	West side, 20 ft GW
b	0.15	12.05	-----	12.2	40	11	2.3	West side, 40 ft GW
c	0.15	2.2	1	3.35	11	11.5	2.2	East side, 11 ft GW, 1 m clay
d	0.15	-----	3.2	3.35	11	11.5	2.2	East side, 11 ft GW, 3.2 m clay
e	0.15	3.7	1	4.85	16	11.5	2.2	East side, 16 ft GW, 1 m clay
f	0.15	-----	4.7	4.85	16	11.5	2.2	East side, 16 ft GW, 4.85 m clay

The NRC comment expresses concern about the statement in Section 4.3.2.1 of the Preliminary Dose Modeling Report that the vadose zone thickness is not an important parameter. These results confirm the report statement; the vadose zone thickness is unimportant, especially in light of the predominance of the thorium external gamma exposure pathway. Additionally, these results demonstrate that the discrepant parameter values saved into the RESRAD file result in effectively the same DCGL values as the full range of values encountered at the site.

- Comment:** Examine the significance of parameter values related to the plant ingestion pathway.

Action: Determine the significance of parameters affecting the plant ingestion pathway through additional sensitivity and uncertainty analysis consistent with its finding with respect to No. 1 above.

DNCS Response: During the preparation of the dose modeling report, the conceptual site model for the Curtis Bay Depot (Figure 10, page 26) identified the majority influence of the direct exposure pathway and the corresponding lack of impact of the plant ingestion pathway. This was later expressed in Section 4.3.2.1

(page 34) of the report which described the significance of the ingestion pathways based on conducted sensitivity analyses as “minimal”.

The DNSC response to NRC Comment No. 1 acknowledges information from the scoping survey that subsurface contamination exists at specified, limited, onsite locations. The ORISE characterization survey (conducted June 2006) and follow-on laboratory evaluations demonstrate that contamination does not exist over a vast majority (99%) of the site. Where it is present, e.g. the former radiological waste disposal site, the areas are targeted for remediated by DNSC. The remediation effort will be focused on meeting the site approved DCGLs.

The DNSC does not believe there is a justifiable need to conduct additional sensitivity and uncertainty analysis as it impacts the plant ingestion pathway, based on:

- Site characteristics (e.g. contamination depth is limited to 15 cm),
- The overriding predominance of the external gamma radiation exposure pathway,
- The remediation that will be conducted as needed to meet the DCGLs,
- The previously performed sensitivity analysis, and
- The lack of any compelling evidence contradictory to the proposed values.

7. **Comment:** DLA/DNSC did not provide sufficient justification for use of the default inhalation rate for the RESRAD-BUILD DCGL calculations.

Action: Justify your use of the default value for the inhalation rate in RESRAD BUILD, or modify your selection of the inhalation rate in RESRAD BUILD.

DNSC Response: As noted in the basis for the NRC comment, a breathing rate of $33.6 \text{ m}^3/\text{day}$ is consistent with NUREG/CR-5512, Volume 3. DNSC acknowledges this value provides a realistically conservative upper bound for the breathing rate. *The parameter value of $33.6 \text{ m}^3/\text{day}$ has been incorporated into the RESRAD-BUILD calculations.*

In line with adopting this parameter value from NUREG/CR-5512, DNSC will also revise the indoor fraction to be consistent with the NUREG. The dose modeling report was based on an overly-conservative indoor fraction of 0.5. NUREG/CR-5512, Volume 3, page 5-6 suggests a more realistic value based on a 45-hour work week for non-agricultural industries. This equates to 97.5 effective 24-hour days, yielding an indoor fraction of 0.267 ($97.5/365$).

RESRAD-BUILD was re-run with the inhalation rate selected at $33.6 \text{ m}^3/\text{day}$, and the indoor fraction set to 0.267. The results are shown in Table 3 below and indicate that use of the NUREG values very slightly increases the DCGL for both the thorium-232 decay chain and the uranium-238 decay chain. Based on the rounded DCGL values of 400 and $800 \text{ dpm}/100 \text{ cm}^2$ in the dose modeling report,

the revised parameter values result in effectively no change from the originally proposed DCGLs.

Table 3: Modified DCGL values for Inhalation Rate at 33.6 m³/day

Decay chain	Proposed DCGL (dpm/100 cm ²) (Inhalation Rate at 18 m ³ /day, Indoor Fraction at 0.5)	Modified DCGL (dpm/100 cm ²) (Inhalation Rate at 33.6 m ³ /day, Indoor Fraction at 0.267)
Th-232	383 *	405 (+ 6%)
U-238	761 *	797 (+ 5%)

* Note that the values in the dose modeling report were rounded to 400 and 800 dpm/100 cm², respectively.

8. **Comment:** DLA/DNSC did not differentiate between or discuss the potential exposure pathways for deconstructed building materials, e.g., concrete pads and debris piles, compared to residual contamination associated with buildings and/or soil contamination.

Action: Provide additional information regarding the final disposition of building materials and debris for the Curtis Bay site. If building materials will remain on-site, you need to consider development of site-specific DCGLs for these building materials and/or demonstrate why other site-specific DCGLs are bounding. Also, provide additional information regarding the potential for migration and transfer of residual contamination from degraded building materials to nearby surface soils and sediments at the Curtis Bay site.

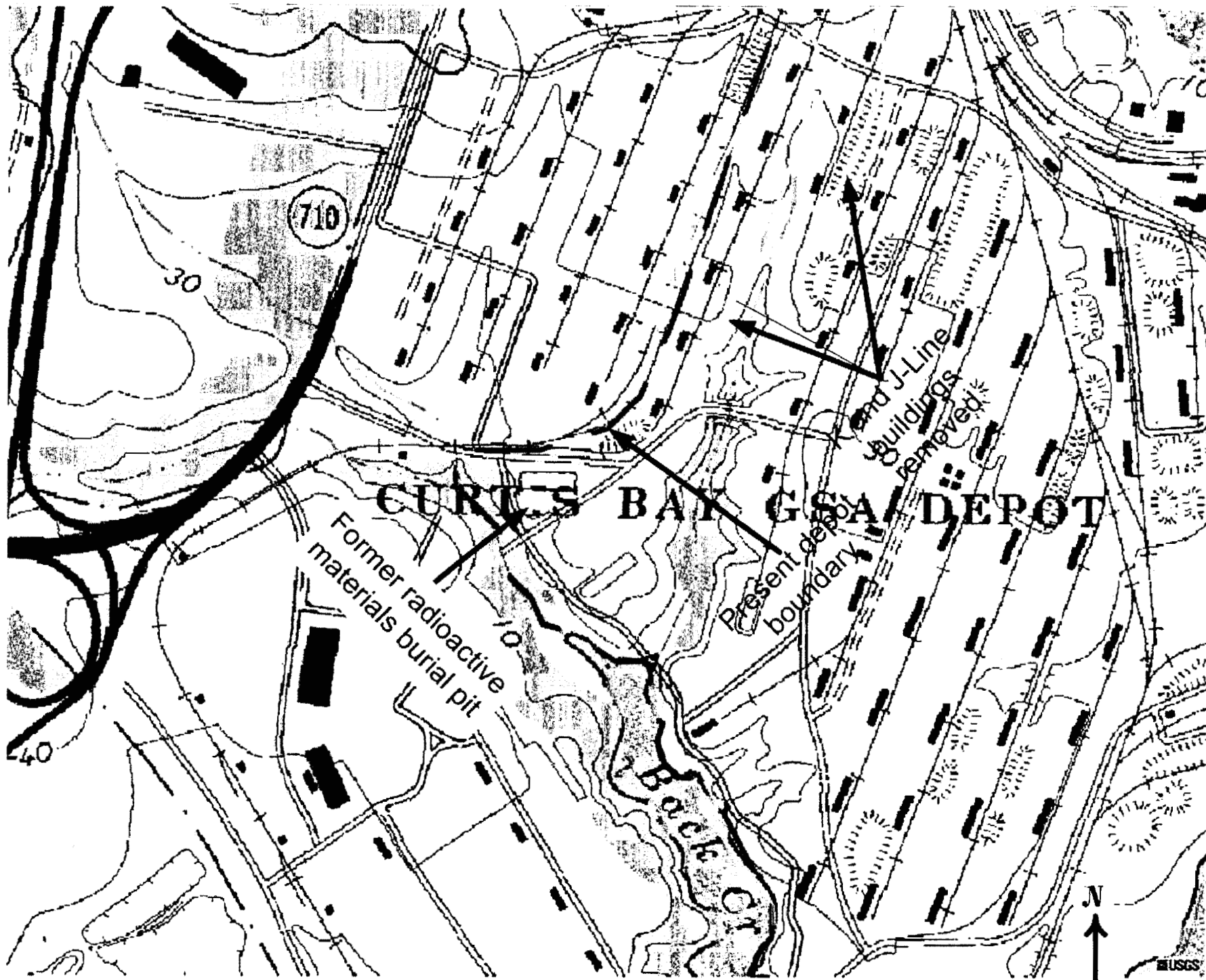
DNSC Response: The deconstructed building materials will remain on site. The buildings in question were not surveyed while intact due to safety considerations. Note that none of the deconstructed buildings were classified as Class 1, and all have very low potential for contamination. After deconstruction, the material was surveyed, and no contamination was found. Surveys included surface scans of up to 50% of the staged material and direct surface activity measurements. Survey results will be provided in the ORISE characterization survey report.

The only elevated reading was on a piece of metal and laboratory analysis identified only radon progeny which are commonly encountered on this type of material. There were no indications of either licensed thorium or uranium, only the NORM found in the terra cotta block walls. The survey design for the deconstructed building material and data evaluation were in accordance with the proposed building surface DCGLs.

The deconstruction scope-of-work was carefully planned out such that the deconstructed building material remained as large, intact sections (not pulverized into a volumetric mass) to the extent possible, to ensure that a surface contamination survey methodology was adequate (versus volumetric methods). To facilitate thorough surveys which were designed to emphasize the

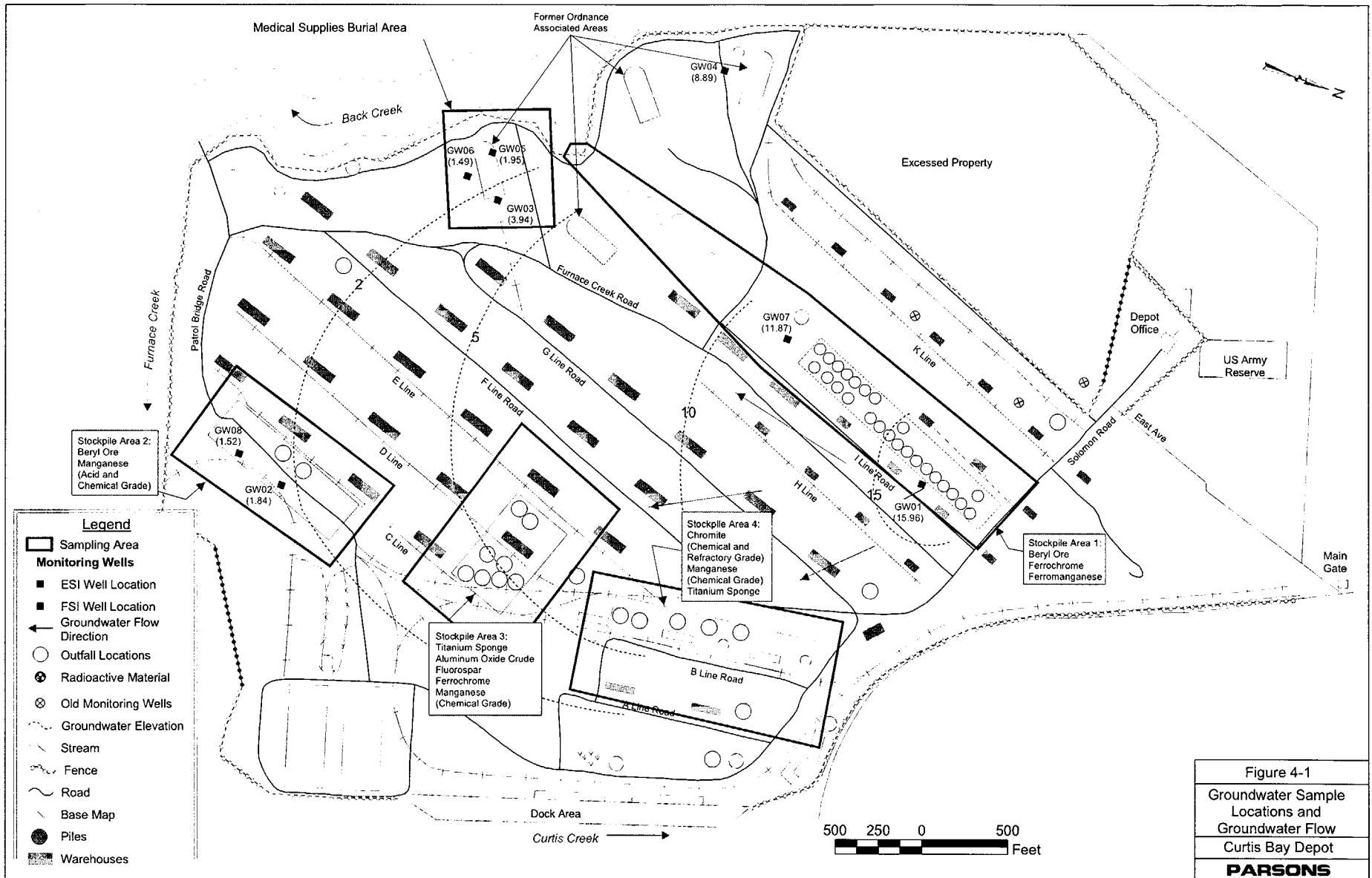
difference in contamination potential between the floors and walls noted, the materials were staged separately as either floor or wall/truss components.

Based on there being no contamination expected, verified by the surveys on the material, and therefore no reasonable potential for migration of contamination to adjacent soils, DNSC believes it is unnecessary to develop an additional site-specific DCGL for the deconstructed building materials.



USGS Quad Map—4 km NE of Ferndale, Maryland (7/1/1974)

Downloaded from TerraServer 06/29/2006



FINAL

**Preliminary Assessment
Curtis Bay Depot
Curtis Bay, Maryland**

Prepared for



**U.S. Army Corps of Engineers
Huntsville Center**

Contract No. DACA87 - 95 - D - 0018

Prepared by

PARSONS ENGINEERING SCIENCE, INC.

*January, 1999
733497*



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP

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January 12, 1999

Ms. Dorothy Richards
US Army Corps of Engineers
Huntsville Division
4820 University Square
Huntsville, Alabama 35816-1822

Dear Mr Skridulis

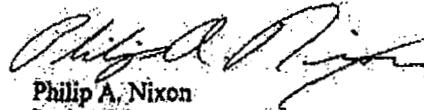
Subject: Submittal of the Final PA report for the Curtis Bay Depot

Enclosed are two copies of the final Preliminary Assessment (PA) report for the Curtis Bay Depot in Maryland. The report includes the results of our field investigations and records search that are used to score the site in accordance with the EPA guidance for the PA process. The PA process generally scores the site on its "potential" for environmental impact. The document also includes a recommended strategy for a focused Site Investigation (SI) for the purpose of testing our hypotheses concerning whether the depot contains sources of hazardous substances and if pathways exist for contaminant migration to the environment. It should be noted that the focused SI proposes a small number of samples in locations most likely to be contaminated to establish if a release of hazardous substances is occurring, rather than characterizing the nature and extent of contamination.

If you have any questions, please feel free to call me at (678) 969-2430.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.



Philip A. Nixon
Project Manager

c: Kevin Reilly, DLA
Twila Frieders, DLA
Ken Stockwell, Parsons ES
central file



FINAL
PRELIMINARY ASSESSMENT
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

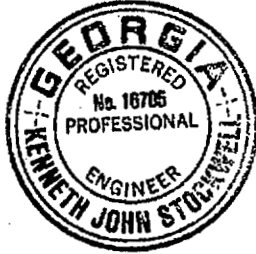
Prepared for
U.S. Army Corps of Engineers
Hunsville Center
Contract No. DACA87 - 95 - D - 0018
Delivery Order 0025

Prepared by
PARSONS ENGINEERING SCIENCE
Fairfax, Virginia

January 1999

Certification

As required by the Statement of Work for Order 0025, under Contract DACA87-95-D-0018, this preliminary assessment for the Curtis Bay Depot, Maryland, was conducted under my supervision and following general procedures provided by the EPA Guidance for Performing Preliminary Assessments Under CERCLA (Publication 9345.0-01A, September 1991).



Kenneth J. Stockwell 1/7/97

Kenneth J. Stockwell, P.E.

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SECTION 1

INTRODUCTION

1.1 PROJECT AUTHORIZATION

Parsons Engineering Science, Inc. (Parsons ES) received Contract No. DACA87-95-D-0018, Delivery Order No. 0025, from the U.S. Army Engineering and Support Center, Huntsville, to conduct Preliminary Assessments (PAs) at 15 Defense National Stockpile Center (DNSC) depots. These PAs were performed in accordance with all applicable State and United States Environmental Protection Agency (USEPA) guidance and regulations [e.g., the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance for performing PAs (Reference 1)]. The work was performed under the supervision of a registered professional engineer.

1.2 PURPOSE AND SCOPE

The National Stockpile program was established under the Strategic and Critical Materials Stock Piling Act (P.L. 79-520; July 23, 1946) as an attempt to avoid dependence on foreign sources of essential materials during times of national emergencies. Prior to 1988, management of the National Stockpile was divided between the Federal Emergency Management Agency (FEMA) and the General Services Administration (GSA). Under Executive Order 12626, the President moved management of the Stockpile to the Secretary of Defense. The DNSC is currently an activity-level agency under the Defense Logistics Agency (DLA).

The DNSC operates a number of depots which are GSA-owned or GSA-leased properties. As a result of the DNSC's operations, there exists a potential for environmental contamination at these depots. The objective of this report is to document the results of the PA at the following Depot:

CURTIS BAY DEPOT
710 EAST ORDNANCE ROAD
CURTIS BAY, MD 21226
CERCLIS NUMBER: NOT ASSIGNED

Specifically, this PA was performed to:

- Determine what hazardous substances have been or are currently stored on the site;
- Assess the immediate or potential threat that hazardous substances or hazardous wastes at the site pose to human health and the environment;
- Assess if there is a need for further site investigation to determine the nature and extent of any potential environmental contamination (i.e., collect information to support a decision regarding the need for further action).

The major activities which were performed in the development of this PA include the following:

- Review of available information for the facility. Information reviewed included records and reports provided by the Government, published data, and data available from other sources;
- Interview of available personnel knowledgeable of past and present site conditions and operations. Table 1.1 presents a summary of the contacts that were made and the information that was provided;
- Visual inspection of the site, and collection of additional relevant data that was available locally and at Fort Belvoir, Virginia;
- Preparation of the Potentially Hazardous Waste Site Preliminary Assessment Form (Appendix A); and
- Scoring of the site using the USEPA's PA Scoresheets (Appendix B).

Table 1.1
Summary of Contacts
Curtis Bay Depot

Name	Agency/Title	Telephone No.	Comment
Joe Scholle	Depot Manager	410/962-2346	3 yrs at Depot
Grant Baker	Storage Specialist	410/962-2346	9 yrs at Depot
John Amole	Site Worker	410/962-2346	16 yrs at Depot
Robert Hansen	Security Guard	410/962-2346	25 yrs at Depot

Appendix C provides the photodocumentation log of photographs taken during the site visit conducted May 18 through May 20, 1998. Appendix D provides suggested sampling locations and analytical parameters to be assessed as part of a Focused Site Investigation (Focused SI). Performance of a focused SI will aid in supporting or refuting the PA hypotheses regarding contaminant migration pathways and possible exposure to human and environmental receptors.

SECTION 2 SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

2.1 SITE DESCRIPTION

The Curtis Bay Depot is an active facility which maintains storage of strategic materials, including bulk ores, minerals, and metals. It has a work force of 12 personnel and has been in operation since 1918.

The Curtis Bay Depot is located approximately one mile south of Baltimore in Anne Arundel County, Maryland. The Depot is located at latitude N391140 and longitude W763524 on the Curtis Bay Quadrangle, Maryland (7.5 minute U.S. Geological Survey topographic map). Figure 2.1 is a base map showing the facility on the topographic map, including a one-mile radius, surface water drainage features, nearest drinking water well, and sensitive environments.

The Depot is approximately 483 acres. It is bordered on the east by Curtis Creek and on the south by Furnace Creek. Unnamed tributaries and/or gullies drain the site flowing south into Back Creek, which discharges to Furnace Creek. There is a 1,955 foot long concrete dock along Curtis Creek. Except for the dock, the facility is enclosed by a security fence. The facility has approximately 74 buildings; only a few are in use, many are in deteriorated condition. The facility utilizes a septic leachfield system which is sized for more people than work at the Depot. There are approximately six miles of paved roads and two miles of railroad tracks. The terrain is mostly flat to gently hilly with grassy, open areas. Figure 2.2 is a site map showing all the features of the Depot.

2.2 OPERATIONAL HISTORY

The original U.S. Army Depot was built in 1918 on 798 acres of farmland. Additional acreage was acquired, making the site total 815 acres. The site was used by the Army for receiving, shipping, and storage, and as an ordnance depot from 1918 until the mid-1950s. From 1919 until sometime in the 1950s, the function of the Depot was storage and maintenance of ammunition. Between 1958 and 1966, approximately 37 acres were reassigned to the U.S. Army Reserve. In the late-1950s, the National Defense Stockpile became a tenant and began storing strategic materials (bulk ores, minerals, and metals). Also, the Depot began receiving post-Korean War munitions for processing and/or disposal.

Figure 2.1

Figure 2.2

In 1965-1966, the remaining 778 acres were reported excess to the GSA which assumed accountability for the facility. Since that time there have been several transfers of land to Anne Arundel County and the Maryland Department of Transportation, resulting in the current Depot acreage of 483. In the early 1980s, the Stockpile program assumed the management function for the GSA property. In 1988, when the Stockpile function was transferred to the DLA, the Stockpile Program continued to manage the property for GSA. Currently, the U.S. Army Reserve, under the command of the 99th Regional Support Command, uses the dock area of Curtis Creek for the maintenance of Army tugboats and the Baltimore City Police Canine Corps uses the facility as a training area for police dogs. Training of the Army Reserve or the Canine Corps, typically on weekends, can increase the Depot population to 200 people.

Subsequent to the dismantling of the regional zone system for DNSC Depots, Curtis Bay also functions as a file/information repository for other DNSC Depots which were formerly in the eastern zone (New York headquarters).

2.2.1 Regulatory Status

The Depot's Federal Facility identification number is MD971500580. The Depot is classified as a small quantity generator of hazardous wastes. The 1997 Hazardous Waste Report indicates waste generation and management of paint related material (D001), dust mixture (barium, chromium) for use with paints (D005 and D007), and batteries (D006 and 777). The RCRA Generator number is MD9470000580.

The Depot stores radioactive material and is listed on the DNSC's Nuclear Regulatory Commission (NRC) license.

The Depot holds a General Stormwater permit (No. 97-SW). NPDES permit (No. MDR000001) was renewed in December 1997. Five outfall locations (Figure 2.2) were sampled in 1992; currently no on-going sampling of these outfall locations is required. The Depot also maintains an Oil Operator's permit.

2.2.2 Stockpiled Materials

The Depot maintains approximately 985,000 square feet of outside storage area with approximately 615,000 square feet currently occupied. Total inside storage is 176,170 square feet with 97,000 square feet occupied. The following materials are, or have been, stored outside at the Curtis Bay Depot: aluminum oxide crud, beryl ore, chromite (refractory), ferrochrome (high and low carbon), ferromanganese, fluorspar, lead, manganese (battery and chemical, grades A & B), tin, and titanium sponge. The following materials are, or have been, stored inside at the Depot: antimony, asbestos, cadmium, chrome (electrolytic and exothermic), cobalt, ferrochrome (LC), ferrochrome silicon, graphite, manganese (electrolytic), talc, tungsten, tungsten rods, and thorium nitrate. Thorium nitrate is a radioactive material typically stored in a separate fenced and restricted area.

Table 2.1 Cont

Table 2.1 Cont

According to the Depot Manager (Reference 2), some of these materials are being sold; there has been no replenishment of materials in more than ten years. Table 2.1 presents the current quantities of materials stored at Curtis Bay. Materials which may have been stored in the past at the Depot, but which are no longer present, are not shown in the table.

2.3 WASTE CHARACTERISTICS

This section discusses the quantities and properties of the wastes, or potential wastes, using the available information.

2.3.1 Potential Sources

A source is defined as an area where a hazardous substance may have been deposited, stored, disposed, or placed. Also, soil that may have become contaminated as a result of hazardous substance migration may be a source (Reference 1). Hazardous substances are defined in accordance with 40 CFR 302.4. The following areas were considered as potential sources.

2.3.1.1 Stockpiles

Most of the stockpiled materials are raw ores. Some of the ores contain metals which are identified as CERCLA hazardous substances and which could be environmental contaminants if migration to surface water, groundwater, soil, or air, has occurred. The chemical composition and general description of the components involved in the stockpiled materials is presented as Table 2.2.

Most of the ores are piled on concrete pads or directly on the ground. Some ore piles are covered to reduce oxidation and erosion through weathering. The concrete pads do not provide complete containment, as numerous cracks and apparent surface water runoff pathways were observed during the site visit. Other materials are stored in warehouses in drums, bundles, or other means of segregation. Building 1022 is the remaining active storage warehouse. The warehouse, a single story building with a concrete floor, appeared to be in good condition with no evidence of cracked floors or any indication of contaminant migration potential.

In order to develop a score for these potential sources, it was necessary to organize the numerous outside stockpiles into general areas. The materials inside the warehouse were not included as the contaminant migration potential is minimal. Due to space limitations, the stockpiles could not be individually named or numbered on the figure. Additionally, there was some uncertainty in matching the most recent inventory of materials, supplied by Depot personnel, with the old site maps provided by Depot personnel. The site visit indicated some inconsistencies with stockpile locations and types, when checked against the site map provided.

Figure 2.2 indicates four stockpile areas based on location. The objective of the grouping was to allow an overall evaluation of the contamination potential of the materials.

Table 2.2

Table 2.2 Cont

Therefore, it was not necessary to ensure that every stockpile was included within one of the areas. Each stockpile area comprises several types of stored materials. A specific material may be present in more than one stockpile area. This orientation represents the current location of the materials and does not reflect past practices or stockpile locations. For example, although lead has been documented as having been stored outside, it no longer is and therefore is not addressed in the following descriptions. However, the potential for lead contamination of the soil, surface water, or groundwater has been considered for this report.

The stockpile areas were organized as follows:

Stockpile Area 1

This area is approximately 1300 feet by 200 feet, comprising the following stockpiles: beryl ore, ferrochrome, and ferromanganese. The stockpiles are uncovered and staged on a concrete pad with visible cracks.

Stockpile Area 2

This area is approximately 900 feet by 200 feet, comprising beryl ore, manganese acid grade, and manganese chemical grade. The manganese piles are covered.

Stockpile Area 3

This area is approximately 500 feet by 300 feet, comprising titanium sponge (drummed on concrete blocks), aluminum oxide, fluorspar, ferrochrome, and manganese chemical grade.

Stockpile Area 4

This area is approximately 1200 feet by 200 feet, comprising chromite chemical, chromite refractory, manganese chemical grade, and titanium sponge (drummed on concrete blocks). The manganese piles are covered.

2.3.2 Other Materials and Areas of Concern

2.3.2.1 Fuel Tanks

Curtis Bay Depot has 10 above ground fuel storage tanks (ASTs) ranging in size from 250 gallons to 10,000 gallons and containing gasoline, diesel, #2 fuel oil, or waste oil. Eight of the ten have containment dikes. There are currently no underground fuel storage tanks. The Depot has converted to natural gas and is in the process of phasing out the ASTs.

2.3.2.2 Asbestos

Numerous reports describing asbestos-containing materials (ACMs) at the Depot were reviewed. A survey dated May 1992 describes buildings, amount of ACMs, whether or not a sample has been analyzed for asbestos, its location in the building, and its condition. Overall,

according to this survey, there still appears to be a large amount of asbestos at this facility, not all of which has been tested, and a sizable portion which is in bad condition. Several reports dated January 1998 describe asbestos sampling activities.

An April 1997 memo discusses disposal of approximately 1 ton of bagged chrysotile asbestos and 27 tons of bagged crocidolite asbestos. No follow-up memos, manifests, or reports were located determining whether or not the 28 tons of stored asbestos have been disposed.

2.3.2.3 Herbicides/Pesticides

The DNSC Herbicide Report from November 1995 describes the herbicide use at the Depot. Round-Up and Spike 80W were used over a six week period, usually in 6 quart quantities, at a 100 gallon concentration. This amount typically covered 3 acre areas, including railroad tracks, buildings, and ore piles. A March 1996 memo to all DNSC facilities discusses reducing the use of herbicides at all Depots, as part of its Pollution Prevention Plan. Herbicides apparently are no longer used on the stockpiles. No herbicides or pesticides are stored at the Depot; all herbicide or pesticide work is performed by a contractor.

2.3.2.4 Polychlorinated Biphenyls

Numerous letters, memos, and inventory sheets pertaining to transformers and PCBs were reviewed. Various reports about transformer leaks, manifests for PCB disposal, and installation of non-PCB transformers were also reviewed. The most recent transformer inventory list, from September 1989, lists 28 areas where transformers exist, 15 of which contain unknown material in them, 12 of which are dry, and one which contains transformer oil. It appears that all PCB transformers were replaced in the 1980s and that no PCB related materials remain on the facility.

2.3.2.5 Ordnance

According to a historical review and analysis report prepared by the U.S. Army Depot System Command Historian, pre-1950s operations included bonderizing metal containers for propellants (involving transfer of propellants from fibre to metal containers) and a renovation plant to reprime ammunition (Reference 3). Following the Korean War, ordnance-related operations at the Depot included a powder burn plant, small arms processing, incineration, and smokeless powder burning under wire enclosures. Storage included nine primer and fuse magazines, 33 standard magazines, 57 smokeless powder magazines, and eight high explosive magazines. An ammunition popping plant reportedly sent 1,900,000 pounds of small brass ammunition to property disposal (Reference 3).

An archives search was conducted in 1993 by the U.S. Army Corps of Engineers, St. Louis District (Reference 4). The St. Louis District had been tasked with preparing Archive Search Reports for those Formerly Used Defense Sites (FUDS) suspected of chemical warfare (CWM) contamination. According to this report, ... "there was no indication that CWM was

present at this installation." However, the report went on to say that the potential for Ordnance and Explosive Waste (OEW) contamination was considerably higher than the potential CWM contamination, and that "...Although the records reviewed did not indicate any OEW CWM disposed of on the property, one cannot ignore the enormous amount of ordnance which went through Curtis Bay Ordnance Depot" (Reference 4).

According to the Depot Manager, in the summer of 1998, some live small arms ammunition was found buried in the southeast corner of the Depot.

2.3.3 Previous Investigations/Removal Actions

2.3.3.1 Excessed Property

In 1980, the GSA sold approximately 85 acres of Depot property to Anne Arundel County, Maryland. Nine warehouses on the tract had been used to store thorium nitrate, a radioactive material. The thorium nitrate, as well as the warehouses and contaminated soils were removed and the county eventually built a jail on the property. As that tract of land had been excessed in 1980, it is not part of this report.

2.3.3.2 Radioactive Waste Burial Pit

According to a 1979 report, a small area of the Depot had been used as a burial pit for various materials, including thorium nitrate contaminated material in 1965 and four drums of beryllium oxide in 1969 (see photo no. 25, Appendix C). Reportedly, all of these materials were removed with the approval of the State of Maryland to an approved landfill by 1987, and the Nuclear Regulatory Commission (NRC) opened the area for unrestricted use. Soil samples were collected. However, it is unclear whether groundwater monitoring had been performed in this area (Reference 5).

2.3.3.3 Monazite Sands Storage Buildings

Portions of building F-737, which stored monazite sands (a source of natural thorium), were assessed as radiologically contaminated and subsequently underwent decontamination efforts. A December 1994 report from the NRC stated that although the building, excluding the concrete slab, met NRC guidelines for release for unrestricted use, the soil samples taken around and under the building exceeded the NRC guidelines for residual thorium in soil. Additional soil sampling was completed in this area in 1995. The area surrounding Building T-0737 was divided into 10 ft² grids. The grids were surveyed by a radiation detector, and any reading above an action level of 5,000 counts per minute was flagged for remediation. Thirty soil samples were collected at a depth of six inches from each grid at the location of the highest reading during the survey. The measured activity concentrations ranged from less than 0.02 to 7.9 picocuries/gram, and all of the results were less than the 10 picocuries/gram level which is the Nuclear Regulatory Commission value for unrestricted release.

2.3.3.4 Buried Medical Supplies

In 1996, a retired Stockpile Operations Foreman reported that medical supplies had been buried in the past at a location approximately 100 yards from the south end of G Line Road. In September 1996, three exploratory trenches uncovered numerous bottles buried at approximately eight feet below ground surface. Some of the bottles were removed, and the trenches backfilled. The bottles removed were labeled as saline and/or dextrose. It is unclear whether sampling identified all the contents of the bottles or how much material remains buried.

SECTION 3 PATHWAY AND ENVIRONMENTAL HAZARD ASSESSMENT

3.1 INTRODUCTION

The pathways addressed in the PA are groundwater, surface water, soil, and air. Targets are physical or environmental receptors that are within the target distance limit for the pathway. Based on professional judgment, a primary target is designated as one with a high likelihood of exposure to a hazardous substance and a secondary target as one with a relatively low likelihood of exposure to a hazardous substance.

In order to define the targets, Parsons ES utilized the services of two database search firms. Population and number of people on private drinking water wells within specified radii of the Depot were obtained from Frost Associates (Reference 6). The Frost report uses the 1990 Census Bureau database for population and water supply data cross referenced against site latitude and longitude coordinates. Environmental Data Resources, Inc. (EDR) provided a search of several environmental databases to identify nearby sites or properties which may have impacted the environment, including CERCLA, RCRA, TSCA, and others (Reference 7). Relevant portions of these reports are presented as Appendix E.

3.2 GROUNDWATER PATHWAY

The groundwater pathway assessment addresses hazardous substance migration to and within aquifers and potential threats to targets such as drinking water supplies. The target population is the human population associated with the site and/or its targets. Target populations consist of those people who use target wells. The target distance limit for groundwater is a 4-mile radius around the site.

3.2.1 Geologic and Hydrogeologic Setting

The site vicinity is located within the Atlantic Coastal Plain Physiographic Province. The Depot is approximately five miles east of the Fall Line, the boundary between the Coastal Plain and the Piedmont Physiographic Province. The alluvial Coastal Plain sediments beneath the site are part of the Lower Cretaceous Potomac Group. These sediments generally thicken from west to east. The Potomac Group sediments in the Baltimore area consist primarily of unconsolidated clays, silts, sands, and gravels. A silt-clay facies of the Patapsco Formation (of the Potomac Group) underlies most of the Depot. This facies consists of a shallow clay, which was not found at all boring locations across the site, underlain by a water-bearing sand and gravel unit (Reference 8).

Regionally, groundwater in the Coastal Plain occurs under water table and artesian conditions. The Patuxent Formation of the Potomac Group is a major source of groundwater in

the coastal plain of Maryland. At the Depot, groundwater occurs in the surficial sediments overlying the shallow clay, often as perched conditions. In the western portion of the site, where perched conditions are not present, groundwater occurs under water table conditions. Groundwater occurs between 12 feet to 16 feet below ground surface in the eastern portion of the Depot, and 25 feet to 50 feet below ground surface in the western portion. An average groundwater flow velocity value of 0.8 feet/day was estimated for the shallow aquifer, with flow direction generally from west to east towards Curtis Bay. There is a slight tidal influence on the uppermost groundwater zone at the site (Reference 8).

3.2.2 Potential for Release to Groundwater

Precipitation in the area averages approximately 43 inches per year (Reference 9). The groundwater table at the Depot is relatively shallow. The soils underlying the site are well-drained. Contaminants could potentially percolate through these relatively permeable soils and reach the groundwater.

The outside, uncovered ore stockpiles are considered contaminant sources due to their exposure to weather, and in some cases, their direct contact with the surrounding soils. Other potential sources of contamination of groundwater include the buried medical supplies and the former radioactive waste burial pit.

3.2.3 Groundwater Use

Drinking water in the site vicinity is provided by Anne Arundel County, utilizing the Glenn Burnie Well System (Reference 10). The system comprises fifteen municipal drinking water wells; the wells are within a four-mile radius of the Depot. The system well nearest the Depot is on Glendale Road, approximately 2.5 miles west of the site. The fifteen wells service the majority of the area, including the Depot, tapping into a semi-confined aquifer. It is estimated that a total of 250,000 people are served by this system within a 4 mile radius of the Depot. The depth of the well system aquifer is reportedly greater than 170 feet (Reference 7).

The nearest drinking water well(s) is within 0.25 miles of the Depot. There are approximately 35 people using private drinking water wells within 0.25 miles of the Depot (Reference 6). Although the exact location of these wells could not be determined, general information indicated the probable location as the northern tip of the Point Pleasant area, across Furnace Creek from the Depot (see Figure 2.1). Within 0.75 miles of the Depot, approximately 93 people utilize private drinking water wells. According to the MDOE, many of these wells are east-southeast of the Depot, across Curtis Creek.

3.2.4 Groundwater Pathways and Targets

There are no wells used for drinking water at the Depot. However, due to the potential for migration of contaminants to the groundwater, the drinking water well(s) identified within 0.25 miles of the Depot were considered primary targets for the groundwater pathway.

The secondary target population includes the population relying on groundwater from secondary target wells. Secondary wells are identified as those having a low likelihood of exposure to a constituent. The fifteen municipal wells within a four-mile radius of the Depot, which constitute the main drinking water supply in the area, are considered secondary targets. All of the wells are currently in use and do not have any recorded health risks associated with water quality (Reference 10). Therefore, there is a very low potential for exposure to secondary wells by releases from the Depot.

3.3 SURFACE WATER PATHWAY

The surface water pathway addresses hazardous substance migration to surface water bodies, drinking water supplies, the human food chain, and sensitive environments. The target population consists of those people who use surface water for drinking water or consume food chain species taken from target fisheries. The target distance limit for the surface water pathway is 15-miles downstream from the probable point of entry to surface water.

3.3.1 Hydrologic Setting

Ground surface elevations range from approximately 50 feet above mean sea level (amsl) in the northern portion of the Depot to approximately 10 feet amsl in the southern and eastern portions. Surface water drainage routes generally flow from north to south and east to large water bodies. The Curtis Bay Depot is bounded on the east by Curtis Creek and on the south by Furnace Creek and Back Creek, which flows into Furnace Creek. Several unnamed tributaries and culverts or gulleys drain the Depot, mostly flowing to Back Creek. Furnace Creek flows into Curtis Creek which flows into Curtis Bay. Curtis Bay flows into the Patapsco River which lies approximately 2.5 miles from the Depot. Approximately 5 miles downstream from the Depot, the Patapsco River flows into the Chesapeake Bay.

3.3.2 Potential for Release to Surface Water

The majority of the stockpiles are not covered and are subject to weathering with the potential generation of runoff containing contaminants. During the site visit, visible signs of surface water runoff pathways from the stockpiles to surface water bodies was evident (see photos nos. 7 & 8, Appendix C). Although dilution of contaminants would be expected, constituents from the stockpiles could migrate into Back Creek or Curtis Creek via overland flow or unnamed tributaries and natural drainage culverts.

3.3.3 Surface Water Pathways and Targets

The surface water targets considered for the Depot are described below.

3.3.3.1 Surface Water used as Drinking Water

Surface water is not used as a potable water source in the site vicinity. There are no surface water intakes within a 15 mile downstream distance of the Depot.

3.3.3.2 Fisheries

According to discussions with Depot personnel, fishing occurs in Back Creek and Curtis Creek. Due to the potential for migration of contaminants to the surface water, these fisheries are considered primary targets for the surface water pathway. These water bodies were classified within the moderate to large stream category.

3.3.3.3 Sensitive environments

Sensitive environments within the site vicinity include threatened species, archeological or historical structures, wetlands, and flood zones.

According to the Maryland Department of Natural Resources, Forest, Wildlife and Heritage Service, there is a Least Tern colony located on the roof of the Central Atlantic Toyota building, within 0.25 miles of the Depot (Reference 11). The Least Tern is listed as a threatened species in the state of Maryland. The State is to undertake all preventative measures in order to ensure this species remains protected. The Least Tern is considered a primary sensitive environment for the surface water pathway.

Cultural resources information in the vicinity of the Depot were supplied by the Maryland Department of Housing and Community Development (MDHCD), Division of Historical and Cultural Programs (Reference 12). According to the MDHCD, there are 13 inventoried archeological properties within a one-mile radius of the Depot. This includes Buildings no. 1001 and no. 1003 on the Depot property. These buildings, which include the former popping plant, are along the dock area of Curtis Creek and are currently used by the Army Reserve.

An extensive wetlands area exists to the southwest of the Depot, along Back Creek, on the southern property border (see Figure 2.1). The area is approximately 2000 feet long, according to a 1994 National Wetlands Inventory. In addition, a small wetlands area exists on the southeastern portion of the property border, along Curtis Creek. Wetlands are considered primary sensitive environments for the surface water pathway.

100-year flood zones exist around the majority of the Depot, where the property intersects water bodies. The southern and eastern border areas of the facility lie within the 100-year flood zone (Anne Arundel County Permit Application Center). Farther inland on the Depot property, approximately 1000 feet from the water bodies, 100-500 year flood zones potentially exist (Reference 13).

3.4 SOIL EXPOSURE PATHWAY

The target distance limit for the soil exposure pathway is 200 feet for resident population and one mile for the nearby population. The pathway for soil exposure accounts for the potential threat to people on or near the site who may come into contact with exposed

materials and areas of suspected contamination. This includes both ingestion and dermal exposure.

3.4.1 Potential for Release to Soil

The majority of the stockpiles are not covered and are subject to weathering with the potential generation of runoff or leaching of contaminants to the soil. During the site visit, visible signs of surface water runoff pathways from the stockpiles to soil was evident.

3.4.2 Soil Pathways and Targets

There are no residential buildings within 200 feet of the Depot; there are 12 full-time employees at the site, but there is no resident population. Therefore, there are no primary targets for the soil exposure pathway.

Secondary targets include a prison located approximately 600 feet west-northwest of the Depot, and a daycare facility located approximately 2,000 feet west-northwest of the site. In addition, approximately 5,600 people live within one-mile of the Depot. The Least Tern colony, discussed in section 3.2.3.3, qualifies as a sensitive terrestrial environment target.

3.5 AIR RELEASE PATHWAY

The air pathway accounts for hazardous substance migration, in gaseous or particulate form, through the air. Airborne deposition is a potential threat to people and sensitive environments. Target populations under the air pathway consist of people who reside, work, or go to school within the target distance limit. The target distance limit for the air pathway is a four mile radius around the site and is divided into incremental distances.

3.5.1 Potential for Release to Air

The stockpiles which are not covered can potentially contribute to particulate migration of contaminants through the air. Additionally, the stockpiles are susceptible to particulate migration during loading or unloading of stockpile materials. Many of the stockpiles are covered with an impermeable cap.

3.5.2 Air Pathways and Targets

No previous incidents of air contaminant migration were discovered, therefore, the 'no suspected release' pathway was evaluated. No primary target population is considered for the 'no suspected release' pathway. The secondary target population includes those residents within the four mile site radius (approximately 130,000 people). Primary sensitive environments included the threatened species and wetlands previously discussed for the surface water pathway.

SECTION 4

SUMMARY AND CONCLUSIONS

4.1 SUMMARY

The Curtis Bay Depot stockpiles potentially hazardous substances, as defined in CERCLA Section 101(14), and found in 40 CFR Part 302.4. A release of hazardous substances could result from leaching of metals from the stockpiles or from the other identified potential source areas. Therefore, a potential for release of contaminants exists for the four pathways evaluated: groundwater, surface water, soil, and air.

After assessing the potential contamination to each of four pathways, as shown on the PA Scoresheets contained in Appendix B, the overall site score was calculated. The site score summarizes the potential for a release at Curtis Bay Depot. An overall score of 79 was calculated for the Curtis Bay Depot, as shown in Table 4.1. According to the EPA CERCLA Guidance Document, a score of 28.5 or greater warrants further investigation. The score exceeded the 28.5 standard primarily because of large quantities of stockpiled materials stored onsite combined with identified primary targets.

A Focused Site Investigation (SI) is recommended for the Curtis Bay Depot; the proposed SI is detailed in Appendix D.

4.2 CONCLUSIONS

The PA evaluation of each pathway is described below.

4.2.1 Groundwater Pathway

It is hypothesized that the metals are not leaching and migrating from the stockpiles at concentrations that exceed groundwater protection standards since metals typically do not move readily through soil. However, due to the potential for migration of contaminants to the groundwater, and the large quantity of stockpiled source areas, a suspected release to groundwater was scored.

The population (35 people) associated with the drinking water well(s) identified within 0.25 miles of the Depot was considered as a primary target. The fifteen municipal wells within a four-mile radius of the Depot, which constitute the main drinking water supply in the area, were considered secondary targets. Primarily because of the population involved, and the quantity of stockpiled source materials, the maximum score of 100 was calculated for the groundwater pathway.

Table 4.1: Site Score Calculation

PATHWAY	SITE SCORE (S)
Groundwater (S_{gw})	100
Surface Water (S_{sw})	100
Soil Exposure (S_s)	41
Air (S_a)	59
Site Score: $\sqrt{(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2)} / 4$	79.3

4.2.2 Surface Water Pathway

It is hypothesized that the metals are not leaching and migrating from the stockpiles at concentrations that exceed surface water protection standards since metals typically do not move readily through soil. However, due to the potential for migration of contaminants into Back Creek or Curtis Creek via overland flow or unnamed tributaries and natural drainage culverts, the observed runoff of surface water flow from the stockpiles to surface water bodies, and the large quantity of stockpiled source areas, a suspected release to surface water was scored.

Surface water is not used as a potable water source in the site vicinity. Therefore, no drinking water threat target was scored. According to discussions with Depot personnel, fishing occurs in Back Creek and Curtis Creek; these fisheries were scored as primary targets for the surface water pathway. In addition, the Least Tern colony located within 0.25 miles of the Depot, and the wetlands in the vicinity of Back Creek, were scored as primary sensitive environments for the surface water pathway.

Primarily because of the fisheries and sensitive environments and the quantity of stockpiled source materials, the maximum score of 100 was calculated for the surface water pathway.

4.2.3 Soil Pathway

It is hypothesized that the metals are not leaching from the stockpiles at concentrations that exceed soil protection standards. However, due to the visual observation of migration of contaminants into the soils, the observation of stockpiles staged directly in contact with soils, and the large quantity of stockpiled source areas, a suspected release to soil was scored.

There are no residential buildings within 200 feet of the Depot; there are 12 full-time employees at the site, but there is no resident population. Therefore, no primary targets for the soil exposure pathway were scored. The Least Tern colony was scored as a sensitive terrestrial environment target. Primarily because of the sensitive terrestrial environment target and the quantity of stockpiled source materials, a score of 41 was calculated for the soil pathway.

4.2.4 Air Pathway

No previous incidents of air contaminant migration were discovered, therefore, no suspected release was scored for the air pathway. No primary target populations were scored for the 'no suspected release' pathway. The secondary target population, including those residents within the four mile site radius (approximately 130,000 people), and the primary sensitive environment targets (the Least Tern Colony and wetlands), were scored. Primarily because of the secondary target population, the sensitive terrestrial environment target, and the quantity of stockpiled source materials, a score of 59 was calculated for the air pathway.

SECTION 5

REFERENCES

5.1 REFERENCES

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Appendix A

Potential Hazardous Waste Site

Preliminary Assessment Form

**Curtis Bay Depot
Curtis Bay, Maryland**

Appendix B

Preliminary Assessment Scoresheets

**Curtis Bay Depot
Curtis Bay, Maryland**

Total Score = 79.3

Appendix C

Photodocumentation Log

**Curtis Bay Depot
Curtis Bay, Maryland**

Appendix D

**Recommended Site Investigation Strategy
Curtis Bay Depot
Curtis Bay, Maryland**

APPENDIX D

RECOMMENDED SITE INVESTIGATION STRATEGY

D.1 BACKGROUND

The results of the PA performed for the Curtis Bay Depot indicate that some of the stockpiled strategic materials stored on the site present the potential for hazardous substance release to the environment with subsequent exposure to these substances by human and ecological receptors. The score calculated on the PA scoresheet exceeded the cut off point of 28.5 primarily because of the targets identified as potential receptors and the large quantity of stockpiled source materials.

In order to assess whether a hazardous substance release has occurred, a site investigation (SI) is recommended for this site. The purpose of the SI is to determine whether hazardous substances have been released to the environment and the likelihood they have or may impact specific targets. The strategy outlined below is based on USEPA guidance for performing SIs under CERCLA (USEPA, 1992: Directive 9345.1-05). The target receptors could be impacted by the stockpiled source materials (some containing hazardous substances) only if there is a release and a transport mechanism by which the hazardous substances could migrate to the receptors. There are no impacts if the hazardous substances are not released and do not migrate. The purpose of this SI is to collect and analyze a limited number of samples to determine whether there has been a release and whether migration is indicated which may expose the target receptors to the hazardous substances.

D.2 CHOICE OF SI APPROACH

D.2.1 There are three basic approaches to performing an SI (USEPA, 1992: Directive 9345.1-05):

- **Focused SI** - Tests PA hypotheses requiring further investigation and may be used to screen sites to determine the need for further action;
- **Expanded SI** - Gathers all information necessary to fulfill the Hazard Ranking System (HRS) requirements for sites with a high probability of qualifying for the NPL; and
- **Single SI** - Combines the functions of the focused and expanded SIs and may be chosen under certain conditions.

Of these three options, use of the Focused SI sampling scheme at this site will allow investigators to test critical PA hypotheses without expending time and resources unnecessarily. If critical PA hypotheses are determined to be incorrect, a "no further action" conclusion may be considered. Conversely, if the PA hypotheses are verified, investigators may conclude that additional sampling is warranted to fill any data gaps to allow HRS scoring.

D.3 RECOMMENDED SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS

The Focused SI attempts to verify PA hypotheses regarding hazardous substances that may have been released to the environment, the potential migration pathways these constituents may have taken, and whether these constituents have reached receptors. The following discussion outlines the rationale for the sample location and analytes proposed to test the critical PA hypotheses at the Curtis Bay Depot.

D.3.1 Pathways to Evaluate with Samples

The determination of which pathways require further evaluation was based on the results of the scoring, known environmental conditions, and previous studies. The primary pathways by which hazardous substances may migrate to targets include groundwater, surface water, and soil. The stockpiled materials are exposed to the elements, including wind and precipitation.

D.3.1.1 Groundwater Pathway

Although it is hypothesized that the contaminants are not leaching from the stockpiles at concentrations that exceed groundwater protection standards, due to the potential for migration of contaminants to the groundwater, and the large quantity of stockpiled source material, it is recommended that the groundwater pathway be further evaluated. The PA score for this pathway was 100.

The hypothesis is based on the results of leach testing performed by the DNSC which indicate that the stockpiles are not leaching significant concentrations of metals to the environment. The following discussion summarizes the EP Toxicity and Toxicity Characteristic Leaching Procedure (TCLP) studies initiated by the DNSC.

The DNSC initiated a study to determine the actual hazardous substance leaching potential of the ores, minerals, and alloys maintained in their stockpiles. Three characteristic leaching tests were performed on each of seventeen stockpile materials. The characteristic leaching test results showed that, with the exception of fluor spar, the stockpile ores, minerals, and alloys leach, but not to a degree to present an environmental hazard.

In September 1992, the EPA finalized their new TCLP to replace the EP toxicity test Procedure. After the new procedure was finalized, DNSC also performed the new TCLP test on selected stockpile samples. The results indicated that lead and mercury were the only constituents that were detected at concentrations that exceeded the TCLP limit.

D.3.1.2 Surface Water Pathway

Although it is hypothesized that the contaminants are not leaching from the stockpiles at concentrations that exceed surface water protection standards, due to the direct observation of source material migration pathways from the stockpiles to unnamed tributaries and natural

drainage culverts, and the large quantity of stockpiled source material, it is recommended that the surface water pathway be further evaluated. The PA score for this pathway was 100.

D.3.1.3 Soil Pathway

Although it is hypothesized that the contaminants are not leaching from the stockpiles at concentrations that exceed soil protection standards, due to observation of stockpile erosion and the potential for migration of contaminants into the soils, the observation of stockpiles staged directly in contact with soils, and the large quantity of stockpiled source materials, it is recommended that the soil pathway be further evaluated. The PA score for this pathway was 41.

D.3.1.4 Air Pathway

Although a score of 59 was calculated for the air pathway, it is hypothesized that migration from the stockpiles would primarily occur during movement of the materials and that best management practices and engineering controls would be the most effective means to address the air pathway. No further action is recommended for the air pathway.

D.3.2 Targets to Evaluate with Samples

The population within 0.25 miles of the site is the primary target group that could be impacted by a migration of contaminants to the groundwater pathway. The human food chain target, as represented by the Back Creek and Curtis Bay fishery classification, and the environmental threat target, as represented by the threatened species and wetlands, are the targets that could be impacted by a migration of contaminants to the surface water pathway. The on-site workers are the resident population threat target and the threatened species is the terrestrial sensitive environment target that could be impacted by a migration of contaminants to the soil pathway. No air pathway targets are recommended for further evaluation.

It is expected that sampling of the ground water, surface water, and soil pathways will evaluate any impacts to the targets described above.

D.3.3 Sources to be Sampled

Although no direct sampling of source materials is recommended, sampling will be performed on the pathways associated with the following source areas:

- The stockpiles (2 of 4 designated)
- The buried medical supplies area
- The radioactive waste burial pit

The groundwater, surface water, and soil pathways associated with stockpile nos. 1 and 2 will be sampled. Only two of the four identified stockpile areas are recommended for

sampling in an attempt to minimize sampling necessary to verify or refute concerning migration from the source.

The groundwater and soil pathways are recommended for sampling medical supplies area. The groundwater sample will verify if contaminants from the medical supplies have migrated to the groundwater pathway. Although no surficial soil pathway contamination is expected, a subsurface soil sample will indicate if contamination exists at the depth of the buried materials which may eventually migrate to the groundwater pathway.

The groundwater pathway is the only one recommended for sampling at the radioactive waste burial pit. The groundwater sample will verify if contaminants from the previously buried substances have migrated to the groundwater pathway. The buried materials and associated soils have been removed and the surface water has been sampled in the past.

D.3.4 SAMPLES TO VERIFY A RELEASE

The following sections describe the rationale and sampling strategy for each source area and pathway. Table D.1 presents a summary of the proposed sampling plan. Figure D.1 indicates the proposed sample locations.

D.3.4.1 Stockpiles

The groundwater and soil pathways associated with potential contaminant migration from the stockpiles will be evaluated by collecting one groundwater sample and two soil samples. Additionally, the surface water pathway will be evaluated by collecting one surface water sample and one sediment sample near stockpile no.1.

The groundwater sample will be collected from a temporary well installed utilizing direct push or similar low cost technologies available to obtain an in situ groundwater sample. The surface water sample will be a grab sample collected from the unnamed tributary downgradient of stockpile no.1. The sediment sample will also be a grab sample collected from the same area. The soil grab samples will be collected at a depth of zero to 6 inches below ground surface (bgs) and from two to three feet bgs using a hand auger.

All samples associated with the stockpile source areas will be analyzed for the Priority Pollutant suite of metals as indicated in Table D.1

D.3.4.2 Buried Medical Supplies Area

The groundwater and soil pathways associated with potential contaminant migration from the buried medical supplies source area will be evaluated by collecting one groundwater sample and one soil sample.

Table D.1

Figure D.1

The groundwater sample will be collected from a temporary well installed utilizing direct push or similar low cost technologies available to obtain an in situ groundwater sample. The soil grab sample will be collected utilizing a hand auger at a depth with the highest head space volatile organic screening result. This depth will be determined in the field.

All samples associated with the buried medical supplies source area will be analyzed for HSL metals, volatile organics (VOCs), and semi-volatile organics (SVOCs) as indicated in Table D.1.

D.3.4.3 Radioactive Waste Burial Pit

The groundwater pathway associated with potential contaminant migration from the Radioactive Waste Burial Pit will be evaluated by collecting one groundwater sample.

The groundwater sample will be collected from a temporary well installed utilizing direct push or similar low cost technologies available to obtain an in situ groundwater sample. This groundwater sample will be analyzed for the metals listed in Table D-1 and radiological parameters including thorium, and gross alpha/gross beta.

D.3.5 QA/QC SAMPLES

During the focused SI, QA/QC samples will be collected to ensure that sample results have not been influenced by contamination introduced during field activities. QA/QC sampling for the SI will include at least one field duplicate and one field blank for each matrix sampled (soil, sediment, groundwater, and surface water). Field duplicates are also proposed for the medical supplies burial area and the radioactive waste burial pit since they are being sampled for different analytical parameters than the stockpiles. The QA/QC samples will be analyzed for the constituents listed in Table D.1.

D.3.6 EXISTING ANALYTICAL DATA

Existing data from the site, which was well documented in the files, includes the June 1992 sampling of the NPDES stormwater outfalls, and the extensive investigation results from the excessed property. Grab and composite samples from the five outfall locations were collected and analyzed for various parameters. Copper, zinc, lead, and tin were metals which slightly exceeded the detection limit in one or more samples. These data support the hypothesis that significant leaching of metals from the stockpiles is not occurring.

The excessed property is not part of this assessment, those data have not been included in this report.

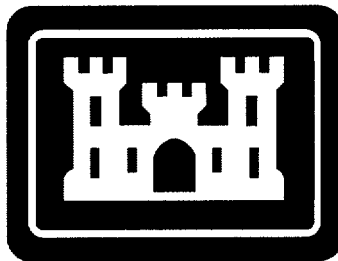
Appendix E

Database Search Information

FINAL

**Site Investigation Report
Curtis Bay Depot
Curtis Bay, Maryland**

Prepared for



**U.S. Army Corps of Engineers
Huntsville Center**

Contract No. DACA87 - 95 - D - 0018

Prepared by

PARSONS ENGINEERING SCIENCE, INC.

AUGUST 2000



PARSONS

**FINAL
SITE INVESTIGATION REPORT
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND**

Prepared for

**U.S. ARMY CORPS OF ENGINEERS
HUNTSVILLE CENTER**

**Contract No. DACA87 - 95 - D - 0018
Delivery Order 0025**

Prepared by

PARSONS ENGINEERING SCIENCE, INC.

AUGUST 2000

COMMENT RESPONSE FORM

Response to Comments on the Draft Site Investigation Report for Curtis Bay Depot, January 2000

DACA-87-95-D-0018, DELIVERY ORDER 0041

Name: Chris King/ED-CS-G/256-895-1843		Date: February 11, 2000	
ITEM	REFERENCE	COMMENT	ACTION
1	Section 4.1	In the first paragraph, mention the "other identified potential source areas."	Concur. This sentence has been expanded.
2	Section 4.2.3 General	Reference the figures/tables that show the location and results of groundwater, surface water, and soil samples. Example: Groundwater sample CB-GW-02 contained detectable levels of mercury (Figure 1, Table 2).	In accordance with the discussion between Chris King and Greg Hedrick, the sample results do not need to appear on the figures. The tables that show the results of groundwater, surface water, and soil samples have been referenced.
3	Section 4.3.1	A map is needed to show the proposed locations of future soil, GW, and SW samples.	Non-concur. A specific sampling plan for future activities at the site will be determined at a later date.
4	Section 4.3.3	Further geophysical investigation of the Medical Supplies Burial Area would not be necessary if a historical records search fails to find any records of evidence of ordnance items being buried in this location. Before planning a geophysical investigation, I would recommend reviewing records and interviewing former Depot personnel. Any ferrous items or scrap material can make a Schonstedt-type magnetometer ring-off.	This area was researched as part of the Preliminary Assessment and preparation for the SI sampling. Former Depot personnel were interviewed. A geophysical investigation was not recommended in Section 4.3.3, but anomaly avoidance protocols utilizing geophysics would be necessary for any further intrusive activities since this is a known ordnance site, i.e., ordnance has been found at various locations as described in Section 2.4.5.

Response to Comments on the Draft Site Investigation Report for Curtis Bay Depot, January 2000

DACA-87-95-D-0018, DELIVERY ORDER 0041

Name: Cheryl G. Peyton		Date: February 8, 2000	
1	General	Based on the review of the Preliminary Assessment Site Investigation Report for Curtis Bay Depot, the following comments are provided.	
2	General	Please include a list of acronyms	Concur. A list of acronyms has been included after the Table of Contents.
3	General	Please include an executive summary	Concur. An executive summary has been included after the list of acronyms.
4	Figure	Please provide a figure which shows the locations and values of the detected contaminants. Also, highlight those values that are exceedances.	In accordance with discussions between USAESCH and Greg Hedrick sample results have not been added to the figures.
5	2.5.2.3	Verify whether the herbicide used was "Pound-up" as indicated in the text, or "Round-up".	This is a typo. Round-up is correct.
6	3.2	Note that background sample CBBG-01-02' seems anomalous with Barium, Copper, and Zinc results an order of magnitude higher than other samples and Lead results two orders of magnitude higher. Consideration should be given to excluding this as a background sample and investigating the area for further contamination. Additional background sampling should be done during the next field sampling event.	Concur. If this sample is excluded, the average background concentration comparison suggests that soils at stockpile 1 should be sampled in the same manner as the recommendation for stockpile 2. It is recommended that those soils be sampled during the next field event. However, the average background value has not been recalculated for this report since only one other background sample was collected. Therefore, additional background samples will also be collected and new comparison criteria developed during the next sampling event.

Response to Comments on the Draft Site Investigation Report for Curtis Bay Depot, January 2000

DACA-87-95-D-0018, DELIVERY ORDER 0041

7	Table 3.2	Verify why certain sample results are missing (e.g., arsenic, mercury, nickel, and zinc for CBBG02-02')	Assume the reference is Table 3.3. This is a table presenting positive results (greater than detection limit) only. No result in this table means the substance was not detected at the detection limit (as shown on the data summary tables). The average background concentration calculation used the actual detection limit to determine the average presented in Table 3.4.
8	Appendix B Data Summary Tables	Please include key to data qualifiers.	Appendix B contains the data qualifier descriptions on page B1-1, Section 1.3.

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LIST OF ACRONYMS

ACMs	asbestos-containing material
asml	above mean sea level
ASTs	aboveground storage tanks
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act
CWM	Chemical Warfare Materiel
DLA	Defense Logistics Agency
DNSC	Defense National Stockpile Center
FEMA	Federal Emergency Management Agency
GSA	Government Services Administration
MDOE	Maryland Department of Environment
MDHCD	Maryland Department of Housing and Community Development
NRC	Nuclear Regulatory Agency
OEW	Ordnance and Explosive Waste
Parsons ES	Parsons Engineering Science, Inc.
PAs	Preliminary Assessments
PCBs	Polychlorinated biphenyls
RCRA	Resource Conservation Recovery Act
SIs	Site investigations
SVOCs	Semi-Volatile Organic Compounds
TOC	top of casing
USAESCH	United States Army Corps of Engineers, Huntsville Center
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

Parsons Engineering Science, Inc. (Parsons ES) conducted Preliminary Assessments (PAs) and Site Investigations (SIs), where necessary, at 15 Defense National Stockpile Center (DNSC) Depot for Corps of Engineers, Huntsville Center (USAESCH). The DLA/DNSC Curtis Bay Depot, in Curtis Bay, Maryland is currently owned by the Federal Government and operated by the DLA, DNSC. The facility is actively operated under the National Stockpile Program, for the purpose of storing metallurgical ores and materials necessary for manufacturing defense materials or strategic materials used in national defense. It has a work force of 12 personnel and has been in operation since 1918.

The PA conducted by Parsons ES in 1998 for the Curtis Bay Depot indicated that the potential exists for hazardous substance releases to the environment via the soil, surface water/sediment, and groundwater pathways. The basis for these hypotheses is documented in the Final Preliminary Assessment Report for Curtis Bay Depot (Parsons ES, January 1999). In July 1999, Parsons ES performed the SI at Curtis Bay Depot to determine whether hazardous substances have been released to the environment and to assess the likelihood they have migrated off site and impacted human or environmental receptors.

Parsons ES collected soil, sediment, groundwater, and surface water samples at four areas of concern - Stockpile 1, Stockpile 2, Medical Supplies Burial Area, and the Former Radioactive Waste Burial Pit. The sampling was performed to determine whether the soil, sediment, groundwater, and surface water pathways contained contaminant concentrations above background and applicable regulatory standards which are attributable to Depot activities.

Each pathway of concern was scored according to the attached SI Worksheets. Upon completion of these worksheets, Curtis Bay Depot scored a 60.0 for the overall site. The individual pathways scored as follows: groundwater = 100, surface water = 66.1, and soil = 6.61. Based on the overall site score, additional field sampling and investigation was recommended to further characterize these three pathways at Curtis Bay Depot.

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

Parsons Engineering Science, Inc. (Parsons ES) received Contract No. DACA87-95-D-0018, Delivery Order No. 0025, from the Corps of Engineers, Huntsville Center (USAESCH), to conduct Preliminary Assessments (PAs) and Delivery Order No. 0041 to perform Site Investigations (SIs), where necessary, at 15 Defense National Stockpile Center (DNSC) Depots. These PAs and SIs were performed in accordance with applicable State and United States Environmental Protection Agency (USEPA) guidance and regulations (e.g., the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance for performing PAs and SIs). The work was performed under the supervision of a registered engineer.

1.2 PURPOSE AND SCOPE

The National Stockpile program was established under the Strategic and Critical Materials Stock Piling Act (P.L. 79-520; July 23, 1946) as an attempt to avoid dependence on foreign sources of essential materials during times of national emergencies. Prior to 1988, management of the National Stockpile was divided between the Federal Emergency Management Agency (FEMA) and the General Services Administration (GSA). Under Executive Order 12626, the President moved management of the Stockpile to the Secretary of Defense. The DNSC is currently an activity-level agency under the Defense Logistics Agency (DLA).

The DNSC operates Depots across the country which are GSA-owned or GSA-leased properties. As a result of the DNSC's operations, there exists a potential for environmental impacts at these Depots. The objective of this report is to document the results of the SI at the following Depot:

**DLA/DNSC Curtis Bay Depot
710 East Ordnance Road
Curtis Bay, MD 21226
CERCLIS Number: Not Assigned**

The PA conducted by Parsons ES in 1998 for Curtis Bay indicated that the potential exists for hazardous substance releases to the environment via the soil, surface water/sediment, groundwater, and air pathways. The basis for these hypotheses is documented in the Final Preliminary Assessment Report for Curtis Bay Depot (Parsons ES, January 1999).

It was hypothesized that there is a remote likelihood that these releases could migrate off site and impact human and environmental receptors. To test this hypothesis, analytical data were collected to assess whether there may have been releases, and to assess the potential for hazardous substances to migrate off site and impact receptors.

A focused SI was recommended for the Curtis Bay Depot to confirm or refute the hypotheses developed in the PA. The SI is also justified by the high PA score for the site (79.3), the proximity of and relatively large numbers of receptors, and the fact that the site is situated within 2.5 miles of a municipal water well.

The purpose of this SI is to determine whether hazardous substances have been released to the environment and to assess the likelihood they have migrated off site and impacted human or environmental receptors. This strategy is based on USEPA guidance for performing SIs under CERCLA (USEPA, 1992: Directive 9345.1-05). The receptors can be impacted by the hazardous substances in the on-site sources only if there is a release and a transport mechanism by which the hazardous substances could migrate to the receptors. There are no impacts if the hazardous substances are not released and do not migrate. If no potential impacts are identified, a "no further action" conclusion may be warranted. If potential impacts are verified, additional sampling may be needed to determine the nature and extent of those impacts, and the need for remediation.

The scope of work for this SI (Parsons ES 1999) was originally based on the proposed scope of work presented in Appendix D of the Final PA Report (Parsons ES, January 1999).

1.3 REPORT ORGANIZATION

Section 2 of this report provides the site description, operational history, and waste characteristics of the Curtis Bay Depot. Section 3 presents migration pathways assessments, the SI scope of work, and analytical results for each migration pathway and source areas sampled. Section 4 presents a summary and conclusions for the SI, and recommendations for further action. Section 5 presents a list of references used in this report. Appendix A presents geologic logs for the soil and well borings, and monitoring well construction schematics. Appendix B presents the Data Validation Report and the analytical results tables for all samples collected and analyzed during the SI. Appendix C presents the SI Worksheets used to generate an SI site score. Appendix D presents a photo documentation log of SI activities.

2. SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

2.1 SITE DESCRIPTION

The Curtis Bay Depot is currently owned by the Federal Government and operated by the DLA, DNSC. The facility is operated under the National Stockpile Program, for the purpose of storing metallurgical ores and materials necessary for manufacturing defense materials or strategic materials used in national defense.

The Depot is located approximately one mile south of Baltimore in Anne Arundel County, Maryland. The Depot is located at latitude N391140 and longitude W763524 on the Curtis Bay Quadrangle, Maryland (7.5 minute U.S. Geological Survey topographic map). Figure 2.1 is a base map showing the facility on the topographic map, including a one-mile radius, surface water drainage features, nearest drinking water well, and sensitive environments.

The Curtis Bay Depot is an active facility which maintains storage of strategic materials, including bulk ores, minerals, and metals. It has a work force of 12 personnel and has been in operation since 1918.

The Depot is approximately 483 acres. Figure 2.2 presents the site plan. It is bordered on the east by Curtis Creek and on the south by Furnace Creek. There is a 1,955 foot long concrete dock along Curtis Creek. Except for the dock, the facility is enclosed by a security fence. The facility has approximately 74 buildings; only a few are in use, many are in deteriorated condition. The facility utilizes a septic leachfield system which is oversized with respect to the number of people currently working at the Depot. There are approximately six miles of paved roads and two miles of railroad tracks. The terrain is mostly flat to gently hilly with grassy, open areas.

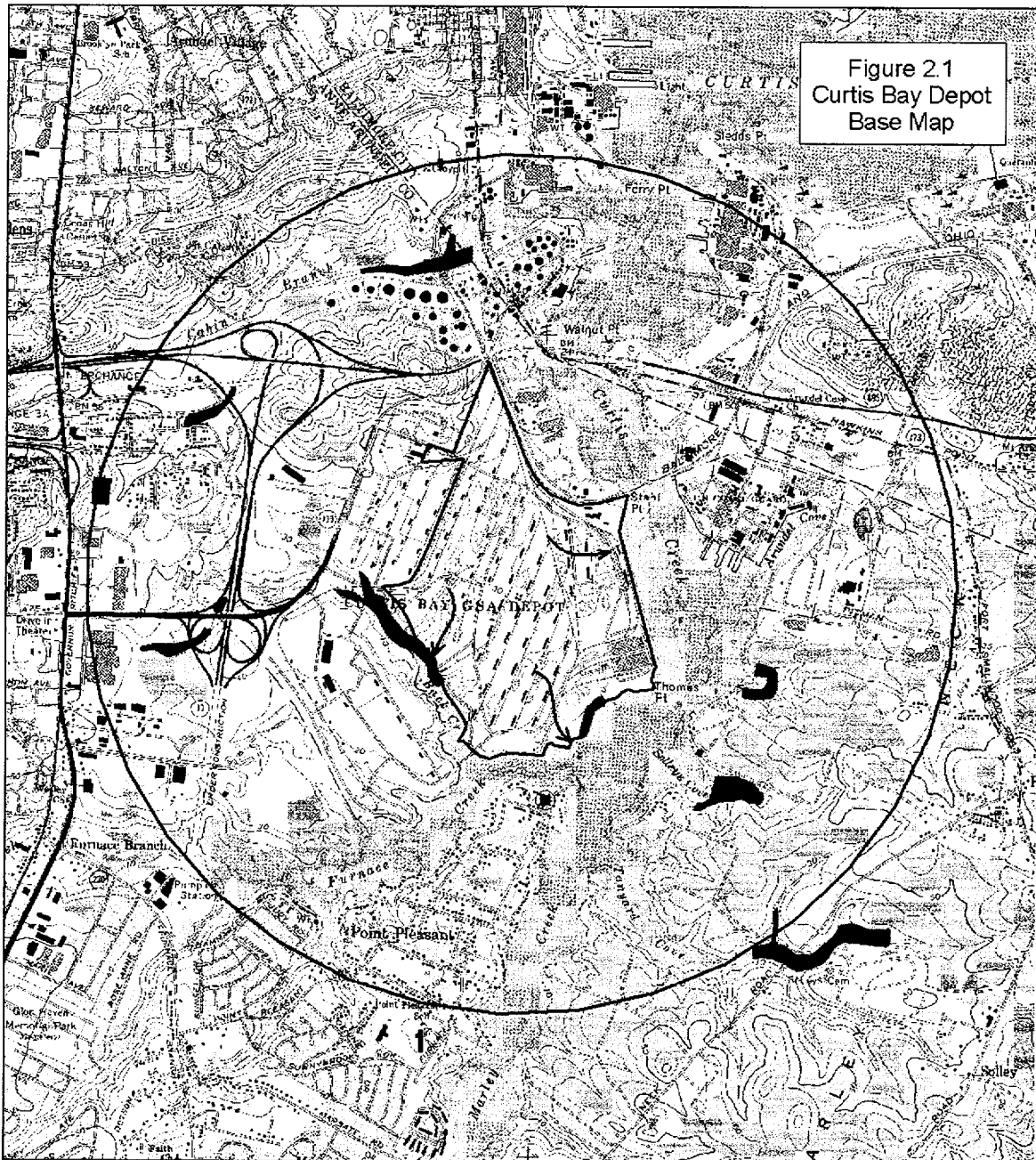


Figure 2.1
Curtis Bay Depot
Base Map

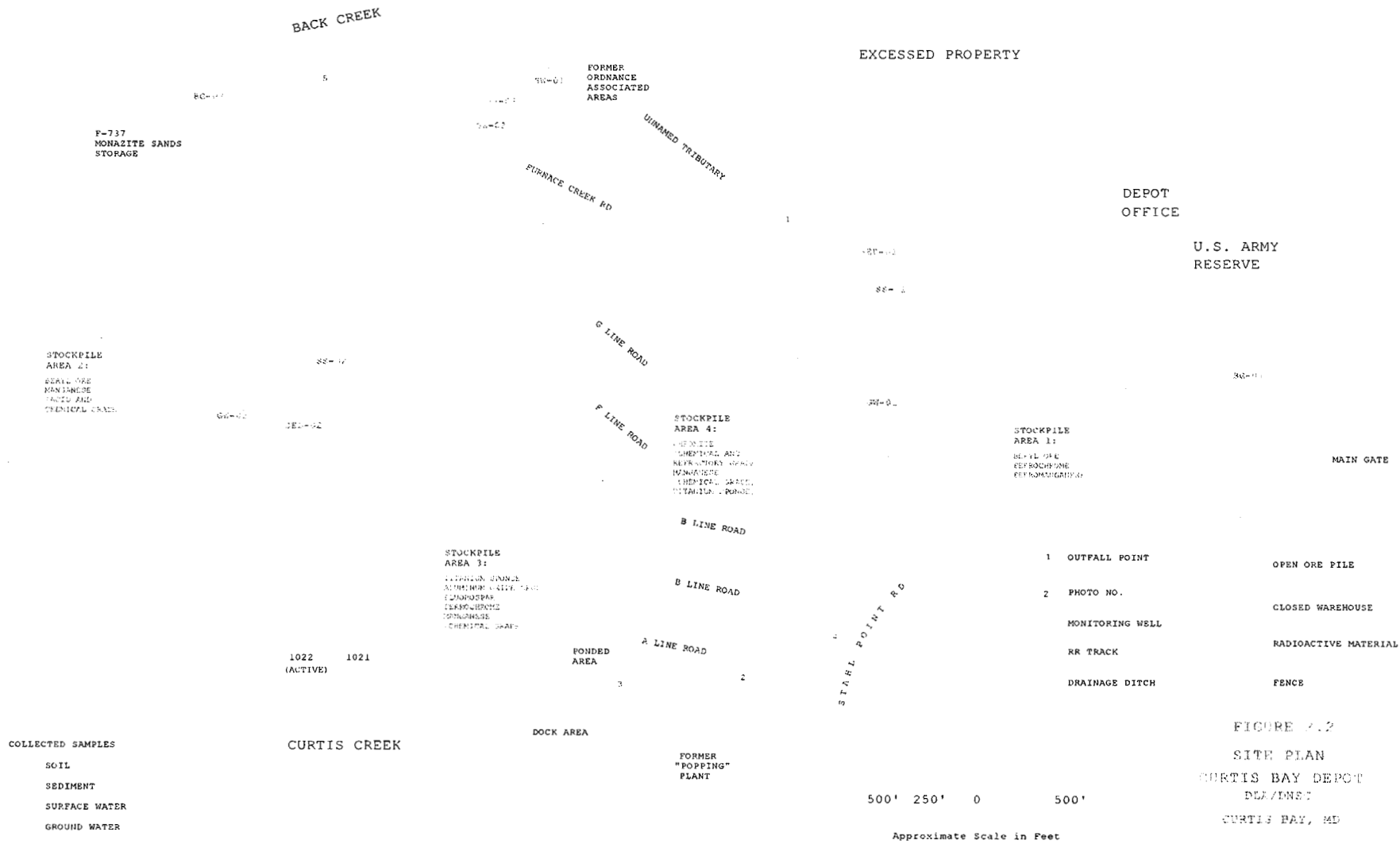
Curtis Bay Quadrangle
Maryland 1974
7.5 Minute Series (Topographic)



0.5 0 0.5 1 Miles

- Wetlands
- Surface Water Drainage Route
- Nearest Drinking Water Well
- Curtis Bay Depot Boundary
- One-Mile Radius





2.2 OPERATIONAL HISTORY

The original U.S. Army Depot was built in 1918 on 798 acres of farmland. Additional acreage was acquired, making the site total 815 acres. The site was used by the U.S. Army for receiving, shipping, and storage, and as an ordnance Depot from 1918 until the mid-1950s. From 1919 until sometime in the 1950s, the function of the Depot was storage and maintenance of ammunition. Between 1958 and 1966, approximately 37 acres were reassigned to the U.S. Army Reserve. In the late-1950s, the National Defense Stockpile became a tenant and began storing strategic materials (bulk ores, minerals, and metals). Also, the Depot began receiving post-Korean War munitions for processing and/or disposal.

In 1965-1966, the remaining 778 acres were reported excess to the GSA which assumed accountability for the facility. Since that time there have been several transfers of land to Anne Arundel County and the Maryland Department of Transportation, resulting in the current Depot acreage of 483. In the early 1980s, the Stockpile Program assumed the management function for the GSA property. In 1988, when the Stockpile function was transferred to the DLA, the Stockpile Program continued to manage the property for GSA. Currently, the U.S. Army Reserve, under the command of the 99th Regional Support Command, uses the dock area of Curtis Creek for the maintenance of Army tugboats and the Baltimore City Police Canine Corps uses the facility as a training area for police dogs. Training of the Army Reserve or the Canine Corps, typically on weekends, can increase the Depot population to 200 people.

Subsequent to the dismantling of the regional zone system for DNSC Depots, Curtis Bay also functions as a file/information repository for other DNSC Depots which were formerly in the eastern zone (New York headquarters).

2.3 REGULATORY STATUS

The Depot's Federal Facility identification number is MD971500580. The Depot is classified as a small quantity generator of hazardous wastes. The 1997 Hazardous Waste Report indicates waste generation and management of paint-related material (D001), dust mixture (barium, chromium) for use with paints (D005 and D007), and batteries (D006 and 7777). The RCRA Generator number is MD9470000580.

The Depot stores radioactive material and is listed on the DNSC's Nuclear Regulatory Commission (NRC) license.

The Depot holds a General Stormwater permit (No. 97-SW). NPDES permit (No. MDR000001) was renewed in December 1997. Five outfall locations (Figure 2.2) were sampled in 1992; currently no on-going sampling of these outfall locations is required. The Depot also maintains an Oil Operator's permit.

2.4 FORMER INVESTIGATIONS AND STUDIES

The following areas of the Curtis Bay Depot have been identified as having been previously investigated or which have undergone remediation or removal actions.

2.4.1 Excessed Property

In 1980, the GSA sold approximately 85 acres of Depot property to Anne Arundel County, Maryland. Nine warehouses on the tract had been used to store thorium nitrate, (radioactive material). The thorium nitrate, as well as the warehouses and contaminated soils were removed and the county eventually built a jail on the property. As that tract of land had been excessed in 1980, it is not part of this report.

2.4.2 Former Radioactive Waste Burial Pit

According to a 1979 report, a small area of the Depot had been used as a burial pit for various materials, including thorium nitrate contaminated material in 1965 and four drums of beryllium oxide in 1969. Reportedly, all of these materials were removed in 1987 (with the approval of the State of Maryland) and disposed in an approved landfill. The NRC opened the area for unrestricted use following the removal action. Soil samples were collected, however, it is unclear whether groundwater monitoring was performed in this area.

2.4.3 Monazite Sands Storage Buildings

Portions of building F-737, which stored monazite sands (a source of natural thorium), were assessed as radiologically contaminated and subsequently underwent decontamination efforts. A December 1994 report from the NRC stated that although the building, excluding the concrete slab, met NRC guidelines for release for unrestricted use, the soil samples taken around and under the building exceeded the NRC guidelines for residual thorium in soil. Additional soil sampling was completed in this area in 1995. The area surrounding Building T-0737 was divided into 10 square foot grids. The grids were surveyed by a radiation detector, and any reading above an action level of 5,000 counts per minute was flagged for remediation. Thirty soil samples were collected at a depth of six inches from each grid at the location of the highest reading during the survey. The measured activity concentrations ranged from less than 0.02 to 7.9 picocuries/gram, and all of the results were less than the 10 picocuries/gram level which is the NRC value for unrestricted release.

2.4.4 Medical Supplies Burial Area

In 1996, a retired stockpile operations foreman reported that medical supplies had been buried in the past at a location approximately 100 yards from the south end of G Line Road. In September 1996, three exploratory trenches uncovered numerous bottles buried at approximately eight feet below ground surface (bgs). Some of the bottles were removed, and the trenches backfilled. The bottles removed were labeled as saline and/or dextrose. It is unclear whether sampling identified all the contents of the bottles or how much material remains buried.

2.4.5 Ordnance

According to a historical review and analysis report prepared by the U.S. Army Depot System Command historian, pre-1950s ordnance-related operations included bonderizing metal

containers for propellants (involving transfer of propellants from fibre to metal containers) and a renovation plant to reprime ammunition. Following the Korean War, ordnance-related activities at the Depot included a powder burn plant, small arms processing, incineration, and smokeless powder burning under wire enclosures. Storage included nine primer and fuse magazines, 33 standard magazines, 57 smokeless powder magazines, and eight high explosive magazines. An ammunition popping plant reportedly sent 1,900,000 pounds of small brass ammunition to property disposal.

An archives search was conducted in 1993 by the U.S. Army Corps of Engineers, St. Louis District. According to this report, ... "there was no indication that Chemical Warfare Materiel (CWM) was present at this installation." However, the report went on to say that the potential for Ordnance and Explosive Waste (OEW) contamination was considerably higher than the potential CWM contamination, and that "...Although the records reviewed did not indicate any OEW CWM disposed of on the property, one cannot ignore the enormous amount of ordnance which went through Curtis Bay Ordnance Depot".

According to the Depot Manager, in the summer of 1998, some live small arms ammunition was found buried in the southeast corner of the Depot. A February 1999 Site Visit Trip Report by the U.S. Army Engineering and Support Center, Huntsville, Alabama (USAESCH) indicated that a contractor was currently on site performing small arms residue removal. The contractor had found numerous unfuzed Stokes mortar rounds and a 2.36-inch bazooka round. Several other areas across the Depot were investigated with a magnetometer and many geophysical anomalies were identified.

2.5 WASTE AND COMMODITY CHARACTERISTICS

According to the CERCLA PA Guidance Document, a site is "the area consisting of the aggregation of sources, the areas between sources, and area that may have been contaminated due to migration from sources; site boundaries are independent of property boundaries". A source is defined as "an area where a hazardous substance may have been deposited, stored, disposed, or placed. Also, soil that may have become contaminated as a result of hazardous substance migration" (USEPA, 1991A). Hazardous substances are defined per CFR 302.4. A hazardous substance or constituent is defined as a hazardous pollutant or contaminant in CERCLA Sections 101(14) and 101(33).

The following subsections describe the characteristics of the commodities stored on-site, and the characteristics of the wastes and other potential hazardous substance source areas associated with the Depot.

2.5.1 Stockpiles

Most of the stockpiled materials are raw ores. Some of the ores contain metals which are identified as CERCLA hazardous substances and which could be environmental

contaminants if migration to surface water, groundwater, soil, or air has occurred. Most of the ores are piled on concrete pads or directly on the ground. Some ore piles are covered to reduce oxidation and erosion through weathering. The concrete pads do not provide complete containment, as numerous cracks and apparent surface water runoff pathways were observed during the site visit. Other materials are stored in warehouses in drums, bundles, or other means of segregation. Building 1022 is the remaining active storage warehouse. The warehouse, a single story building with a concrete floor, appeared to be in good condition with no evidence of cracked floors or any indication of contaminant migration potential.

In order to develop a PA or SI score for these potential sources, it was necessary to organize the numerous outside stockpiles into general areas. The materials inside the warehouse were not included as the contaminant migration potential is minimal. Due to space limitations, the stockpiles could not be individually named or numbered on the figure. Additionally, there was some uncertainty in matching the most recent inventory of materials, supplied by Depot personnel, with the old site maps provided by Depot personnel. The site visit indicated some inconsistencies with stockpile locations and types, when checked against the site map provided.

Figure 2.2 indicates four stockpile area designations based on location. The objective of the grouping was to allow an overall evaluation of the contamination potential of the materials. Therefore, it was not necessary to ensure that every stockpile was included within one of the areas. Each stockpile area comprises several types of stored materials. A specific material may be present in more than one stockpile area. This orientation represents the current location of the materials and does not reflect past practices or stockpile locations. For example, although lead has been documented as having been stored outside, it no longer is and therefore is not addressed in the following descriptions. However, the potential for lead contamination of soil, surface water, or groundwater has been considered for this report.

The stockpile areas were organized as follows:

Stockpile Area 1

This area is approximately 1,300 feet by 200 feet, comprising the following stockpiles: beryl ore, ferrochrome, and ferromanganese. The stockpiles are uncovered and staged on a concrete pad with visible cracks.

Stockpile Area 2

This area is approximately 900 feet by 200 feet, comprising the following stockpiles: beryl ore, manganese acid grade, and manganese chemical grade. The manganese piles are covered.

Stockpile Area 3

This area is approximately 500 feet by 300 feet, comprising titanium sponge (drummed on concrete blocks), and stockpiles of aluminum oxide, fluorspar, ferrochrome, and manganese chemical grade.

Stockpile Area 4

This area is approximately 1200 feet by 200 feet, comprising titanium sponge (drummed on concrete blocks), and stockpiles of chromite chemical, chromite refractory, and manganese chemical grade. The manganese piles are covered.

2.5.2 Other Materials and Areas of Concern

2.5.2.1 Fuel Tanks

Curtis Bay has 10 above ground fuel storage tanks (ASTs) ranging in size from 250 gallons to 10,000 gallons and containing gasoline, diesel, #2 fuel oil, or waste oil. Eight of the ten have containment dikes. There are currently no underground fuel storage tanks on-site. The Depot has converted to natural gas and is in the process of phasing out the ASTs.

2.5.2.2 Asbestos

Numerous reports describing asbestos-containing material (ACMs) at the Depot were reviewed. A survey dated May 1992 describes buildings, amount of ACMs, whether or not a sample has been analyzed for asbestos, its location in the building, and its condition. Overall, according to this survey, there still appears to be a large amount of asbestos at this facility, not all of which has been tested, and a sizable portion that is in bad condition. Several reports dated January 1998 describe asbestos sampling activities.

An April 1997 memo discusses disposal of approximately one ton of bagged chrysotile asbestos and 27 tons of bagged crocidolite asbestos. No follow-up memos, manifests, or reports were located determining whether or not the 28 tons of stored asbestos have been disposed.

2.5.2.3 Herbicides/Pesticides

The DNSC Herbicide Report from November 1995 describes the herbicide use at the Depot. Round-up and Spike 80W were used over a six week period, usually in 6 quart quantities, at a 100 gallon concentration. This amount typically covered 3 acre areas, including railroad tracks, buildings, and ore piles. A March 1996 memo to all DNSC facilities discusses reducing the use of herbicides at all Depots, as part of its Pollution Prevention Plan. Herbicides apparently are no longer used on the stockpiles. No herbicides or pesticides are stored at the Depot; all herbicide or pesticide work is performed by a contractor.

2.5.2.4 Polychlorinated Biphenyls

Numerous letters, memos, and inventory sheets pertaining to transformers and PCBs were reviewed. Various reports about transformer leaks, manifests for PCB disposal, and installation of non-PCB transformers were also reviewed. The most recent transformer inventory list, from September 1989, lists 28 areas where transformers exist, 15 of which contain unknown material in them, 12 of which are dry, and one which contains transformer oil. It appears that all PCB transformers were replaced in the 1980s and that no PCB related materials remain on the facility.

2.5.2.5 Ordnance

Section 2.4.5 summarizes the history and occurrence of ordnance on the Depot.

3. MIGRATION PATHWAYS ASSESSMENT AND SI SAMPLING RESULTS

3.1 INTRODUCTION

This section describes the soil, sediment, surface water, groundwater, and air migration pathways as they relate to the Curtis Bay Depot. The following subsections are organized by pathway, and also explain the SI scope of work conducted to investigate these pathways, along with the rationale for sample locations, selection of analyses, etc. Field decisions that resulted in changes to the scope of work as presented in the Final Field Sampling Plan (Parsons ES, 1999) and the Addendum to the Field Sampling Plan (Parsons ES, 1999) are explained in these subsections. The analytical results for samples collected during the SI are also discussed in these subsections. Figure 2-2 shows all SI sampling locations. Table 3.1 presents the sampling and analytical program conducted for the SI.

Note that the intent of the SI is to make a determination of whether there are soil, groundwater, surface water, or sediment contaminant concentrations above background and applicable regulatory standards are identified which are attributable to Depot activities. If concentrations above background and regulatory standards are identified, additional investigation may be necessary to fully define the nature and extent of those impacts. If no impacts are identified, a recommendation of “no further action” may be warranted.

3.2 SOIL EXPOSURE PATHWAY

The target distance limit for the soil exposure pathway is 200 feet for resident population and one mile for the nearby population. The pathway for soil exposure accounts for the potential threat to people on or near the site who may come into contact with exposed materials and areas of suspected contamination. This includes both ingestion and dermal exposure.

3.2.1 Soil Pathways and Targets

There are no residential buildings within 200 feet of the Depot; there are 12 full-time employees at the site, but there is no resident population. Other targets include a prison located approximately 600 feet west-northwest of the Depot and a daycare facility located approximately 2,000 feet west-northwest of the site. In addition, approximately 5,600 people live within one-mile of the Depot. A Least Tern colony, discussed in subsection 3.3.2.3, qualifies as a sensitive terrestrial environment target.

**Table 3.1
Sampling and Analytical Program
Curtis Bay Depot Site Investigation**

Sample ID	Description	VOCs	SVOCs	Metals*	Thorium
		SW8260	SW8270	SW6010B SW7470 SW7471A	Alpha Spectrometry
GROUNDWATER					
CB-GW-01	Stockpile Area 1			X	
CB-GW-02	Stockpile Area 2			X	
CB-GW-03	Med. Supplies Burial Area	X	X	X	
CB-GW-04	Radioactive Waste Burial Pit			X	X
SOIL					
CB-SS-01-6"	Stockpile Area 1			X	
CB-SS-01-2'	Stockpile Area 1			X	
CB-SS-02-6"	Stockpile Area 2			X	
CB-SS-02-2'	Stockpile Area 2			X	
CB-SS-03-6"	Med. Supplies Burial Area	X	X	X	
CB-BG-01-6"	Background			X	
CB-BG-01-2'	Background			X	
CB-BG-02-6"	Background			X	
CB-BG-02-2'	Background			X	
SEDIMENT					
CB-SED-01	Stockpile Area 1			X	
CB-SED-02	Stockpile Area 2			X	
SURFACE WATER					
CB-SW-01	Stockpile Area 1			X	
QA/QC					
CB-TB-01	Trip Blank	X			
CB-SS-04	Duplicate of SS-01-6"			X	
CB-SED-03	Duplicate of SED-01			X	
CB-SW-02	Duplicate of SW-01			X	
CB-GW-05	Duplicate of GW-01			X	
CB-GW-06	Duplicate of GW-03	X	X	X	
CB-GW-07	Duplicate of GW-04			X	X
MS/MSDs**				X	X
CB-IDW-01	Investigation Derived Waste (Water)	TCLP	TCLP	TCLP	
CB-IDW-02	Investigation Derived Waste (Soil)	TCLP	TCLP	TCLP	

VOCs - Volatile Organic Compounds

SVOCs - Semivolatile Organic Compounds

* - SW6010B = Sb, Be, Cr, Cu, Pb, Ni, Zn, As, Cd, Hg, Se, Ag, Ti, Ba. SW7470 analysis performed on water samples and SW7471 analysis will be performed on soil/sediment samples.

** - Groundwater, Soil, and Sediment MS/MSD samples were collected.

3.2.2 Potential for Release to Soil

Most of the stockpiles are not covered and are subject to weathering with the potential generation of runoff or leaching of contaminants to the soil. During the PA site visit, visible signs of surface water runoff pathways from the stockpiles to soil were evident. It was hypothesized in the Final PA Report (Parsons ES, January 1999) that the metals were not leaching from the stockpiles at concentrations that exceed soil protection standards. However, due to the visual observation of migration of contaminants into the soils, the observation of stockpiles staged directly in contact with soils, and the large quantity of stockpiled source areas, the hypothesis was tested by collecting selected soil samples for the SI.

3.2.3 SI Scope of Work

Four soil samples (six inches and 24 inches deep at each of two locations), two sediment samples, four background soil samples (six inches and 24 inches deep at each of two locations), and one subsurface soil sample, were collected during the SI. All soil sampling was conducted in accordance with the Final General Site Investigation Work Plan (Parsons ES, May 1999) and the Final Field Sampling Plan Addendum (Parsons ES, June 1999).

3.2.3.1 Soil Boring Installation

One subsurface soil boring was installed under unexploded ordnance anomaly avoidance protocols in accordance with Section 4.1 of the Final Field Sampling Plan Addendum. The subsurface soil sample (CB-SS-03-6') collected from the Medical Supplies Burial Area was obtained at a depth just below where medical supply debris was encountered in the borehole cuttings, and just above where a geophysical anomaly was identified by the magnetometer instrument.

3.2.3.2 Soil Sample Collection

As indicated in Table 3.1, the SI soilsamples collected were associated with Stockpile Area 1, Stockpile Area 2, and the Medical Supplies Burial Area as follows:

Stockpile Area 1

- One surface soil sample (CB-SS-01-6") and one subsurface (CB-SS-01-2')
- One sediment soil sample (CB-SED-01)

Stockpile Area 2

- One surface soil sample (CB-SS-02-6") and one subsurface (CB-SS-02-2')
- One sediment soil sample (CB-SED-02)

Medical Supplies Burial Area

- One subsurface soil sample (CB-SS-03-6')

Background

- Two surface soil samples (CB-BG-01-6" and CB-BG-02-6")
- Two subsurface soil samples (CB-BG-01-2' and CB-BG-02-2')

3.2.4 SI Sampling Results

Tables 3.2 and 3.3 provide a summary of the positive results detected in the soil samples for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs), and Metals, respectively. Background samples were used to develop comparison criteria for the metals detected in the soils. The soil background comparison data are presented in Table 3.4.

3.2.4.1 Background

Four soil samples were collected from two locations within the Depot and analyzed for metals. The sample locations were selected from undeveloped areas that had not been impacted by historic Depot activities. At each location, a sample was collected from six inches and 24 inches bgs. The metals concentrations of each six inch horizon sample were averaged to derive a metals background concentration for the six inch horizon. Similarly, a metals background concentration for the 24-inch horizon was determined. A comparison standard of two times the background concentration was used to evaluate the results from the SI sampling.

3.2.4.2 Stockpile Area 1

Table 3.3 indicates that seven metals were detected in each soil sample collected to characterize the stockpile. The same seven metals were detected in each horizon, six inches and 24 inches. None of the detections exceeded twice the average background concentrations for those metals.

A sediment sample (CB-SED-01) associated with the stockpile contained positive detections for seven metals (the same metals detected in the soil samples discussed above). The duplicate of this sample contained a positive detection for thallium.

Table 3.2. Positive Results - VOCs and SVOCs

SAMPLE	MATRIX	Units	Acetone	Bromodichloromethane	Chloroform	Methylene Chloride
CB-SS-03-6'	Soil	ug/kg	72 J			54
CB-GW-03	Water	ug/L		1.8 J	8.8 J	
CB-GW-06 (DUP GW-03)	Water	ug/L		2	9.6	

Note: J - estimated at the given value

Table 3.3. Positive Results - Metals

SAMPLE	MATRIX	Units	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Thallium	Zinc
CBBG-01-06"	Soil	mg/kg	8.7	166.0		17.8	35.4	325	0.23	11.7 J		160.0
CBBG-01-02'	Soil	mg/kg	7.6	482.0	1.4	25.4	119.0	1960	7.0	13.2 J		623.0
CBBG-02-06"	Soil	mg/kg	1.2	17.8		13.0	8.3	6.8				
CBBG-02-02'	Soil	mg/kg		4.4		3.6	5.3	1.5				
CB-SS-01-6"	Soil	mg/kg	4.4	53.3		24.9	12.1	16.0		7.3		18.7 J
CB-SS-01-2'	Soil	mg/kg	8.4	67.7		28.0	12.0	17.2		8.6		26.2 J
CB-SS-02-6"	Soil	mg/kg	112.0	57.3		15.4	21.5	92.2	0.13	7.0	12.0	223 J
CB-SS-02-2'	Soil	mg/kg	4.2	11.5		6.6	7.9	7.1				16.3
CB-SS-03-6'	Soil	mg/kg	14.7	47.6		27.2	13.6	26.1		9.9		42.0
CB-SS-04 (dup SS-01-6")	Soil	mg/kg	3.6	64.1		20.8	11.2	15.4		5.8		16.9
CB-SED-01	Sediment	mg/kg	17.9	61.8		73.9 J	19.6	53.8		14.2		552.0
CB-SED-02	Sediment	mg/kg	11.1	47.2		57 J	33.2	36.5		43.3	3.6	73.4
CB-SED-03 (dup SED-01)	Sediment	mg/kg	20.3	79.6	0.96	90.2 J	23.5	69.4		17.6	3.2	659
CB-SW-01	Water	mg/L	0.078	0.072		0.025						0.06 J
CB-SW-02 (dup SW-01)	Water	mg/L	0.065	0.072		0.025						0.097 J
CB-GW-01	Water	mg/L		0.079 J		0.051 J	0.034 J	0.01 J				0.056 J
CB-GW-02	Water	mg/L	0.07 J	0.51 J		0.25 J	0.13	0.083 J	0.0011	0.1		0.28 J
CB-GW-03	Water	mg/L	0.033 J	0.17 J		0.14 J	0.045	0.049 J				0.12 J
CB-GW-04	Water	mg/L	0.021 J	0.17 J		0.12 J		0.038 J				0.087 J
CB-GW-05 (dup GW-01)	Water	mg/L	0.012 J	0.097 J		0.074 J	0.051	0.016 J				0.068 J
CB-GW-06 (dup GW-03)	Water	mg/L	0.012 J	0.13 J		0.061 J		0.025 J				0.078 J
CB-GW-07 (dup GW-04)	Water	mg/L	0.028 J	0.21 J		0.18 J	0.04	0.055 J				0.084 J

Note: J - estimated at the given value

Table 3.4. Soil Background Comparison Total Metals (6" and 24" Horizons)

(6 INCH HORIZON)					
SAMPLE	CB-SS-01-6"	CB-SS-02-6"		Average Background Conc.	Comparison Standard*
MATRIX	Soil	Soil		Soil	Soil
Units	mg/kg	mg/kg		mg/kg	mg/kg
Arsenic	4.4	112.0		4.95	9.9
Barium	53.3	57.3		91.9	183.8
Chromium	24.9	15.4		15.4	30.8
Copper	12.1	21.5		21.85	43.7
Lead	16.0	92.2		165.9	331.8
Mercury		0.13		0.175	0.35
Nickel	7.3	7.0		4.7	9.4
Thallium		12.0		1.2	2.4
Zinc	18.7 J	223 J		83.2	166.4
(24 INCH HORIZON)					
SAMPLE	CB-SS-01-2'	CB-SS-02-2'	CB-SS-03-6'	Average Background Conc.	Comparison Standard*
MATRIX	Soil	Soil	Soil	Soil	Soil
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	8.4	4.2	14.7	4.4	8.8
Barium	67.7	11.5	47.6	243.2	486.4
Chromium	28.0	6.6	27.2	14.5	29.0
Copper	12.0	7.9	13.6	62.2	124.3
Lead	17.2	7.1	26.1	980.8	1961.5
Nickel	8.6		9.9	4.3	8.6
Zinc	26.2 J	16.3	42.0	313.1	626.1
Note: J - estimated at the given value					
* Comparison Standard = 2 x (Average Background Concentration)					
Exceedance					

3.2.4.3 Stockpile Area 2

Soil sample CB-SS-02-6" contained positive detections for nine metals. Three of the metals, arsenic, thallium, and zinc, exceeded twice the average background concentrations for those metals. The arsenic concentration (112.0 mg/kg) was more than 11 times the average background concentration for arsenic for the six inch horizon. The 24-inch horizon sample at this location contained positive detections for six metals.

A sediment sample (CB-SED-02) associated with the stockpile contained positive detections for eight metals (the same metals detected in the six inch sample discussed above except for mercury).

3.2.4.4 Medical Supplies Burial Area

Table 3.2 indicates that acetone and methylene chloride (VOCs) were detected in the soil sample (CB-SS-03-6') collected at six feet bgs. The presence of these compounds is most likely related to the medical supply debris encountered in the boring. The boring could not be completed as a groundwater well because of strong magnetometer readings suggesting a buried metallic object.

This sample also contained positive detections for seven metals, including two (arsenic and nickel) which exceeded twice the average background concentration for those metals (Table 3.4).

3.3 SURFACE WATER PATHWAY

The surface water pathway addresses hazardous substance migration to surface water bodies, drinking water supplies, the human food chain, and sensitive environments. The target population consists of those people who use surface water for drinking water or consume food chain species taken from target fisheries. The target distance limit for the surface water pathway is 15 miles downstream from the probable point of entry to surface water.

3.3.1 Hydrologic Setting

Ground surface elevations range from approximately 50 feet above mean sea level (amsl) in the northern portion of the Depot to approximately 10 feet amsl in the southern and eastern portions. Surface water drainage routes generally flow from north to south and east to large water bodies. The Curtis Bay Depot is bounded on the east by Curtis Creek and on the south by Furnace Creek and Back Creek, which flows into Furnace Creek. Several unnamed tributaries and culverts or gulleys drain the Depot, mostly flowing to Back Creek. Furnace Creek flows into Curtis Creek which flows into Curtis Bay. Curtis Bay flows into the Patapsco River which lies approximately 2.5 miles from the Depot. Approximately 5 miles downstream from the Depot, the Patapsco River flows into the Chesapeake Bay.

3.3.2 Surface Water Pathways and Targets

The surface water targets considered for the Depot are described below.

3.3.2.1 Surface Water Used as Drinking Water

Surface water is not used as a potable water source in the site vicinity. There are no surface water intakes within a 15-mile downstream distance of the Depot.

3.3.2.2 Fisheries

According to discussions with Depot personnel, fishing occurs in Back Creek and Curtis Creek. Due to the potential for migration of contaminants to the surface water, these fisheries are considered targets for the surface water pathway. These water bodies were classified within the moderate to large stream category.

3.3.2.3 Sensitive Environments

Sensitive environments within the site vicinity include threatened species, archeological or historical structures, wetlands, and flood zones.

According to the Maryland Department of Natural Resources, Forest, Wildlife and Heritage Service, there is a Least Tern colony located on the roof of the Central Atlantic Toyota building, within 0.25 miles of the Depot (Reference 11). The Least Tern is listed as a threatened species in the State of Maryland. The State is to undertake all preventative measures in order to ensure this species remains protected. The Least Tern is considered a primary sensitive environment for the surface water pathway.

Cultural resources information in the vicinity of the Depot were supplied by the Maryland Department of Housing and Community Development (MDHCD), Division of Historical and Cultural Programs (Reference 12). According to the MDHCD, there are 13 inventoried archeological properties within a one-mile radius of the Depot. This includes Buildings No. 1001 and No. 1003 on the Depot property. These buildings, which include the former popping plant, are along the dock area of Curtis Creek and are currently used by the Army Reserve.

An extensive wetlands area exists to the southwest of the Depot, along Back Creek, on the southern property border (see Figure 2.1). The area is approximately 2,000 feet long, according to a 1994 National Wetlands Inventory. In addition, a small wetlands area exists on the southeastern portion of the property border, along Curtis Creek.

Several 100-year flood zones exist around the majority of the Depot, where the property intersects water bodies. The southern and eastern border areas of the facility lie within the 100-year flood zone (Anne Arundel County Permit Application Center). Farther inland on the Depot property, approximately 1000 feet from the water bodies, 100-500 year flood zones potentially exist (Reference 13).

3.3.3 Potential for Release to Surface Water

Most of the stockpiles are not covered and are subject to weathering with the potential generation of runoff containing contaminants. During the PA site visit, visible signs of surface water runoff pathways from the stockpiles to surface water bodies were evident. It was hypothesized in the Final PA Report that the metals were not leaching and migrating from the stockpiles at concentrations that exceed surface water protection standards since metals typically do not move readily through soil. However, due to the potential for migration of contaminants into Back Creek or Curtis Creek via overland flow or unnamed tributaries and natural drainage culverts, the observed runoff of surface water flow from the stockpiles to surface water bodies, and the large quantity of stockpiled source areas, the hypothesis was tested by collecting a surface water sample.

3.3.4 SI Scope of Work

One surface water sample was collected during the SI. All surface water sampling was conducted in accordance with the Final General Site Investigation Work Plan (Parsons ES, May 1999) and the Final Field Sampling Plan Addendum (Parsons ES, June 1999).

The sample was collected from an unnamed tributary that drains Stockpile Area 1. However, the actual sample location is approximately 1,600 feet downstream from Stockpile Area 1 (where a sufficient volume of flowing surface water was available) and may have impacts from other on-site sources. Note that the sediment sample (CB-SED-01) associated with Stockpile Area 1 was collected near the stockpile and not near CB-SW-01. As indicated in Table 3.1, the following surface water sample was collected for the SI:

Stockpile Area 1

- One surface water sample (CB-SW-01)

3.3.5 SI Sampling Results

Table 3.3 provides a summary of the positive results detected in the surface water sample analyzed for metals.

3.3.5.1 Stockpile Area 1

Surface water sample CB-SW-01 contained positive detections for four metals. These metals were also detected in the sediment and soil samples associated with this stockpile.

3.4 GROUNDWATER PATHWAY

The following subsections describe the geologic and hydrogeologic setting, the potential for release to groundwater, groundwater use, the SI scope of work, and the SI sampling results. Target populations consist of those people who use target wells. Target wells are those within a 4-mile radius around the site.

3.4.1 Geologic and Hydrogeologic Setting

The site is located within the Atlantic Coastal Plain Physiographic Province. The Depot is approximately five miles east of the fall line, the boundary between the Coastal Plain and the Piedmont Physiographic Province. The alluvial Coastal Plain sediments beneath the site are part of the Lower Cretaceous Potomac Group. These sediments generally thicken from west to east. The Potomac Group sediments in the Baltimore area consist primarily of unconsolidated clays, silts, sands, and gravels. A silt-clay facies of the Patapsco Formation (of the Potomac Group) underlies most of the Depot. This facies consists of a shallow clay, which was not found at all boring locations across the site, underlain by a water-bearing sand and gravel unit.

Regionally, groundwater in the Coastal Plain occurs under water table and artesian conditions. The Patuxent Formation of the Potomac Group is a major source of groundwater in the coastal plain of Maryland. At the Depot, groundwater occurs in the surficial sediments overlying the shallow clay, often as perched conditions. In the western portion of the site, where perched conditions are not present, groundwater occurs under water table conditions. Groundwater occurs between 11 feet to 16 feet bgs in the eastern portion of the Depot, and 20 feet to 40 feet bgs in the western portion. An average groundwater flow velocity value of 0.8 feet/day was estimated for the shallow aquifer, with flow direction generally from west to east towards Curtis Bay. However, it is likely that there are components of groundwater flow which move westward with discharge to Back Creek. There is a slight tidal influence on the uppermost groundwater zone at the site.

3.4.2 Groundwater Use

Drinking water in the site vicinity is provided by Anne Arundel County, utilizing the Glen Burnie Well System (Reference 10). The system comprises fifteen municipal drinking water wells; the wells are within a 4-mile radius of the Depot. The system well nearest the Depot is on Glendale Road, approximately 2.5 miles west of the site. The fifteen wells service the majority of the area, including the Depot, tapping into a semi-confined aquifer. It is estimated that a total of 250,000 people are served by this system within a 4 mile radius of the Depot. The depth of the well system aquifer is reportedly greater than 170 feet (Reference 7).

The nearest drinking water well(s) is within 0.25 miles of the Depot. There are approximately 35 people using private drinking water wells within 0.25 miles of the Depot (Reference 6). Although the exact location of these wells could not be determined, general information indicated the probable location as the northern tip of the Point Pleasant area, across Furnace Creek from the Depot (see Figure 2.1). Within 0.75 miles of the Depot, approximately

93 people utilize private drinking water wells. According to the Maryland Department of Environment (MDOE), many of these wells are east-southeast of the Depot, across Curtis Creek.

3.4.3 Groundwater Pathways and Targets

There are no wells used for drinking water at the Depot. However, due to the potential for migration of contaminants to the groundwater, the drinking water well(s) identified within 0.25 miles of the Depot were considered targets for the groundwater pathway.

The target population also includes the population relying on groundwater from other nearby wells. The fifteen municipal wells within a 4-mile radius of the Depot, which constitute the main drinking water supply in the area, are considered targets. However, all of the wells are currently in use and do not have any recorded health risks associated with water quality (Reference 10). Therefore, there is a very low potential for exposure to these wells by releases from the Depot.

3.4.4 Potential for Release to Groundwater

Precipitation in the area averages approximately 43 inches per year (Reference 9). The groundwater table at the Depot is relatively shallow. The soils underlying the site are well-drained. Contaminants could potentially percolate through these relatively permeable soils and reach the groundwater. The outside, uncovered ore stockpiles are considered contaminant sources due to their exposure to weather, and in some cases, their direct contact with the surrounding soils. Other potential sources of contamination of groundwater include the Medical Supplies Burial Area and the Former Radioactive Waste Burial Pit.

It was hypothesized in the Final PA Report that the metals were not leaching and migrating from the stockpiles at concentrations of concern since metals typically do not move readily through soil. However, due to the potential for migration of contaminants to the groundwater, and the large quantity of stockpiled source areas, the hypothesis was tested by collecting groundwater samples.

3.4.5 SI Scope of Work

Four groundwater monitoring wells were installed and sampled during the SI. Monitoring well installation and groundwater sampling activities were conducted in accordance with the Final General Site Investigation Work Plan (Parsons ES, May 1999) and the Final Field Sampling Plan Addendum (Parsons ES, June 1999).

3.4.5.1 Monitoring Well Installation

The four groundwater monitoring wells were installed under unexploded ordnance anomaly avoidance protocols in accordance with Section 4.1 of the Final Field Sampling Plan Addendum. Table 3.5 presents a summary of the monitoring well data, including casing and groundwater elevations.

Three borings were required to complete monitoring well CB-GW-03, located in the Medical Supplies Burial Area. The anomaly avoidance downhole magnetometer identified geophysical anomalies in the first two borings, at six feet and eight feet bgs, respectively, resulting in abandonment of the holes. The third boring, which was relocated to the edge of the identified burial boundary, was completed as CB-GW-03. Various pieces of medical supply debris were found in the cuttings from the first two borings.

No other problems were encountered while installing the monitoring wells.

**Table 3.5
GROUNDWATER MONITORING WELL DATA
CURTIS BAY DEPOT SITE INVESTIGATION**

Well Name	Source Area	Well Type	Date Measured	T.O.C.* Elevation (feet AMSL) [†]	Depth to Groundwater (ft)	Groundwater Elevation (feet AMSL) [†]
CB-GW-01	Stockpile Area 1	2" PVC	7/30/99	38.16	21.61	16.55
CB-GW-02	Stockpile Area 2	2" PVC	7/30/99	15.33	11.10	4.23
CB-GW-03	Medical Supplies Burial Area	2" PVC	7/30/99	27.83	24.53	3.30
CB-GW-04	Former Radioactive Waste Burial Pit	2" PVC	7/30/99	31.79	22.90	8.89

† Above Mean Sea Level

* Top of Casing

3.4.5.2 Groundwater Sample Collection

As indicated in Table 3.1, the SI samples collected were associated with Stockpile Area 1, Stockpile Area 2, the Medical Supplies Burial Area, and the Former Radioactive Waste Burial Pit as follows:

Stockpile Area 1

- One groundwater sample (CB-GW-01)

Stockpile Area 2

- One groundwater sample (CB-GW-02)

Medical Supplies Burial Area

- One groundwater sample (CB-GW-03)

Former Radioactive Waste Burial Pit

- One groundwater sample (CB-GW-04)

3.4.6 SI Sampling Results

Tables 3.2 and 3.3 provide a summary of the positive results detected in the groundwater samples for VOCs and SVOCs, and Metals, respectively.

3.4.6.1 Stockpile Area 1

Table 3.3 indicates that five metals were detected in the groundwater sample (CB-GW-01) collected to characterize the stockpile. All of these metals were detected in the soil and sediment samples associated with the stockpile.

3.4.6.2 Stockpile Area 2

Table 3.3 indicates that eight metals were detected in the groundwater sample (CB-GW-02) collected to characterize the stockpile. All of these metals were detected in the six inch horizon soil sample associated with the stockpile. Two of the metals (mercury and nickel) detected in the groundwater sample were not found in the 24 inch horizon sample associated with the stockpile.

3.4.6.3 Medical Supplies Burial Area

Table 3.2 indicates that bromodichloromethane and chloroform (Halogenated VOCs) were detected in the groundwater sample (CB-GW-02) collected at the Medical Supplies Burial Area. The presence of these compounds is most likely related to the medical supply debris encountered in the two borings within the identified boundaries of the burial area. The well was completed just beyond the boundary and slightly downgradient of the burial area. Groundwater in this well stabilized at approximately 23 feet bgs. Perched water encountered (at approximately six feet bgs) in one of the borings which could not be completed as a well may have contained additional organic compounds related to the pit burial area, but this groundwater could not be sampled.

This sample also contained positive detections for six metals, all of which were found in the soil sample collected from the abandoned boring within the burial area.

3.4.6.4 Former Radioactive Waste Burial Pit

The groundwater sample (CB-GW-04) associated with this pit was analyzed for thorium by alpha spectrometry. Table 3.6 presents positive results for thorium. The results indicate positive detections for the isotopes thorium 228, thorium 230, and thorium 232. However, these concentrations do not exceed EPA's drinking water standard for gross alpha amounts.

This sample also contained positive detections for five metals.

TABLE 3.6 POSITIVE RESULTS - THORIUM

	UNITS	CB-GW-04	CB-GW-07 (dup of GW-04)
Thorium 228	pCi/L	0.96	1.39
Thorium 230	pCi/L	0.84 J	1.49 J
Thorium 232	pCi/L	0.33	0.25

J - estimated

PCi/L – picocuries per liter

3.5 AIR RELEASE PATHWAY

The air pathway accounts for hazardous substance migration, in gaseous or particulate form, through the air. Airborne deposition is a potential threat to people and sensitive environments. Target populations under the air pathway consist of people who reside, work, or go to school within the target distance limit. The target distance limit for the air pathway is a four-mile radius around the site and is divided into incremental distances.

3.5.1 Air Pathways and Targets

No previous incidents of air contaminant migration were discovered, therefore, the 'no suspected release' pathway was evaluated. No primary target population is considered for the 'no suspected release' pathway. The secondary target population includes those residents within the four mile site radius (approximately 130,000 people). Primary sensitive environments included the threatened species and wetlands previously discussed for the surface water pathway.

3.5.2 Potential for Release to Air

Many of the stockpiles are covered with an impermeable cap. The stockpiles that are not covered can potentially contribute to particulate migration of contaminants through the air. Additionally, the stockpiles are susceptible to particulate migration during loading or unloading of stockpile materials. It was hypothesized in the Final PA Report that migration from the stockpiles would primarily occur during movement or transfer of the materials and that best

management practices and engineering controls would adequately address the pathway. No sampling was proposed to test the hypothesis.

SI Scope of Work

Based on the Final PA recommendation, no sampling was performed during the SI to assess the air pathway.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 SUMMARY

The Curtis Bay Depot stockpiles potentially hazardous substances, as defined in CERCLA Section 101(14), and found in 40 CFR Part 302.4. A release of hazardous substances could result from leaching of metals from the stockpiles or from the other identified potential source areas. Therefore, a potential for release of contaminants exists for the four pathways evaluated: groundwater, surface water, soil, and air.

A PA was performed to assess the potential for release of contaminants. The overall site score for the PA exceeded the EPA CERCLA Guidance Document standard of 28.5 primarily because of large quantities of stockpiled materials stored onsite combined with identified primary targets. The PA recommended that a Focused SI be performed. The SI, which was performed in July and August 1999, included soil, sediment, surface water, and groundwater sampling to further evaluate the pathways. These data were used to generate a SI score for the Depot.

4.2 CONCLUSIONS

The SI findings for the soil, surface water, groundwater, and air pathways are described below.

4.2.1 Soil Pathway

It was hypothesized in the PA that metals are not leaching from the stockpiles at concentrations of concern. The findings indicate that metals concentrations in some samples exceeded the comparison standard of two times the average background concentration. Soil sample CB-SS-02-6" contained arsenic, thallium, and zinc concentrations in excess of the comparison standard (Table 3.3). This sample was collected six inches bgs at a location near Stockpile Area 2. Most of the detected metals were also present in the 24-inch bgs sample at the same location, but at lower concentrations.

The sediment sample (CB-SED-01) associated with Stockpile Area 1 contained detections of the same metals found in the six and 24-inch horizon soil samples associated with the stockpile (Table 3.3). The sediment sample was collected from a drainage ditch leading from the stockpile.

The subsurface soil sample (CB-SS-03-6') associated with the Medical Supplies Burial Area contained VOC detections and metals detections (Tables 3.2 and 3.3). Arsenic and nickel concentrations exceeded the comparison standard in this sample.

Primarily because of a low target population, a SI score of 6.61 was calculated for the soil pathway.

4.2.2 Surface Water Pathway

It was hypothesized that metals are not leaching and migrating from the stockpiles at concentrations of concern. The findings indicate that relatively low levels of four metals were detected in the sample (CB-SW-01) collected downstream from Stockpile Area 1 (Table 3.3). These metals were also detected in the soil and sediment samples associated with the stockpile, although the surface water sample was collected approximately 1,600 feet downstream of the stockpile and may reflect other on-site sources.

Surface water is not used as a potable water source in the site vicinity. Therefore, no drinking water threat target was scored. According to discussions with Depot personnel, fishing occurs in Back Creek and Curtis Creek; these fisheries were scored as primary targets for the surface pathway. In addition, the Least Tern colony located within 0.25 miles of the Depot, and the wetlands in the vicinity of Back Creek, were scored as primary sensitive environments for the surface water pathway.

Primarily because of the presence of arsenic in the sample and the associated toxicity/persistence/bioaccumulation factors of the human food chain threat, an SI score of 66.1 was calculated for the surface water pathway.

4.2.3 Groundwater Pathway

It was hypothesized that metals are not leaching and migrating from the stockpiles at concentrations of concern. The findings indicate numerous detections of metals in the groundwater. Groundwater samples CB-GW-01 and CB-GW-02, associated with Stockpile Area 1 and 2, respectively, contained low levels of metals which were also detected in the soil samples associated with the stockpiles (Table 3.3). Groundwater sample CB-GW-02 contained detectable levels of mercury, which was also found in the six inch horizon soil sample associated with the same stockpile. Mercury was not otherwise detected in study area soil or groundwater samples.

The Medical Supplies Burial Area well (CB-GW-03) contained positive detections of VOCs as well as metals (Tables 3.2 and 3.3). The VOCs detected in the groundwater were not the same ones found in the associated soil sample. However, all but one detected compound, acetone, are classified as halogenated VOCs, suggesting a possible release from the burial area to the groundwater. The location of this well was just beyond and slightly downgradient of the identified burial area boundaries. Arsenic, which exceeded the comparison for the soil sample associated with the burial area, was also detected in the groundwater.

The groundwater sample (CB-GW-04) associated with the Former Radioactive Waste Burial Pit contained positive detections of the thorium isotopes 228, 230, and 232 (Table 3.6). There are no thorium-specific groundwater standards, but the EPA's drinking water standard for gross alpha content is 15 pCi/L. Additionally, EPA's proposed release criterion for low-level radioactive waste sites not licensed by the NRC is 15 millirems per year (mrem/yr). This equates to a value of 60 pCi/L, 30 pCi/L, and 9 pCi/L for thorium 228, 230, and 232,

respectively. The highest detection of thorium in the groundwater was 1.49 pCi/L for thorium 230.

Primarily because of the high potential contamination population and the waste characteristics scores, the maximum score of 100 was calculated for the groundwater pathway.

4.2.4 Air Pathway

In accordance with the PA recommendation, no sampling was performed for this pathway since no previous incidents of air contaminant migration were discovered. Primarily because of the zero score for air toxicity/mobility, a score of zero was calculated for the air pathway.

4.2.5 SI Score

The overall site score considers each of the pathways discussed above. Table 4.1 indicates the overall score for the Depot. The worksheet used to develop the score is presented as Appendix C. The score of 60.0, which exceeds the 28.5 standard, suggests the need for additional investigation.

Table 4.1: Site Score Calculation

PATHWAY	SITE SCORE (S)
Groundwater (S_{sw})	100
Surface Water (S_{sw})	66.1
Soil Exposure (S_s)	6.61
Air (S_a)	0
Site Score:	
$\sqrt{(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2) / 4}$	60.0

4.3 RECOMMENDATIONS

The following recommendations are based on the sampling data and the SI score for each pathway.

4.3.1 Soil

- Based on the exceedance of the comparison standard for three metals in sample CB-SS-02-6", additional soil sampling is recommended for the six inch and 24 inch horizons in Stockpile Area 2 with the objective of either confirming isolated contamination spots or further delineating the extent of contamination.

- Based on the presence of many of the same metals in sample CB-SED-01 as were found in the six inch and 24-inch horizon soil samples associated with Stockpile Area 1, additional sediment samples are recommended to confirm or refute a migration of metals to the sediment. Two sediment samples are recommended: one slightly downstream of the CB-SED-01 location, and one at the CB-SW-01 location.
- Based on the limited number of background soil samples collected to provide a comparison standard, six additional background soil samples are recommended.

4.3.2 Surface Water

- Based on positive detections of metals in the surface water, which were also detected in the sediment and soil associated with Stockpile Area 1, an additional surface water sample is recommended at a location slightly downstream of SI sample CB-SED-01 to confirm or refute a migration of metals to the surface water. This sample would be at the same location as the recommended sediment sample discussed above.
- Re-sampling of the CB-SW-01 location is recommended to provide comparison with the sample recommended for farther upstream (closer to the stockpile).

4.3.3 Groundwater

- Based on the finding of VOCs in the groundwater in a well completed outside of the identified boundaries of the Medical Supplies Burial Area, further investigation of the area is recommended. Two additional groundwater wells are recommended near the boundaries of the burial area to determine groundwater flow direction and further characterize the groundwater quality. These wells would need to be constructed under unexploded ordnance avoidance protocols based on the geophysical readings encountered during the SI field work.
- Based on the presence of medical supply debris in the borings at the Medical Supplies Burial Area, and the geophysical anomalies at six feet bgs and eight feet bgs in two borings, further investigation of the burial area may be warranted even if the groundwater samples recommended above do not indicate contamination. It is recommended that the cause of the significant magnetometer readings encountered at six and eight feet bgs in the burial area be investigated.

5. REFERENCES

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APPENDIX A
GEOLOGIC LOGS

MONITORING WELL CONSTRUCTION LOG

Project No: 735143
 Project: CURTIS BAY S.I.
 Client: USACE
 City/State: CURTIS BAY, MD
 Geologist: TOM BACHOVCHIN

Well No: CB-GW-01
 Northing:
 Easting:
 TOC Elevation: 38.16 AMSL
 Stickup: 2.88 ft.

Depth	USCS Symbol	Lithology/Remarks	Well Diagram	Well Data	Sample ID	Sample Type	Recovery %	Blow Count	Time	PID Reading (ppm)	Location of Reading	Depth	
0		Ground Surface							0800	0.0	BH	0	
2	SM	Silt, brown, some SD and clay		Grout								2	
4													4
6	CL	Clay, brown, some silt, slightly damp											6
8													8
10	SM	Sand, light brown, fine, dry			Bentonite					0815	0.0	BH	10
12													12
14					Sand								14
16													16
18	SP	Sand, brown, wet at 19 feet			0.01 Slot Screen								18
20													20
22												22	
24		End of Borehole		Well Cap					0850	0.0	BH	24	
26												26	
28												28	
30												30	

Driller: CT&E
 Drilling Method: Hollow Stem Auger
 Rig Type:
 Auger Size: 6 5/8"
 Casing: 2" PVC

Weather: Sunny, hot, dry.
 Date/Time Start: 7-28-99, 0800
 Date/Time Finish: 7-28-99, 0900

CAL = CALIBRATION
 BZ = BREATHING ZONE
 CUTTINGS
 HC = HYDROCARBON
 HS = HEADSPACE
 C = COMPOSITE
 CUTTINGS

SS = SPLIT SPOON
 A = AUGER
 BH = BORE HOLE
 GS = GRAB SAMPLE
 DC = DRILL

PARSONS ENGINEERING

MONITORING WELL CONSTRUCTION LOG

Project No: 735143
 Project: CURTIS BAY S.I.
 Client: USACE
 City/State: CURTIS BAY, MD
 Geologist: TOM BACHOVCHIN

Well No: CB-GW-02
 Northing:
 Easting:
 TOC Elevation: 15.33 ft. AMSL
 Stickup: 2.75 ft.

Depth	USCS Symbol	Lithology/Remarks	Well Diagram	Well Data	Sample ID	Sample Type	Recovery %	Blow Count	Time	PID Reading (ppm)	Location of Reading	Depth	
0		Ground Surface										0	
0	SM	Sand and silt, brown, organic matter							1510	0.0	BH	0	
2	SM	Sand and silt, yellow-brown, some cobbles			Grout								2
4	SP	Sand, dark brown, then more silt, yellow-brown							1515	0.0	BH	4	
6	SM				Bentonite		NO SOIL SAMPLES COLLECTED		1525	0.0	BH	6	
8					Sand								8
10	SM	Sand and silt, yellow-brown, slightly damp			0.01 Slot Screen				1545	0.0	BH	10	
12													12
14		Wet at 12 feet											14
16													16
18				Well Cap				1600	0.0	BH	18		
20		End of Borehole										20	
22												22	
24												24	
26												26	
28												28	
30												30	

Driller: CT&E
 Drilling Method: Hollow Stem Auger
 Rig Type:
 Auger Size: 6 5/8"
 Casing: 2" PVC

Weather: Sunny, hot & dry
 Date/Time Start: 7-27-99
 Date/Time Finish: 7-27-99

CAL = CALIBRATION
 BZ = BREATHING ZONE
 CUTTINGS
 HC = HYDROCARBON
 HS = HEADSPACE
 C = COMPOSITE
 SS = SPLIT SPOON
 A = AUGER
 BH = BORE HOLE
 GS = GRAB SAMPLE
 DC = DRILL

PARSONS ENGINEERING

MONITORING WELL CONSTRUCTION LOG

Project No: 735143
 Project: CURTIS BAY S.I.
 Client: USACE
 City/State: CURTIS BAY, MD
 Geologist: TOM BACHOVCHIN

Well No: CB-GW-03
 Northing:
 Easting:
 TOC Elevation: 27.83 ft. AMSL
 Stickup: 3.35 ft.

Depth	USCS Symbol	Lithology/Remarks	Well Diagram	Well Data	Sample ID	Sample Type	Recovery %	Blow Count	Time	PID Reading (ppm)	Location of Reading	Depth	
0		Ground Surface										0	
2	ML	Silt, some sand, red-brown, slight odor (sweet)							1020	20	BH	2	
4										0	BZ	4	
6	SM	Sand and silt, brown, same odor, slightly damp at 6 ft.							1040	20	BH	6	
8					Grout								8
10							NO SOIL						10
12	CL	Clay and silt, light brown, dry, no odor					SAMPLES						12
14							COLLECTED		1050	0	BH	14	
16					Bentonite								16
18													18
20	SC	Sand, some clay, light brown, no odor		Sand				1055	0	BH	20		
22												22	
24									1100	0	BH	24	
26	SP	Sand, yellow, fine to medium grained, damp, no odor		0.01 Slot Screen								26	
28												28	
30		End of Borehole		Well Cap								30	

Driller: CT&E
 Drilling Method: Hollow Stem Auger
 Rig Type:
 Auger Size: 6 5/8"
 Casing: 2" PVC

Weather: Sunny, hot & dry
 Date/Time Start: 7-27-99
 Date/Time Finish: 7-27-99

CAL = CALIBRATION
 BZ = BREATHING ZONE
 CUTTINGS
 HC = HYDROCARBON
 HS = HEADSPACE
 C = COMPOSITE
 SS = SPLIT SPOON
 A = AUGER
 BH = BORE HOLE
 GS = GRAB SAMPLE
 DC = DRILL

PARSONS ENGINEERING

Sheet: 1 of 1

MONITORING WELL CONSTRUCTION LOG

Project No: 735143
 Project: CURTIS BAY S.I.
 Client: USACE
 City/State: CURTIS BAY, MD
 Geologist: TOM BACHOVCHIN

Well No: CB-GW-04
 Northing:
 Easting:
 TOC Elevation: 31.79 ft. AMSL
 Stickup: 2.20 ft.

Depth	USCS Symbol	Lithology/Remarks	Well Diagram	Well Data	Sample ID	Sample Type	Recovery %	Blow Count	Time	PID Reading (ppm)	Location of Reading	Depth	
0		Ground Surface										0	
2	SM	Sand and silt, yellow-brown							1030	0	BH	2	
4													4
6	SM	Sand and silt, yellow-brown, same clay, damp at 8 ft.			Grout					1040	0	BH	6
8													8
10													10
12	ML	Sand, silt and clay, gray-brown											12
14					Bentonite						0	BH	12
16					Sand								14
18	SM	Sand, brown, fine to medium grained, then more clay, slightly damp at 18 ft.											16
20					0.01 Slot Screen								18
22	GC	Gravel at 19 ft., then sand, light brown, fine to medium grained							1050			20	
24	SM	Wet at 24 feet								0	BH	22	
26				Well Cap								24	
28												26	
30		End of Borehole							1130			28	
												30	

Driller: CT&E
 Drilling Method: Hollow Stem Auger
 Rig Type:
 Auger Size: 6 5/8"
 Casing: 2" PVC

Weather: Sunny, hot & dry
 Date/Time Start: 7-28-99
 Date/Time Finish: 7-28-99

CAL = CALIBRATION
 EZ = BREATHING ZONE
 CUTTINGS
 HC = HYDROCARBON
 HS = HEADSPACE
 C = COMPOSITE
 SS = SPLIT SPOON
 A = AUGER
 BH = BORE HOLE
 GS = GRAB SAMPLE
 DC = DRILL



APPENDIX B
DATA VALIDATION REPORT

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1. DATA VALIDATION SUMMARY

Soil, sediment, surface water and groundwater samples were collected from the Curtis Bay Depot site between July 26 and August 25 1999. Analytical results from these samples were validated and reviewed by Parsons Engineering Science, Inc. (Parsons ES) for usability with respect to the following requirements:

- DNSC-SI Global Workplan, Parsons ES, May 1999,
- Curtis Bay Site-Specific Workplan, Parsons ES, May 1999,
- United States Environmental Protection Agency (USEPA) SW-846 analytical methods, and
- USEPA National Functional Guidelines for Data Review, 1994.

The analytical laboratory for this project was Quanterra, Inc. located in North Canton, Ohio. The samples collected from Curtis Bay Depot for isotopic thorium were analyzed by Quanterra, Inc. located in St. Louis, Missouri.

1.1 LABORATORY DATA PACKAGES

The data packages received from Quanterra were paginated, complete, and overall were of good quality. Comments on specific quality control (QC) and other requirements are discussed in detail in the attached data validation report, which is summarized in Section 2.

1.2 SAMPLING AND CHAIN-OF-CUSTODY

Samples were collected, properly preserved, shipped under a chain-of-custody (COC) record, and received at Quanterra within one day of sampling. All samples were received intact and in good condition at Quanterra.

1.3 LABORATORY ANALYTICAL METHODS

The soil, sediment, surface water, and groundwater samples were collected from the Curtis Bay site and analyzed for volatile organics compounds, semivolatile organics compounds, polynuclear aromatics compounds, and the following metals: As, Pb, Sb, Ba, Se, Be, Tl, Cd, Cr, Cu, Ni, Ag, Zn, and Hg. Summaries of issues concerning these laboratory analyses are presented in Subsections 1.3.1 through 1.3.6. The data qualifications resulting from the data validation review and statements on the laboratory analytical precision, accuracy, representativeness, completeness, and comparability (PARCC) are discussed for each analytical method in Section 2. The laboratory data were reviewed and qualified with the following validation flags:

“U” – not detected at the value given,

“UJ” – estimated and not detected at the value given,

“J” – estimated at the value given,

The validated laboratory data were tabulated and are presented in Attachment A.

1.3.1 Volatile Organic Compounds Analyses

The samples collected from the Curtis Bay Depot site were analyzed for volatile organics using the USEPA SW-846 8260B method. Certain reported volatile organic results were qualified as

estimated due to non-compliant continuing calibration percent differences and surrogate recoveries. The volatile organics analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

1.3.2 Semivolatile Organic Compounds Analyses

The samples collected from the Curtis Bay Depot site were analyzed for semivolatile organics using the USEPA SW-846 8270C method. Certain reported semivolatile organics results were qualified as non-detect due to contamination present in the laboratory method blanks. The semivolatile organics analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

1.3.3 Polynuclear Aromatics Analyses

The samples collected from the Curtis Bay Depot site were analyzed for polynuclear aromatics using the USEPA SW-846 8310 method. No reported polynuclear aromatic results were qualified as result of the data validation procedures. The polynuclear aromatic analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

1.3.4 ICP Metals Analyses

The samples collected from the Curtis Bay Depot site were analyzed for ICP metals using the USEPA SW-846 6010B method. Certain reported ICP metals results were qualified as estimated due to non-compliant MS/MSD accuracy and precision and field duplicate precision. Certain reported ICP metals results were qualified as non-detect due to contamination in the method blanks. The ICP metals analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

1.3.5 Mercury Analyses

The samples collected from the Curtis Bay Depot site were analyzed for mercury using the USEPA SW-846 7470A/7471A methods. No reported mercury results were qualified as a result of the data validation procedures. The mercury analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

1.3.6 Isotopic Thorium Analyses

Two samples collected from the Curtis Bay Depot site were analyzed for isotopic thorium using the NAS-NS-3004 method. Certain reported thorium results were qualified as estimated due to high LCS recovery for Thorium-230. The thorium analyses were 100% complete and usable as presented by Quanterra and PARCC requirements were met overall.

2. DATA VALIDATION REPORT

2.1 CURTIS BAY DEPOT

Data review has been completed for the data packages generated by Quanterra containing soil, sediment, surface water, and groundwater samples collected from the Curtis Bay Depot. The specific samples, the analyses performed and a usability summary are presented in Table 2.1. All of the samples were properly preserved, shipped under a COC record, and received intact by the analytical laboratory. The validated laboratory data for these samples are presented in Attachment A.

Data validation was performed for all samples in accordance with the 1994 edition of the USEPA National Functional Guidelines for Data Review. This data validation and usability report is presented by analysis type.

2.1.1 Volatile Organics

The following were reviewed for compliancy in the volatile organics analysis:

- Custody documentation
- Holding times
- Initial Calibration Relative Standard Deviations
- Continuing Calibration Percent Differences
- Method Blanks
- Trip Blank
- Surrogate Recoveries
- Laboratory Control Spike Recoveries
- Matrix Spike/Matrix Spike Duplicate Recoveries and RPD
- Field Duplicate Relative Percent Difference
- Sample results verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of continuing calibration percent recoveries and non-compliant surrogate recoveries.

Continuing Calibration

All continuing calibrations met the percent difference criteria of a maximum of 25% with the following exceptions:

CCAL	Compound	%D	Associated Samples
8/5/99	Tetrachloroethene	-40.8	CB-GW-03, CB-GW-06, Trip blank (7/30/99)
8/10/99	Acetone	58.5	CB-SS-03-6'
	2-Butanone	44.0	
	4-Methyl-2-pentanone	27.9	
	2-Hexanone	37.5	

Associated samples were considered estimated and were flagged "J" (detect) or "UJ" (nondetect) for the non-compliant continuing calibration compounds.

Surrogate Recovery

The toluene-d8 surrogate recovery (78%) for sample CB-GW-03 was below the lower QC Limits (84-112). All volatile organic compounds were flagged "J" (detect) or "UJ" (nondetect) in sample CB-GW-03.

Usability

All volatile organics sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The volatile organics data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

2.1.2 Semivolatile Organics

The following were reviewed for compliancy in the semivolatile organics analysis:

- Custody documentation
- Holding times
- Initial Calibration Relative Standard Deviations
- Continuing Calibration Percent Differences
- Method Blanks

- Surrogate Recoveries
- Laboratory Control Spike Recoveries
- Matrix Spike/Matrix Spike Duplicate Recoveries and RPD
- Field Duplicate Relative Percent Difference
- Sample results verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of contamination present in the laboratory method blanks.

Laboratory Method Blank

All method blanks were free of target contamination with the following exception:

Blank ID	Compound	Concentration	Associated Samples
D0XLM101	Bis(2-ethylhexyl)phthalate	3.4 g/L	CB-GW-03, CB-GW-06

The associated bis(2-ethylhexyl)phthalate sample results were considered non-detect and flagged “U” at the reporting limit based on the contamination present in the blank.

Usability

All semivolatile organics sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The semivolatile organics data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

2.1.3 Polynuclear Aromatics

The following were reviewed for compliancy in the semivolatile organics analysis:

- Custody documentation
- Holding times
- Initial Calibration Relative Standard Deviations

- Continuing Calibration Percent Differences
- Method Blanks
- Surrogate Recoveries
- Laboratory Control Spike Recoveries
- Matrix Spike/Matrix Spike Duplicate Recoveries and RPD
- Field Duplicate Relative Percent Difference
- Sample results verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols.

Usability

All polynuclear aromatics sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The polynuclear aromatics data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

2.1.4 ICP Metals

The following were reviewed for compliancy in the ICP metals analysis:

- Custody documentation
- Holding times
- Initial and continuing calibration verifications
- Initial and continuing calibration blank contamination
- Laboratory preparation blank contamination
- Inductively coupled plasma (ICP) interference check sample
- Matrix spike/matrix spike duplicate recoveries and relative percent difference
- Laboratory control sample
- Field duplicate relative percent difference
- ICP serial dilution
- Sample results verification and identification

- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of MS/MSD precision and accuracy, ICP serial dilution results, field duplicate precision, and preparation blank contamination.

MS/MSD Precision and Accuracy

All precision (RPDs) and accuracy (percent recoveries, %Rs) measurements were within QC limits for MS/MSD analyses with the following exceptions:

MS Sample	Analyte	MS %R	MSD %R	RPD	QC Limits	Associated Samples
CB-BG-01-6"	antimony	63	67	-	75-125/20	CBBG-01-6",CBBG-01-2',
	nickel	-	74	-	75-125/20	CBBG-02-6", CBBG-02-2'
CB-SS-01-2'	antimony	34	31	-	75-125/20	CB-SS-01-0-6", CB-SS-04,
						CB-SS-01-2', CB-SS-02-6"
						CB-SS-02-2'
CB-SED-01	antimony	39	52	29	75-125/20	CB-SED-01, CB-SED-02,
	chromium		181	-	75-125/20	CB-SED-03

Notes: - indicates result was compliant

All non-compliant analytes below the lower QC limit, were considered estimated, possibly biased low. These analytes were flagged "J" if above the reporting limit or "UJ" if non-detect in the associated samples. All non-compliant analytes above the upper QC limit were considered estimated, possibly biased high, were flagged "J" if above the reporting limit in the associated samples.

ICP Serial Dilution

All ICP serial dilution results were compliant with maximum percent difference (%D) of 10% with the exception of the %D for zinc (17.1%) for sample CB-SS-01-6". Associated samples (CB-SS-XX) were considered estimated and were flagged "J" if the concentration reported was greater than 50 times the IDL.

Preparation Blank

All preparation blanks were free of target contamination with the following exception:

Blank ID	Compound	Concentration	Associated Samples
9251238	zinc	2.5mg/kg	CBBG-02-06", CBBG-02-2'

The associated zinc results were considered non-detect and flagged "U" at the value given based on the contamination present in the blank.

Field Duplicate Precision

Six field duplicate pairs were collected at the Curtis Bay Depot site for metals analysis. The sample and corresponding duplicate IDs were as follows:

Pair	Sample ID	Duplicate ID
1	CB-SW-01	CB-SW-02
2	CB-SS-01-6"	CB-SS-04
3	CB-SED-01	CB-SED-03
4	CB-GW-01	CB-GW-05
5	CB-GW-03	CB-GW-06
6	CB-GW-04	CB-GW-07

The precision (RPD) of all analytical results between field duplicate pairs were acceptable with the following exceptions:

Field Duplicate Pair	Analyte	RPD	QC Limit (%)	Associated Samples
1	zinc	-47.1	35	CB-SW-01, CB-SW-02
4	lead	-46.1	35	CB-GW-01, CB-GW-02, CB-GW-03, CB-GW-04, CB-GW-05, CB-GW-06, CB-GW-07
	barium	-20.5	20	
5	lead	64.8	20	CB-GW-01, CB-GW-02, CB-GW-03, CB-GW-04, CB-GW-05, CB-GW-06, CB-GW-07
	barium	26.7	20	
	chromium	78.6	20	
	zinc	42.4	20	
	arsenic	93.3	20	
6	barium	-21.0	20	CB-GW-01, CB-GW-02, CB-GW-03, CB-GW-04, CB-GW-05, CB-GW-06, CB-GW-07

Field Duplicate Pair	Analyte	RPD	QC Limit (%)	Associated Samples
	lead	-36.6	20	
	chromium	-40.0	20	
	arsenic	-28.6	20	

The non-compliant analytes were considered estimated and flagged “J” if above the reporting limit or “UJ” if non-detect in all associated samples.

Usability

All ICP metals sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The ICP metals data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

2.1.5 Mercury

The following were reviewed for compliancy in the mercury analysis:

- Custody documentation
- Holding times
- Initial and continuing calibration verifications
- Initial and continuing calibration blank contamination
- Laboratory preparation blank contamination
- Matrix spike/matrix spike duplicate recoveries and relative percent difference
- Laboratory control sample
- Field duplicate relative percent difference
- Sample results verification and identification
- Quantitation limits
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols.

Usability

All mercury sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The mercury data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

2.1.6 Isotopic Thorium

The following were reviewed for compliancy in the isotopic thorium analysis:

- Custody documentation
- Holding times
- Energy Calibrations
- Efficiency Calibrations
- Pulser Quality Control Verifications
- Method Blanks
- Surrogate Recoveries
- Laboratory Control Spike Recoveries
- Data completeness

These items were considered compliant and acceptable in accordance with the validation protocols with the exception of LCS accuracy.

LCS Accuracy

All accuracy (percent recoveries, %Rs) measurements were within QC limits for LCS analyses with the exception of a high recovery for thorium-230. Both samples were considered estimated, possibly biased high, and flagged “J” if above the reporting limit for thorium-230 based on the LCS recovery.

Usability

All isotopic thorium sample results were considered usable following data validation protocols.

Summary

The quality assurance objectives for measurement data included considerations for precision, accuracy, representativeness, completeness, and comparability. The isotopic thorium data presented by Quanterra were 100% complete with all data considered usable and valid. The validated laboratory data are tabulated and presented in Attachment A.

**TABLE 2.1
SUMMARY OF SAMPLE ANALYSES AND USABILITY
CURTIS BAY DEPOT**

SAMPLE ID	MATRIX	SAMPLE DATE	VOLATILE ORGANICS	SEMIVOLATILE ORGANICS	POLYNUCLEAR AROMATICS	ICP METALS	MERCURY	ISOTOPIC THORIUM
CB-SS-01-01-6"	soil	7/26/99	-	-	-	OK	OK	-
CB-SS-01-2'	soil	7/26/99	-	-	-	OK	OK	-
CB-SS-04	soil	7/26/99	-	-	-	OK	OK	-
CB-SED-01	sediment	7/26/99	-	-	-	OK	OK	-
CB-SED-03	sediment	7/26/99	-	-	-	OK	OK	-
CB-SW-01	surface water	7/26/99	-	-	-	OK	OK	-
CB-SW-02	surface water	7/26/99	-	-	-	OK	OK	-
CB-SS-02-6"	soil	7/26/99	-	-	-	OK	OK	-
CB-SS-02-2'	soil	7/26/99	-	-	-	OK	OK	-
CB-SED-02	sediment	7/26/99	-	-	-	OK	OK	-
CB-SS-03-6'	soil	7/27/99	OK	OK	-	OK	OK	-
CB-GW-01	groundwater	7/30/99	-	-	-	OK	OK	-
CB-GW-02	groundwater	7/30/99	-	-	-	OK	OK	-
CB-GW-03	groundwater	7/30/99	OK	OK	OK	OK	OK	-
CB-GW-04	groundwater	7/30/99	-	-	-	OK	OK	OK
CB-GW-05	groundwater	7/30/99	-	-	-	OK	OK	-
CB-GW-06	groundwater	7/30/99	OK	OK	OK	OK	OK	-
CB-GW-07	groundwater	7/30/99	-	-	-	OK	OK	OK
CBBG-01-6"	soil	8/25/99	-	-	-	OK	OK	-
CBBG-01-2'	soil	8/25/99	-	-	-	OK	OK	-
CBBG-02-06"	soil	8/25/99	-	-	-	OK	OK	-
CBBG-02-2'	soil	8/25/99	-	-	-	OK	OK	-

Notes: OK – Sample analysis considered usable and valid.

NO – Sample analysis has non-compliances resulting in unusable data. See appropriate footnote.

Footnotes: None

**DATA SUMMARY TABLES (WATER)
CURTIS BAY DEPOT SITE INVESTIGATION**

	locid ==>		CB-GW-03	CB-GW-06	TRIP/BLANK
	logdate ==>		7/30/99	7/30/99	7/30/99
	matrix ==>		WATER	WATER (DUP OF GW-03)	WATER
Total Metals					
SW846 6010B	Lead	mg/L	0.049	0.025	
SW846 6010B	Nickel	mg/L	0.04 U	0.04 U	
SW846 6010B	Silver	mg/L	0.01 U	0.01 U	
SW846 6010B	Thallium	mg/L	0.01 U	0.01 U	
SW846 6010B	Antimony	mg/L	0.02 U	0.02 U	
SW846 6010B	Arsenic	mg/L	0.033	0.012	
SW846 6010B	Barium	mg/L	0.17	0.13	
SW846 6010B	Beryllium	mg/L	0.01 U	0.01 U	
SW846 6010B	Cadmium	mg/L	0.01 U	0.01 U	
SW846 6010B	Chromium	mg/L	0.14	0.061	
SW846 6010B	Copper	mg/L	0.045	0.03 U	
SW846 6010B	Zinc	mg/L	0.12	0.078	
SW846 6010B	Selenium	mg/L	0.01 U	0.01 U	
SW846 7470A	Mercury	mg/L	0.0002 U	0.0002 U	
Volatile Organics					
SW846 8260B	None	ug/L			
SW846 8260B	Ethylbenzene	ug/L	1 U	1 U	1 U
SW846 8260B	Styrene	ug/L	1 U	1 U	1 U
SW846 8260B	cis-1,3-Dichloropropene	ug/L	1 U	1 U	1 U
SW846 8260B	trans-1,3-Dichloropropene	ug/L	1 U	1 U	1 U
SW846 8260B	1,2-Dichloroethane	ug/L	1 U	1 U	1 U
SW846 8260B	4-Methyl-2-pentanone	ug/L	10 U	10 U	10 U
SW846 8260B	Toluene	ug/L	1 U	1 U	1 U
SW846 8260B	Chlorobenzene	ug/L	1 U	1 U	1 U
SW846 8260B	Dibromochloromethane	ug/L	1 U	1 U	1 U

locid ==>	logdate ==>	matrix ==>	CB-GW-03 7/30/99 WATER	CB-GW-06 7/30/99 WATER (DUP OF GW-03)	TRIP BLANK 7/30/99 WATER
SW846 8260B		Tetrachloroethene	ug/L	1 U	1 U
SW846 8260B		Xylenes (total)	ug/L	1 U	1 U
SW846 8260B		1,2-Dichloroethene (total)	ug/L	1 U	1 U
SW846 8260B		Carbon tetrachloride	ug/L	1 U	1 U
SW846 8260B		2-Hexanone	ug/L	10 U	10 U
SW846 8260B		Acetone	ug/L	10 U	10 U
SW846 8260B		Chloroform	ug/L	8.8	9.6
SW846 8260B		Benzene	ug/L	1 U	1 U
SW846 8260B		1,1,1-Trichloroethane	ug/L	1 U	1 U
SW846 8260B		Bromomethane	ug/L	2 U	2 U
SW846 8260B		Chloromethane	ug/L	2 U	2 U
SW846 8260B		Chloroethane	ug/L	2 U	2 U
SW846 8260B		Vinyl chloride	ug/L	2 U	2 U
SW846 8260B		Methylene chloride	ug/L	1 U	1.3
SW846 8260B		Carbon disulfide	ug/L	1 U	1 U
SW846 8260B		Bromoform	ug/L	1 U	1 U
SW846 8260B		Bromodichloromethane	ug/L	1.8	2
SW846 8260B		1,1-Dichloroethane	ug/L	1 U	1 U
SW846 8260B		1,1-Dichloroethene	ug/L	1 U	1 U
SW846 8260B		1,2-Dichloropropane	ug/L	1 U	1 U
SW846 8260B		2-Butanone	ug/L	10 U	10 U
SW846 8260B		1,1,2-Trichloroethane	ug/L	1 U	1 U
SW846 8260B		Trichloroethene	ug/L	1 U	1 U
SW846 8260B		1,1,2,2-Tetrachloroethane	ug/L	1 U	1 U
SW846 8260B		Propanoic acid, 1-methylethyl-	mg/L		
SW846 8260B		Butanoic acid, 1-methylethyl e	mg/L		
SW846 8260B		Acetic acid, 1-methylethyl est	mg/L		

locid ==>	logdate ==>	matrix ==>	CB-GW-03 7/30/99 WATER	CB-GW-06 7/30/99 WATER (DUP OF GW-03)	TRIP BLANK 7/30/99 WATER
Semivolatile Organics					
SW846 8270C	Unknown	ug/L	4.4 J	4.9 J	
SW846 8270C	Unknown Acid	ug/L	8.8 J	8.3 J	
SW846 8270C	4-Nitroaniline	ug/L	67 U	50 U	
SW846 8270C	4-Nitrophenol	ug/L	67 U	50 U	
SW846 8270C	4-Bromophenyl phenyl ether	ug/L	13 U	10 U	
SW846 8270C	2,4-Dimethylphenol	ug/L	13 U	10 U	
SW846 8270C	4-Methylphenol	ug/L	13 U	10 U	
SW846 8270C	1,4-Dichlorobenzene	ug/L	13 U	10 U	
SW846 8270C	4-Chloroaniline	ug/L	13 U	10 U	
SW846 8270C	2,2-Oxybis(1-Chloropropane)'	ug/L	13 U	10 U	
SW846 8270C	Phenol	ug/L	13 U	10 U	
SW846 8270C	bis(2-Chloroethyl) ether	ug/L	13 U	10 U	
SW846 8270C	bis(2-Chloroethoxy)methane	ug/L	13 U	10 U	
SW846 8270C	bis(2-Ethylhexyl) phthalate	ug/L	4.2 J B	6.4 J B	
SW846 8270C	Di-n-octyl phthalate	ug/L	13 U	10 U	
SW846 8270C	Hexachlorobenzene	ug/L	13 U	10 U	
SW846 8270C	Anthracene	ug/L	13 U	10 U	
SW846 8270C	1,2,4-Trichlorobenzene	ug/L	13 U	10 U	
SW846 8270C	2,4-Dichlorophenol	ug/L	13 U	10 U	
SW846 8270C	2,4-Dinitrotoluene	ug/L	13 U	10 U	
SW846 8270C	Pyrene	ug/L	13 U	10 U	
SW846 8270C	Dimethyl phthalate	ug/L	13 U	10 U	
SW846 8270C	Dibenzofuran	ug/L	13 U	10 U	
SW846 8270C	Benzo(ghi)perylene	ug/L	13 U	10 U	
SW846 8270C	Indeno(1,2,3-cd)pyrene	ug/L	13 U	10 U	
SW846 8270C	Benzo(b)fluoranthene	ug/L	13 U	10 U	
SW846 8270C	Fluoranthene	ug/L	13 U	10 U	
SW846 8270C	Benzo(k)fluoranthene	ug/L	13 U	10 U	
SW846 8270C	Acenaphthylene	ug/L	13 U	10 U	

locid ==>			CB-GW-03 7/30/99 WATER	CB-GW-06 7/30/99 WATER (DUP OF GW-03)	TRIP BLANK 7/30/99 WATER
SW846 8270C	Chrysene	ug/L	13 U	10 U	
SW846 8270C	Benzo(a)pyrene	ug/L	13 U	10 U	
SW846 8270C	2,4-Dinitrophenol	ug/L	67 U	50 U	
SW846 8270C	Dibenz(a,h)anthracene	ug/L	13 U	10 U	
SW846 8270C	4,6-Dinitro-2-methylphenol	ug/L	67 U	50 U	
SW846 8270C	1,3-Dichlorobenzene	ug/L	13 U	10 U	
SW846 8270C	Benzo(a)anthracene	ug/L	13 U	10 U	
SW846 8270C	4-Chloro-3-methylphenol	ug/L	13 U	10 U	
SW846 8270C	2,6-Dinitrotoluene	ug/L	13 U	10 U	
SW846 8270C	N-Nitrosodi-n-propylamine	ug/L	13 U	10 U	
SW846 8270C	Hexachloroethane	ug/L	13 U	10 U	
SW846 8270C	4-Chlorophenyl phenyl ether	ug/L	13 U	10 U	
SW846 8270C	Hexachlorocyclopentadiene	ug/L	67 U	50 U	
SW846 8270C	Isophorone	ug/L	13 U	10 U	
SW846 8270C	Acenaphthene	ug/L	13 U	10 U	
SW846 8270C	Diethyl phthalate	ug/L	13 U	10 U	
SW846 8270C	Di-n-butyl phthalate	ug/L	13 U	10 U	
SW846 8270C	Phenanthrene	ug/L	13 U	10 U	
SW846 8270C	Butyl benzyl phthalate	ug/L	13 U	10 U	
SW846 8270C	N-Nitrosodiphenylamine	ug/L	13 U	10 U	
SW846 8270C	Fluorene	ug/L	13 U	10 U	
SW846 8270C	Carbazole	ug/L	13 U	10 U	
SW846 8270C	Hexachlorobutadiene	ug/L	13 U	10 U	
SW846 8270C	Pentachlorophenol	ug/L	13 U	10 U	
SW846 8270C	2,4,6-Trichlorophenol	ug/L	13 U	10 U	
SW846 8270C	2-Nitroaniline	ug/L	67 U	50 U	
SW846 8270C	2-Nitrophenol	ug/L	13 U	10 U	
SW846 8270C	Naphthalene	ug/L	13 U	10 U	
SW846 8270C	2-Methylnaphthalene	ug/L	13 U	10 U	
SW846 8270C	2-Chloronaphthalene	ug/L	13 U	10 U	

locid ==>	logdate ==>	matrix ==>	CB-GW-03 7/30/99 WATER	CB-GW-06 7/30/99 WATER (DUP OF GW-03)	TRIP BLANK 7/30/99 WATER
SW846 8270C	3,3-Dichlorobenzidine'	ug/L	67 U	50 U	
SW846 8270C	2-Methylphenol	ug/L	13 U	10 U	
SW846 8270C	1,2-Dichlorobenzene	ug/L	13 U	10 U	
SW846 8270C	2-Chlorophenol	ug/L	13 U	10 U	
SW846 8270C	2,4,5-Trichlorophenol	ug/L	13 U	10 U	
SW846 8270C	Nitrobenzene	ug/L	13 U	10 U	
SW846 8270C	3-Nitroaniline	ug/L	67 U	50 U	
SW846 8310	Benzo(a)pyrene	ug/L	0.1 U	0.1 U	
SW846 8270C	Benzothiazole	ug/L	3.8 NJ		

locid ==>	logdate ==>	matrix ==>	CB-GW-01 7/30/99 WATER	CB-GW-02 7/30/99 WATER	CB-GW-04 7/30/99 WATER	CB-GW-05 7/30/99 WATER (Dup GW-01)	CB-GW-07 7/30/99 WATER (Dup GW-04)	CB-SW-01 7/26/99 WATER	CB-SW-02 7/26/99 WATER (Dup SW-01)
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Total Metals									
SW846 6010B	Lead	mg/L	0.01	0.083	0.038	0.016	0.055	0.01 U	0.01 U
SW846 6010B	Nickel	mg/L	0.04 U	0.1	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SW846 6010B	Silver	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
SW846 6010B	Thallium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
SW846 6010B	Antimony	mg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
SW846 6010B	Arsenic	mg/L	0.01 U	0.07	0.021	0.012	0.028	0.078	0.065
SW846 6010B	Barium	mg/L	0.079	0.51	0.17	0.097	0.21	0.072	0.072
SW846 6010B	Beryllium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
SW846 6010B	Cadmium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
SW846 6010B	Chromium	mg/L	0.051	0.25	0.12	0.074	0.18	0.025	0.025
SW846 6010B	Copper	mg/L	0.034	0.13	0.03 U	0.051	0.035	0.03 U	0.03 U
SW846 6010B	Zinc	mg/L	0.056	0.28	0.087	0.068	0.084	0.06	0.097
SW846 6010B	Selenium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
SW846 7470A	Mercury	mg/L	0.0002 U	0.0011	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U

**DATA SUMMARY TABLES (SOIL)
CURTIS BAY DEPOT SITE INVESTIGATION**

locid ==>	CB-SS-03-6'
logdate ==>	7/30/99
matrix ==>	SOIL

Total Metals

SW846 6010B	Lead	mg/kg	26.1
SW846 6010B	Nickel	mg/kg	9.9
SW846 6010B	Silver	mg/kg	1.3 U
SW846 6010B	Thallium	mg/kg	1.3 U
SW846 6010B	Antimony	mg/kg	6.3 U
SW846 6010B	Arsenic	mg/kg	14.7
SW846 6010B	Barium	mg/kg	47.6
SW846 6010B	Beryllium	mg/kg	0.63 U
SW846 6010B	Cadmium	mg/kg	0.63 U
SW846 6010B	Chromium	mg/kg	27.2
SW846 6010B	Copper	mg/kg	13.6
SW846 6010B	Zinc	mg/kg	42
SW846 6010B	Selenium	mg/kg	1.3 U
SW846 7470A	Mercury	mg/kg	0.13 U

Volatile Organics

SW846 8260B	Ethylbenzene	ug/kg	6.3 U
SW846 8260B	Styrene	ug/kg	6.3 U
SW846 8260B	cis-1,3-Dichloropropene	ug/kg	6.3 U
SW846 8260B	trans-1,3-Dichloropropene	ug/kg	6.3 U
SW846 8260B	1,2-Dichloroethane	ug/kg	6.3 U
SW846 8260B	4-Methyl-2-pentanone	ug/kg	25 UJ
SW846 8260B	Toluene	ug/kg	6.3 U
SW846 8260B	Chlorobenzene	ug/kg	6.3 U
SW846 8260B	Dibromochloromethane	ug/kg	6.3 U
SW846 8260B	Tetrachloroethene	ug/kg	6.3 U
SW846 8260B	Xylenes (total)	ug/kg	6.3 U
SW846 8260B	1,2-Dichloroethene (total)	ug/kg	6.3 U
SW846 8260B	Carbon tetrachloride	ug/kg	6.3 U
SW846 8260B	2-Hexanone	ug/kg	25 UJ
SW846 8260B	Acetone	ug/kg	72 J
SW846 8260B	Chloroform	ug/kg	6.3 U
SW846 8260B	Benzene	ug/kg	6.3 U
SW846 8260B	1,1,1-Trichloroethane	ug/kg	6.3 U
SW846 8260B	Bromomethane	ug/kg	13 U
SW846 8260B	Chloromethane	ug/kg	13 U
SW846 8260B	Chloroethane	ug/kg	13 U
SW846 8260B	Vinyl chloride	ug/kg	13 U
SW846 8260B	Methylene chloride	ug/kg	54
SW846 8260B	Carbon disulfide	ug/kg	6.3 U

locid ==>	CB-SS-03-6'		
logdate ==>	7/30/99		
matrix ==>	SOIL		

SW846 8260B	Bromoform	ug/kg	6.3 U
SW846 8260B	Bromodichloromethane	ug/kg	6.3 U
SW846 8260B	1,1-Dichloroethane	ug/kg	6.3 U
SW846 8260B	1,1-Dichloroethene	ug/kg	6.3 U
SW846 8260B	1,2-Dichloropropane	ug/kg	6.3 U
SW846 8260B	2-Butanone	ug/kg	25 UJ
SW846 8260B	1,1,2-Trichloroethane	ug/kg	6.3 U
SW846 8260B	Trichloroethene	ug/kg	6.3 U
SW846 8260B	1,1,2,2-Tetrachloroethane	ug/kg	6.3 U

Semivolatile Organics			
SW846 8270C	4-Nitroaniline	ug/kg	2000 U
SW846 8270C	4-Nitrophenol	ug/kg	2000 U
SW846 8270C	4-Bromophenyl phenyl ether	ug/kg	420 U
SW846 8270C	2,4-Dimethylphenol	ug/kg	420 U
SW846 8270C	4-Methylphenol	ug/kg	420 U
SW846 8270C	1,4-Dichlorobenzene	ug/kg	420 U
SW846 8270C	4-Chloroaniline	ug/kg	420 U
SW846 8270C	2,2-Oxybis(1-Chloropropane)'	ug/kg	420 U
SW846 8270C	Phenol	ug/kg	420 U
SW846 8270C	bis(2-Chloroethyl) ether	ug/kg	420 U
SW846 8270C	bis(2-Chloroethoxy)methane	ug/kg	420 U
SW846 8270C	bis(2-Ethylhexyl) phthalate	ug/kg	420 U
SW846 8270C	Di-n-octyl phthalate	ug/kg	420 U
SW846 8270C	Hexachlorobenzene	ug/kg	420 U
SW846 8270C	Anthracene	ug/kg	420 U
SW846 8270C	1,2,4-Trichlorobenzene	ug/kg	420 U
SW846 8270C	2,4-Dichlorophenol	ug/kg	420 U
SW846 8270C	2,4-Dinitrotoluene	ug/kg	420 U
SW846 8270C	Pyrene	ug/kg	420 U
SW846 8270C	Dimethyl phthalate	ug/kg	420 U
SW846 8270C	Dibenzofuran	ug/kg	420 U
SW846 8270C	Benzo(ghi)perylene	ug/kg	420 U
SW846 8270C	Indeno(1,2,3-cd)pyrene	ug/kg	420 U
SW846 8270C	Benzo(b)fluoranthene	ug/kg	420 U
SW846 8270C	Fluoranthene	ug/kg	420 U
SW846 8270C	Benzo(k)fluoranthene	ug/kg	420 U
SW846 8270C	Acenaphthylene	ug/kg	420 U
SW846 8270C	Chrysene	ug/kg	420 U
SW846 8270C	Benzo(a)pyrene	ug/kg	420 U
SW846 8270C	2,4-Dinitrophenol	ug/kg	2000 U
SW846 8270C	Dibenz(a,h)anthracene	ug/kg	420 U
SW846 8270C	4,6-Dinitro-2-methylphenol	ug/kg	2000 U
SW846 8270C	1,3-Dichlorobenzene	ug/kg	420 U

locid ==>	CB-SS-03-6'		
logdate ==>	7/30/99		
matrix ==>	SOIL		
SW846 8270C	Benzo(a)anthracene	ug/kg	420 U
SW846 8270C	4-Chloro-3-methylphenol	ug/kg	420 U
SW846 8270C	2,6-Dinitrotoluene	ug/kg	420 U
SW846 8270C	N-Nitrosodi-n-propylamine	ug/kg	420 U
SW846 8270C	Hexachloroethane	ug/kg	420 U
SW846 8270C	4-Chlorophenyl phenyl ether	ug/kg	420 U
SW846 8270C	Hexachlorocyclopentadiene	ug/kg	2000 U
SW846 8270C	Isophorone	ug/kg	420 U
SW846 8270C	Acenaphthene	ug/kg	420 U
SW846 8270C	Diethyl phthalate	ug/kg	420 U
SW846 8270C	Di-n-butyl phthalate	ug/kg	420 U
SW846 8270C	Phenanthrene	ug/kg	420 U
SW846 8270C	Butyl benzyl phthalate	ug/kg	420 U
SW846 8270C	N-Nitrosodiphenylamine	ug/kg	420 U
SW846 8270C	Fluorene	ug/kg	420 U
SW846 8270C	Carbazole	ug/kg	420 U
SW846 8270C	Hexachlorobutadiene	ug/kg	420 U
SW846 8270C	Pentachlorophenol	ug/kg	420 U
SW846 8270C	2,4,6-Trichlorophenol	ug/kg	420 U
SW846 8270C	2-Nitroaniline	ug/kg	420 U
SW846 8270C	2-Nitrophenol	ug/kg	420 U
SW846 8270C	Naphthalene	ug/kg	420 U
SW846 8270C	2-Methylnaphthalene	ug/kg	420 U
SW846 8270C	2-Chloronaphthalene	ug/kg	420 U
SW846 8270C	3,3-Dichlorobenzidine'	ug/kg	2000 U
SW846 8270C	2-Methylphenol	ug/kg	420 U
SW846 8270C	1,2-Dichlorobenzene	ug/kg	420 U
SW846 8270C	2-Chlorophenol	ug/kg	420 U
SW846 8270C	2,4,5-Trichlorophenol	ug/kg	420 U
SW846 8270C	Nitrobenzene	ug/kg	420 U
SW846 8270C	3-Nitroaniline	ug/kg	2000 U
SW846 8310	Benzo(a)pyrene	ug/kg	420 U
SW846 8270C	Benzothiazole	ug/kg	420 U

locid ==>	CB-SED-01	CB-SED-02	CB-SED-03	CB-SS-01-2"	CB-SS-01-6"	CB-SS-02
logdate ==>	7/26/99	7/26/99	7/26/99	7/26/99	7/26/99	7/26/99
matrix ==>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			(DUP SED-01)			

Total Metals	Units						
Lead	mg/kg	53.8	36.5	69.4	17.2	16	7.1
Nickel	mg/kg	14.2	43.3	17.6	8.6	7.3	4.4 U
Silver	mg/kg	1.6 U	1.2 UG	1.5 U	1.2 U	1.2 U	1.1 U
Thallium	mg/kg	1.6 U	3.6	3.2	1.2 U	1.2 U	1.1 U
Antimony	mg/kg	8.2 UJ	5.9 UG	7.4 UJ	5.9 UJ	6 UJ	5.5 UJ
Arsenic	mg/kg	17.9	11.1	20.3	8.4	4.4	4.2
Barium	mg/kg	61.8	47.2	79.6	67.7	53.3	11.5
Beryllium	mg/kg	0.82 U	0.59 U	0.74 U	0.59 U	0.6 U	0.55 U
Cadmium	mg/kg	0.82 U	0.59 U	0.96	0.59 U	0.6 U	0.55 U
Chromium	mg/kg	73.9 J	57 J	90.2 J	28	24.9	6.6
Copper	mg/kg	19.6	33.2	23.5	12	12.1	7.9
Zinc	mg/kg	552	73.4	659	26.2 J	18.7 J	16.3
Selenium	mg/kg	1.6 U	1.2 UG	3 UG	1.2 U	1.2 U	1.1 U
Mercury	mg/kg	0.16 U	0.12 U	0.15 U	0.12 U	0.12 U	0.11 U

locid ==>	CB-SS-02-6"	CB-SS-04	CBBG-01-2"	CBBG-01-6"	CBBG-02-2"	CBBG-02-6"
logdate ==>	7/26/99	7/26/99	8/25/99	8/25/99	8/25/99	8/25/99
matrix ==>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			(DUP SS-01-6")			

Total Metals	Units						
Lead	mg/kg	92.2	15.4	1960	325	1.5	6.8
Nickel	mg/kg	7	5.8	13.2 J	11.7 J	4.3 UJ	4.7 UJ
Silver	mg/kg	11.4 UG	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Thallium	mg/kg	12	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Antimony	mg/kg	5.7 UJ	6 UJ	5.7 UJ	6 UJ	5.3 UJ	5.9 UJ
Arsenic	mg/kg	112	3.6	7.6	8.7	1.1 U	1.2
Barium	mg/kg	57.3	64.1	482	166	4.4	17.8
Beryllium	mg/kg	0.57 U	0.6 U	0.57 U	0.6 U	0.53 U	0.59 U
Cadmium	mg/kg	5.7 UG	0.6 U	1.4	0.6 U	0.53 U	0.59 U
Chromium	mg/kg	15.4	20.8	25.4	17.8	3.6	13
Copper	mg/kg	21.5	11.2	119	35.4	5.3	8.3
Zinc	mg/kg	223 J	16.9	623	160	3.1 U	6.4 U
Selenium	mg/kg	5.7 UG	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Mercury	mg/kg	0.13	0.12 U	7	0.23	0.11 U	0.12 U

APPENDIX C
SITE INSPECTION WORKSHEETS

SITE INSPECTION WORKSHEET

CERCLIS IDENTIFICATION NUMBER
(NOT ASSIGNED)

SITE LOCATION			
SITE-NAME: LEGAL, COMMON, OR DESCRIPTIVE NAME OF SITE DLA/DNSC Curtis Bay Depot			
STREET ADDRESS, ROUTE, OR SPECIFIC LOCATION IDENTIFIER 710 East Ordnance Road			
CITY Curtis Bay	STATE MD	ZIP CODE 21226	TELEPHONE 410/962-2346
COORDINATES: LATITUDE and LONGITUDE Lat: 39° 11' 40" Long: 76° 35' 24"		TOWNSHIP, RANGE, AND SECTION Anne Arundel County	

OWNER/OPERATOR IDENTIFICATION					
OWNER General Services Administration			OPERATOR Department of Defense/ DLA		
OWNER ADDRESS Office of National Defense; 26 Federal Plaza			OPERATOR ADDRESS 8725 John Kingman Rd.		
CITY New York			CITY Ft. Belvoir		
STATE NY	ZIP CODE 10278	TELEPHONE ()	STATE VA	ZIP CODE 22060	TELEPHONE (703) 767-6500

SITE EVALUATION		
AGENCY/ORGANIZATION Parsons Engineering Science, Inc.		
INVESTIGATOR		
CONTACT Thomas Bachovchin		
ADDRESS 10521 Rosehaven St		
CITY Fairfax	STATE VA	ZIP CODE 22030
TELEPHONE (703) 934-2345		

GENERAL INFORMATION

Site Description and Operational History: Provide a brief description of the site and its operational history. State the site name, owner, operator, type of facility and operations, size of property, active or inactive status, and years of waste generation. Summarize waste treatment, storage, or disposal activities that have or may have occurred at the site; note whether these activities are documented or alleged. Identify all source types and prior spills, floods, or fires. Summarize highlights of the PA and other investigations.

See Section 2 of the Site Investigation Report.

Site Sketch: Provide a sketch of the site. Indicate all pertinent features of the site and nearby environments including sources of wastes, areas of visible and buried wastes, buildings, residences, access roads, parking areas, fences, fields, drainage patterns, water bodies, vegetation, wells, sensitive environments, and other features.

See SI Figure 2.2

Source Description: Include description of containment per pathway for ground water (see HRS Table 3-2), surface water (see HRS Table 4-2), and air (see HRS Tables 6-3 and 6-9).

See SI Sections 3.2, 3.3, 3.4, and 3.5.

Hazardous Waste Quantity (HWQ) Calculation: SI Tables 1 and 2 (See HRS Tables 2-5, 2-6, and 5-2).

Multiple source. Source type is Pile. Tier is Area.

Material	Area (FT ²)	Source WQ-Mult Source Divisor (13)	Site WQ Total	HWQ Score
Stockpile 1	260,000	20,000	20,000	
Stockpile 2	180,000	13,846	13,846	
Stockpile 3	150,000	11,538	11,538	
Stockpile 4	240,000	18,462	18,462	
			63,846	10,000

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET

Site Name: Curtis Bay, MD Depot

References: HRS Package Preparation Course

Sources:

N/A

SOURCE	HAZARDOUS SUBSTANCES	TOXICITY	SURFACE WATER PATHWAY													
			GROUND WATER PATHWAY		OVERLAND/FLOOD MIGRATION							GROUND WATER TO SURFACE WATER				
			GW Mobility (HRS Table 3-8) (mg/L)	Tox/Mobility Value (HRS Table 3-9)	Per (HRS Tables 4-10 and 4-11)	Tox/Per Value (HRS Table 4-12)	Bioac Pot. (HRS Table 4-15)	Tox/Pers/Bioac Value (HRS Table 4-16)	Ecotox (HRS Table 4-19)	Ecotox/Pers/ (HRS Table 4-20)	Ecotox/Pers/Bioacc Value (HRS Table 4-21)	Tox/Mob/Pers Value (HRS Table 4-26)	Tox/Mob/Pers/Bioacc Value (HRS Table 4-28)	Ecotox/Mob/Pers Value (HRS Table 4-29)	Ecotox/Mob/Per/Bioacc Value (HRS Table 4-30)	

SI TABLE 4: GROUND WATER OBSERVED RELEASE SUBSTANCES (BY AQUIFER)

Sample ID	Hazardous Substances	Bckgrd. Conc.	Toxicity/ Mobility	References
CB-GW-03	Arsenic	N/A	10000	Hazardous Substance Reference Table
CB-GW-03	Barium	N/A	10000	Same
CB-GW-03	Chromium	N/A	10000	Same
CB-GW-03	Lead	N/A	10000	Same
Highest Toxicity/Mobility			10000	

SI TABLE 5: GROUND WATER ACTUAL CONTAMINATION TARGETS

Well ID: N/A Level I Level II Population Served References

Sample ID	Hazardous Substances	Conc. (ug/L)	Benchmark Conc. (MCL or MCLG)	% of Benchmark	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD
N/A								
Highest Percent					Sum of Percents		Sum of Percents	

Well ID: N/A Level I Level II Population Served References

Sample ID	Hazardous Substances	Conc. (ug/L)	Benchmark Conc. (MCL or MCLG)	% of Benchmark	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD
N/A								
Highest Percent					Sum of Percents		Sum of Percents	

**GROUND WATER PATHWAY
GROUND WATER USE DESCRIPTION**

Describe Ground Water Use within 4 Miles of the Site:

Describe generalized stratigraphy, aquifers, municipal and private wells.

See Section 3.4 of the Site Investigation Report.

Show Calculation of Ground Water Drinking Water Populations for each Aquifer:

Provide apportionment calculations for blended supply systems.

County average number of persons per household: _____

Reference Frost Associates

Distance from Site	Population Served	Population Value
0 – ¼ mile	35	53
¼ - ½ mile	39	33
½ - 1 mile	93	17
1 – 2 mile	317	94
2 – 3 mile	125,000	21,222
3 – 4 mile	125,000	13,060
Totals	250,484	34,479

GROUND WATER PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to the aquifer, assign a score of 550. Record observed release substances on SI Table 4.	550	+	Sampling data
2. POTENTIAL TO RELEASE: Depth to aquifer. _____ feet. If sampling data do not support a release to the aquifer, and the site is in karst terrain or the depth to aquifer is 70 feet or less, assign a score of 500; otherwise, assign a score of 340. Optionally, evaluate potential to release according to HRS Section 3.			
LR =	550		

TARGETS

Are any wells part of a blended system? Yes___ No <u>X</u> . If yes, attach a page to show apportionment calculations.			
3. ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates that any target drinking water well for the aquifer has been exposed to a hazardous substance from the site, evaluate the factor score for the number of people served (SI Table 5). LEVEL I: <u>0</u> people x 10 = <u>0</u> . TOTAL = LEVEL II: <u>0</u> people x 1 = <u>0</u> .	0	H	Sampling data
4. POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water wells for the aquifer or overlying aquifers that are not exposed to a hazardous substance from the site; record the population for each distance category in SI Table 6a or 6b. Sum the population values and multiply by 0.1.	3,447.9	H	Frost Assoc.
5. NEAREST WELL: Assign a score of 50 for any Level I Actual Contamination Targets for the aquifer or overlying aquifer. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Targets exist, assign the Nearest Well score from SI Table 6a or 6b. If no drinking water wells exist within 4 miles, assign 0.	20	H	Frost Assoc.
6. WELLHEAD PROTECTION AREA (WHPA): If any source lies within or above a WHPA for the aquifer, or if a ground water observed release has occurred within a WHPA, assign a score of 20; assign 5 if neither condition applies but a WHPA is within 4 miles; otherwise assign 0.	5	+	Frost Assoc.

TARGETS (Cont.)

7. RESOURCES: Assign a score of 5 if one or more ground water resources applies; assign 0 if none applies. <ul style="list-style-type: none"> ▪ Irrigation (5 acre minimum) of commercial food crops or commercial forage crops ▪ Watering of commercial livestock ▪ Ingredient in commercial food preparation ▪ Supply for commercial aquaculture ▪ Supply for a major or designated water recreation area, excluding drinking water use. 	5	E	Land Use
Sum of Targets T =	3,477.9		

WASTE CHARACTERISTICS

	Score	Data Type	Refs																						
8. If any Actual Contamination Targets exist for the aquifer or overlying aquifers, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if no Actual Contamination Targets exist, assign the hazardous waste quantity score calculated for sources available to migrate to ground water.	10,000	H	Site Material Logs																						
9. Assign the highest ground water toxicity/mobility value from SI Table 3 or 4.	10,000	H	HRS Course																						
10. Multiply the ground water toxicity/mobility and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below: (from HRS Table 2-7).																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Product</th> <th style="text-align: left;">WC Score</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>>0 to 10</td><td>1</td></tr> <tr><td>10 to <100</td><td>2</td></tr> <tr><td>100 to <1,000</td><td>3</td></tr> <tr><td>1,000 to <10,000</td><td>6</td></tr> <tr><td>10,000 to <1E+05</td><td>10</td></tr> <tr><td>1E+05 to <1E+06</td><td>18</td></tr> <tr><td>1E+06 to <1E+07</td><td>32</td></tr> <tr><td>1E+7 to <1E+08</td><td>56</td></tr> <tr><td>1E+08 or greater</td><td>100</td></tr> </tbody> </table>	Product	WC Score	0	0	>0 to 10	1	10 to <100	2	100 to <1,000	3	1,000 to <10,000	6	10,000 to <1E+05	10	1E+05 to <1E+06	18	1E+06 to <1E+07	32	1E+7 to <1E+08	56	1E+08 or greater	100	100	+	Site Material Logs & HRS
Product	WC Score																								
0	0																								
>0 to 10	1																								
10 to <100	2																								
100 to <1,000	3																								
1,000 to <10,000	6																								
10,000 to <1E+05	10																								
1E+05 to <1E+06	18																								
1E+06 to <1E+07	32																								
1E+7 to <1E+08	56																								
1E+08 or greater	100																								
WC =	100																								

Multiply LR by T and by WC. Divide the product by 82,500 to obtain the ground water pathway score for each aquifer. Select the highest aquifer score. If the pathway score is greater than 100, assign 100.

Ground Water Pathway Score:

$$\frac{LR \times T \times WC}{82,500} =$$

100

SURFACE WATER PATHWAY

Sketch of the Surface Water Migration Route: Label all surface water bodies. Include runoff route and drainage direction, probable point of entry, and 15-mile target distance limit. Mark sample locations, intakes, fisheries, and sensitive environments. Indicate flow directions, tidal influence, and rate.

See SI Figures 2.1 and 2.2

SURFACE WATER PATHWAY

LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET

LIKELIHOOD OF RELEASE -

OVERLAND/FLOOD MIGRATION

	Score	Data Type	Refs												
1. OBSERVED RELEASE: If sampling data or direct observation support a release to the surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.	550	+	Sampling Data												
2. POTENTIAL TO RELEASE: Depth to surface water <25000 feet. If sampling data do not support a release to surface water in the watershed, use the data below to assign a score from the table below based on distance to surface water and flood frequency.															
<table border="1"> <tr> <td>Distance to surface water < 2500 feet</td> <td>500</td> </tr> <tr> <td>Distance to surface water < 25000 feet</td> <td></td> </tr> <tr> <td>Site in annual or 10-yr floodplain</td> <td>500</td> </tr> <tr> <td>Site in 100-yr floodplain</td> <td>400</td> </tr> <tr> <td>Site in 500-yr floodplain</td> <td>300</td> </tr> <tr> <td>Site outside 500-yr floodplain</td> <td>100</td> </tr> </table>				Distance to surface water < 2500 feet	500	Distance to surface water < 25000 feet		Site in annual or 10-yr floodplain	500	Site in 100-yr floodplain	400	Site in 500-yr floodplain	300	Site outside 500-yr floodplain	100
Distance to surface water < 2500 feet	500														
Distance to surface water < 25000 feet															
Site in annual or 10-yr floodplain	500														
Site in 100-yr floodplain	400														
Site in 500-yr floodplain	300														
Site outside 500-yr floodplain	100														
Optionally, evaluate surface water potential to release according to HRS Section 4.1.2.1.2.	N/A														
LR =	550														

LIKELIHOOD OF RELEASE -

GROUND WATER TO SURFACE WATER MIGRATION

	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to the surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.			
NOTE: Evaluate ground water to surface water migration only for a surface water body that meets all of the following conditions:			
1) A portion of the surface water is within 1 mile of site sources having a containment factor greater than 0.			
2) No aquifer discontinuity is established between the source and the above portion of the surface water body.			
3) The top of the uppermost aquifer is at or above the bottom of the surface water.			
Elevation at the uppermost aquifer _____.			
Elevation of bottom of surface water body _____.			
	550	+	Sampling Data
POTENTIAL TO RELEASE: Use the ground water potential release. Optionally, evaluate surface water potential to release according to HRS Section 4.1.2.1.2.	N/A		
LR =	550		

**SURFACE WATER PATHWAY
LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET
(CONTINUED)**

DRINKING WATER THREAT TARGETS	Score	Data Type	Refs																
<p>Record the water body type, flow, and number of people served by each drinking water intake within the target distance limit in the watershed. If there is no drinking water intake within the target distance limit, assign 0 to factors 3, 4, and 5.</p> <table border="1"> <thead> <tr> <th>Intake Name</th> <th>Water Body Type</th> <th>Flow</th> <th>People Served</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Are any intakes part of a blended system? Yes ___ No <u>X</u>. If yes, attach a page to show apportionment calculations.</p> <p>3. ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates a drinking water intake has been exposed to a hazardous substance from the site, list the intake name and evaluate the factor score for the drinking water population (SI Table 8).</p> <p>LEVEL I: <u>0</u> people x 10 = <u>0</u> TOTAL = LEVEL II: <u>0</u> people x 1 = <u>0</u></p>	Intake Name	Water Body Type	Flow	People Served	N/A												0	+	Sampling Data
Intake Name	Water Body Type	Flow	People Served																
N/A																			
<p>4. POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water intakes for the watershed that have not been exposed to a hazardous substance from the site. Assign population values from SI Table 9. Sum the values and multiply by 0.1.</p>	0	+	Frost Assoc.																
<p>5. NEAREST INTAKE: Assign a score of 50 for any Level I Actual Contamination Drinking Water Targets for the watershed. Assign a score of 45 if there are Level II targets for the watershed, but no Level I targets. If no Actual Contamination Drinking Water Targets exist, assign a score for the intake nearest the PPE from SI Table 9. If no drinking water intakes exist, assign 0.</p>	0	+	Frost Assoc.																
<p>7. RESOURCES: Assign a score of 5 if one or more ground water resources applies; assign 0 if none applies.</p> <ul style="list-style-type: none"> ▪ Irrigation (5 acre minimum) of commercial food crops or commercial forage crops ▪ Watering of commercial livestock ▪ Ingredient in commercial food preparation ▪ Major or designated water recreation area, excluding drinking water use. 	5	E	Land Use																
Sum of Targets T =	5																		



SI TABLE 10: HUMAN FOOD CHAIN ACTUAL CONTAMINATION TARGETS

Fishery ID: Back Creek, Curtis Creek Sample Type _____ Level I X Level II _____ References _____

Sample ID	Hazardous Substances	Conc. (mg/kg)	Benchmark Conc. (FDAAL)	% of Benchmark	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD
SED-01	Arsenic	20.3	N/A	N/A	N/A	N/A	1.3	100
SED-01	Barium	79.6	N/A	N/A	N/A	N/A	65	100
SED-01	Chromium	90.2	N/A	N/A	N/A	N/A	6.5	100
SED-01	Lead	69.4	N/A	N/A	N/A	N/A	N/A	N/A
SED-01	Zinc	659	N/A	N/A	N/A	N/A	260	100
Highest Percent					Sum of Percents		Sum of Percents	

SI TABLE 11: SENSITIVE ENVIRONMENT ACTUAL CONTAMINATION TARGETS FOR WATERSHED

Environment ID: N/A Sample Type _____ Level I _____ Level II _____ Environmental Value _____

Sample ID	Hazardous Substances	Conc. (ug/L)	Benchmark Conc. (AWQC or AALAC)	% of Benchmark	References
N/A					
Highest Percent					

Environment ID: N/A Sample Type _____ Level I _____ Level II _____ Environmental Value _____

Sample ID	Hazardous Substances	Conc. (ug/L)	Benchmark Conc. (AWQC or AALAC)	% of Benchmark	References
N/A					
Highest Percent					

SURFACE WATER PATHWAY (continued)
HUMAN FOOD CHAIN THREAT WORKSHEET

HUMAN FOOD CHAIN THREAT TARGETS	Score	Data Type	Refs																						
<p>Record the water body type and flow for each fishery within the target distance limit. If there is no fishery within the target distance limit, assign a score of 0 at the bottom of this page.</p> <table border="1"> <tr> <td>Fishery Name</td> <td>Water Body</td> <td>Flow</td> </tr> <tr> <td>Back Creek</td> <td>Moderate Stream</td> <td>500 cfs</td> </tr> <tr> <td>Fishery Name</td> <td>Water Body</td> <td>Flow</td> </tr> <tr> <td>Curtis Creek</td> <td>Large Stream</td> <td>1000 cfs</td> </tr> </table> <p>FOOD CHAIN INDIVIDUAL</p> <p>7. ACTUAL CONTAMINATION FISHERIES:</p> <p>If analytical evidence indicates that a fishery has been exposed to a hazardous substance with a bioaccumulation factor greater than or equal to 500 (SI Table 10), assign a score of 50 if there is a Level I fishery. Assign 45 if there is a Level II fishery, but no Level I fishery.</p> <p>8. POTENTIAL CONTAMINATION FISHERIES:</p> <p>If there is a release of a substance with a bioaccumulation factor greater than or equal to 500 to a watershed containing fisheries within the target distance limit, but there are no Level I or Level II fisheries, assign a score of 20.</p> <p>If there is no observed release to the watershed, assign a value for potential contamination fisheries from the table below using the lowest flow at all fisheries within the target distance limit:</p> <table border="1"> <tr> <td>Lowest Flow</td> <td>FCI Value</td> </tr> <tr> <td><10 cfs</td> <td>20</td> </tr> <tr> <td>10 to 100 cfs</td> <td>2</td> </tr> <tr> <td>>100 cfs, coastal tidal waters, oceans, or Great Lakes</td> <td>0</td> </tr> <tr> <td>3-mile mixing zone in quiet flowing river</td> <td>10</td> </tr> </table> <p align="right">FCI Value =</p> <p align="right">T =</p>	Fishery Name	Water Body	Flow	Back Creek	Moderate Stream	500 cfs	Fishery Name	Water Body	Flow	Curtis Creek	Large Stream	1000 cfs	Lowest Flow	FCI Value	<10 cfs	20	10 to 100 cfs	2	>100 cfs, coastal tidal waters, oceans, or Great Lakes	0	3-mile mixing zone in quiet flowing river	10	50	+	Sampling Data
Fishery Name	Water Body	Flow																							
Back Creek	Moderate Stream	500 cfs																							
Fishery Name	Water Body	Flow																							
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Lowest Flow	FCI Value																								
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3-mile mixing zone in quiet flowing river	10																								
	50																								

**SURFACE WATER PATHWAY (continued)
ENVIRONMENTAL THREAT WORKSHEET**

When measuring length of wetlands that are located on both sides of a surface water body, sum both frontage lengths. For a sensitive environment that is more than one type, assign a value for each type.

ENVIRONMENTAL THREAT TARGETS	Score	Data Type	Refs																																																												
<p>Record the water body type and flow for each fishery within the target distance limit. If there is no fishery within the target distance limit, assign a score of 0 at the bottom of this page.</p> <table border="1"> <thead> <tr> <th>Environment Name</th> <th>Water Body Type</th> <th>Flow</th> <th>cfs</th> </tr> </thead> <tbody> <tr><td>Threatened Species</td><td></td><td></td><td>cfs</td></tr> <tr><td>Wetlands</td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> <tr><td></td><td></td><td></td><td>cfs</td></tr> </tbody> </table> <p>9. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: If sampling data or direct observation indicate any sensitive environments has been exposed to a hazardous substance from the site, record this information on SI Table 11, and assign a factor value for the environment (SI Tables 13 and 14).</p> <table border="1"> <thead> <tr> <th>Environment Name</th> <th>Environment Type and Value (SI Tables 13 & 14)</th> <th>Multiplier (10 for Level I, 1 for Level II)</th> <th>Product</th> </tr> </thead> <tbody> <tr><td>N/A</td><td></td><td>X =</td><td></td></tr> <tr><td></td><td></td><td>X =</td><td></td></tr> <tr><td></td><td></td><td>X =</td><td></td></tr> <tr><td></td><td></td><td>X =</td><td></td></tr> <tr><td align="right" colspan="3">Sum =</td><td></td></tr> </tbody> </table>	Environment Name	Water Body Type	Flow	cfs	Threatened Species			cfs	Wetlands			cfs				cfs				cfs				cfs				cfs				cfs				cfs	Environment Name	Environment Type and Value (SI Tables 13 & 14)	Multiplier (10 for Level I, 1 for Level II)	Product	N/A		X =				X =				X =				X =		Sum =				0	+	Site Visits and Maps
Environment Name	Water Body Type	Flow	cfs																																																												
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Sum =																																																															
<p>10. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS</p> <table border="1"> <thead> <tr> <th>Flow</th> <th>Dilution Wt. (SI Table 12)</th> <th>Environment Type and Value (SI Tables 13 & 14)</th> <th>Pot. Cont.</th> <th>Product</th> </tr> </thead> <tbody> <tr><td>cfs</td><td>x</td><td>50</td><td>0.1 =</td><td>5</td></tr> <tr><td>cfs</td><td>x</td><td>25</td><td></td><td>2.5</td></tr> <tr><td>cfs</td><td>x</td><td></td><td>x</td><td></td></tr> <tr><td>cfs</td><td>x</td><td></td><td>x</td><td></td></tr> <tr><td>cfs</td><td>x</td><td></td><td>x</td><td></td></tr> <tr><td align="right" colspan="4">Sum =</td><td></td></tr> <tr><td align="right" colspan="4">T =</td><td></td></tr> </tbody> </table>	Flow	Dilution Wt. (SI Table 12)	Environment Type and Value (SI Tables 13 & 14)	Pot. Cont.	Product	cfs	x	50	0.1 =	5	cfs	x	25		2.5	cfs	x		x		cfs	x		x		cfs	x		x		Sum =					T =					7.5	+	Site Visits and Maps																				
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T =																																																															
	7.5																																																														

**SURFACE WATER PATHWAY (concluded)
WASTE CHARACTERISTICS, THREAT, AND PATHWAY SCORE SUMMARY**

WASTE CHARACTERISTICS	Score																								
14. If an Actual Contamination Target (drinking water, human food chain, or environmental threat) exists for the watershed, assign the calculated hazardous waste quantity score, or a score of 100, whichever is greater.	10,000																								
15. Assign the highest value from SI Table 7 (observed release) or SI Table 3 (no observed release) for the hazardous substance waste characterization factors below. Multiply each by the surface water hazardous waste quantity score and determine the waste characteristics score for each threat.																									
<table border="1"> <thead> <tr> <th></th> <th>Substance Value</th> <th>HWQ</th> <th>Product</th> </tr> </thead> <tbody> <tr> <td>Drinking Water Threat Toxicity/Persistence</td> <td align="center">10,000</td> <td align="center">10,000</td> <td align="center">1.00E+06</td> </tr> <tr> <td>Food Chain Threat Toxicity/Persistence</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bioaccumulation</td> <td align="center">500,000</td> <td align="center">10,000</td> <td align="center">5.00E+09</td> </tr> <tr> <td>Environmental Threat Ecotoxicity/Persistence/Ec bioaccumulation</td> <td align="center">50,000</td> <td align="center">10,000</td> <td align="center">5.00E+08</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Substance Value	HWQ	Product	Drinking Water Threat Toxicity/Persistence	10,000	10,000	1.00E+06	Food Chain Threat Toxicity/Persistence				Bioaccumulation	500,000	10,000	5.00E+09	Environmental Threat Ecotoxicity/Persistence/Ec bioaccumulation	50,000	10,000	5.00E+08					32
	Substance Value	HWQ	Product																						
Drinking Water Threat Toxicity/Persistence	10,000	10,000	1.00E+06																						
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	180																								
	100																								

SURFACE WATER PATHWAY THREAT SCORES

Threat	Likelihood of Release (LR) Score	Targets (T) Score	Pathway Waste Characteristics (WC) Score	Threat Score $\frac{LR \times T \times WC}{82,500}$
Drinking Water	550	5	32	1.1
Human Food Chain	550	50	180	60
Environmental	550	7.5	100	5

SURFACE WATER PATHWAY SCORE: =
(Sum of Threat Scores)

66.1

SI TABLE 15: SOIL EXPOSURE RESIDENT POPULATION TARGETS

Residence ID: N/A Sample Type _____ Level I _____ Level II _____ References _____ HRS Score Package _____

Sample ID	Hazardous Substances	Conc. (mg/kg)	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD	Toxicity Value	References
Highest Percent					Sum of Percents		Sum of Percents	

Residence ID: _____ Sample Type _____ Level I _____ Level II _____ References _____ HR Score Package _____

Sample ID	Hazardous Substances	Conc. (mg/kg)	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD	Toxicity Value	References
Highest Percent					Sum of Percents		Sum of Percents	

Residence ID: _____ Sample Type _____ Level I _____ Level II _____ References _____ HRS Score Package _____

Sample ID	Hazardous Substances	Conc. (mg/kg)	Cancer Risk Conc.	% of Cancer Risk Conc.	RfD	% of RfD	Toxicity Value	References
Highest Percent					Sum of Percents		Sum of Percents	

**SOIL EXPOSURE PATHWAY WORKSHEET
RESIDENT POPULATION THREAT**

LIKELIHOOD OF EXPOSURE	Score	Data Type	Refs
1. OBSERVED RELEASE: If evidence indicates the presence of observed contamination (depth of 2 feet or less), assign a score of 550; otherwise assign 0. Note that a likelihood of exposure score of 0 results in a soil exposure pathway score.	550	+	Sampling Data
LE =	550		

TARGETS	Score	Data Type	Refs										
2. RESIDENT POPULATION: Determine the number of people occupying residences or attending school or day care on or within 200 feet of areas of observed contamination (HRS section 5.1.3). Level I: <u> 0 </u> people x 10 = <u> 0 </u> . Level II: <u> 0 </u> people x 1 = <u> 0 </u> .	0	+	Frost Assoc.										
3. RESIDENT INDIVIDUAL: Assign a score of 50 if any Level I resident population exists. Assign a score of 45 if there are Level II targets but no Level I targets. If no resident population exists (i.e., no Level I or Level II targets), assign 0 (HRS Section 5.2.3).	0	+	Frost Assoc.										
4. WORKERS: Assign a score from the table below for the total number of workers at the site and nearby facilities with areas of observed contamination associated with the site.	5	+	Site Visit										
<table border="1"> <thead> <tr> <th>Number of Workers</th> <th>Score</th> </tr> </thead> <tbody> <tr> <td align="center">0</td> <td align="center">0</td> </tr> <tr> <td align="center">1 to 100</td> <td align="center">5</td> </tr> <tr> <td align="center">101 to 1,000</td> <td align="center">10</td> </tr> <tr> <td align="center">> 1,000</td> <td align="center">15</td> </tr> </tbody> </table>	Number of Workers	Score	0	0	1 to 100	5	101 to 1,000	10	> 1,000	15			
Number of Workers	Score												
0	0												
1 to 100	5												
101 to 1,000	10												
> 1,000	15												
5. TERRESTRIAL SENSITIVE ENVIRONMENTS: Assign a value for each terrestrial sensitive environment (SI Table 16) in an area of observed contamination.	50	+	Site Visit and Ref. 11										
<table border="1"> <thead> <tr> <th>Terrestrial Sensitive Environment Type</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>State Threatened Species</td> <td align="center">50</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Terrestrial Sensitive Environment Type	Value	State Threatened Species	50									
Terrestrial Sensitive Environment Type	Value												
State Threatened Species	50												
6. RESOURCES: Assign a score of 5 if any one or more of the following resources is present on an area of observed contamination at the site; assign 0 if none applies.	0	E	Site Visit										
T =	55												

**SOIL EXPOSURE PATHWAY WORKSHEET
NEARBY POPULATION THREAT**

LIKELIHOOD OF EXPOSURE	Score	Data Type	Refs
1. Attractiveness/Accessibility (from SI Table 17 or HRS Table 5-6) Value <u>0</u> .			
Area of Contamination (from SI Table 18 or HRS Table 5-6) Value <u>5</u> .	5	+	Site Visit
LE =	5		

TARGETS	Score	Data Type	Refs
8. Assign a score of 0 if Level I or Level II resident individual has been evaluated or if no individuals live within ¼ mile travel distance of an area of observed contamination. Assign a score of 1 if nearby population is within ¼ mile travel distance and no Level I or Level II resident population has been evaluated.	1	+	Frost Assoc.
9. Determine the population within 1 mile travel distance that is not exposed to a hazardous substance from the site (i.e., properties that are not determined to be Level I or Level II); record the population for each distance category in SI Table 20 (HRS Table 5-10). Sum the population values and multiply by 0.1.	5.3	+	Frost Assoc.
T =	6.3		

SOIL EXPOSURE PATHWAY WORKSHEET (CONCLUDED)

WASTE CHARACTERISTICS

10. Assign the hazardous waste quantity score calculated for soil exposure.	10,000																							
11. Assign the highest toxicity value from SI Table 16.	50																							
12. Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:	WC = 18																							
<table border="1"> <thead> <tr> <th>Product</th> <th>WC Score</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>>0 to <10</td><td>1</td></tr> <tr><td>10 to <100</td><td>2</td></tr> <tr><td>100 to <1,000</td><td>3</td></tr> <tr><td>1,000 to <10,000</td><td>6</td></tr> <tr><td>10,000 to <1E+05</td><td>10</td></tr> <tr><td>1E+05 to <1E+06</td><td>18</td></tr> <tr><td>1E+06 to <1E+07</td><td>32</td></tr> <tr><td>1E+07 to <1E+08</td><td>56</td></tr> <tr><td>1E+08 to <1E+09</td><td>100</td></tr> </tbody> </table>		Product	WC Score	0	0	>0 to <10	1	10 to <100	2	100 to <1,000	3	1,000 to <10,000	6	10,000 to <1E+05	10	1E+05 to <1E+06	18	1E+06 to <1E+07	32	1E+07 to <1E+08	56	1E+08 to <1E+09	100	
Product		WC Score																						
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1,000 to <10,000		6																						
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1E+06 to <1E+07	32																							
1E+07 to <1E+08	56																							
1E+08 to <1E+09	100																							

RESIDENT POPULATION THREAT SCORE:

6.6

$$\left(\frac{LExTxWC}{82,500} \right)$$

NEARBY POPULATION THREAT SCORE:

0.007

$$\left(\frac{LExTxWC}{82,500} \right)$$

SOIL EXPOSURE PATHWAY SCORE:

6.61

(Resident + Nearby)

AIR PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to air, assign a score of 550. Record observed release substances on SI Table 21.	0		
2. POTENTIAL TO RELEASE: If sampling data do not support a release to air, assign a score of 500. Optionally, evaluate air migration gaseous and particulate potential to release (HRS Section 6.1.2).	500	+	PA
LR =	500		

TARGETS

	Score	Data Type	Refs
3. ACTUAL CONTAMINATION POPULATION: Determine the number of people within the target distance limit subject to exposure from a release of a hazardous substance to the air. a) Level I: <u> 0 </u> people x 10 = <u> 0 </u> . b) Level II: <u> 0 </u> people x 1 = <u> 0 </u> .	0	+	PA
4. POTENTIAL TARGET POPULATION: Determine the number of people within the target distance limit not subject to exposure from a release of a hazardous substance to the air, and assign the total population score from SI Table 22. Sum the values and multiply the sum by 0.1.	71.8	+	Frost Assoc.
5. NEAREST INDIVIDUAL: Assign a score of 50 if there are any Level I targets. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Population exists, assign the Nearest Individual score from SI Table 22.	20	+	Frost Assoc.
6. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: Sum the sensitive environment values (SI Table 13) and wetland acreage values (SI Table 23) for environments subject to exposure from the release of a hazardous substance to the air.	0	+	Site Visit, Wetland Maps, Species
7. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS: Use SI Table 24 to evaluate sensitive environments not subject to exposure from a release.	1	+	Site Visit, etc.
8. RESOURCES: Assign a score of 5 if one or more air resources apply within ½ mile of a source; assign a 0 if none applies. <ul style="list-style-type: none"> ▪ Commercial agriculture ▪ Commercial silviculture ▪ Major or designated recreation area 	5	E	Recreational Area
T =	97.8		

AIR PATHWAY (CONCLUDED)

WASTE CHARACTERISTICS

9. If any Actual Contamination Targets exist for the air pathway, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if there are no Actual Contamination Targets for the air pathway, assign the calculated HWQ score for sources available for migration.	10,000																						
10. Assign the highest air toxicity/mobility value from SI Table 21.	0																						
11. Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:	WC = 0																						
<table border="1"> <thead> <tr> <th>Product</th> <th>WC Score</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>>0 to <10</td><td>1</td></tr> <tr><td>10 to <100</td><td>2</td></tr> <tr><td>100 to <1,000</td><td>3</td></tr> <tr><td>1,000 to <10,000</td><td>6</td></tr> <tr><td>10,000 to <1E+05</td><td>10</td></tr> <tr><td>1E+05 to <1E+06</td><td>18</td></tr> <tr><td>1E+06 to <1E+07</td><td>32</td></tr> <tr><td>1E+07 to <1E+08</td><td>56</td></tr> <tr><td>1E+08 to <1E+09</td><td>100</td></tr> </tbody> </table>		Product	WC Score	0	0	>0 to <10	1	10 to <100	2	100 to <1,000	3	1,000 to <10,000	6	10,000 to <1E+05	10	1E+05 to <1E+06	18	1E+06 to <1E+07	32	1E+07 to <1E+08	56	1E+08 to <1E+09	100
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AIR PATHWAY SCORE:

0

$$\left(\frac{LExTxWC}{82,500} \right)$$

SITE SCORE CALCULATION

	S	S²
GROUND WATER PATHWAY SCORE (S_{GW})	100	10,000
SURFACE WATER PATHWAY SCORE (S_{SW})	66.1	4,369.2
SOIL EXPOSURE (S_S)	6.61	43.69
AIR PATHWAY SCORE (S_A)	0	0
SITE SCORE: $((S_{GW}^2 + S_{SW}^2 + S_S^2 + S_A^2)/4)^{1/2}$		60.0

COMMENTS:

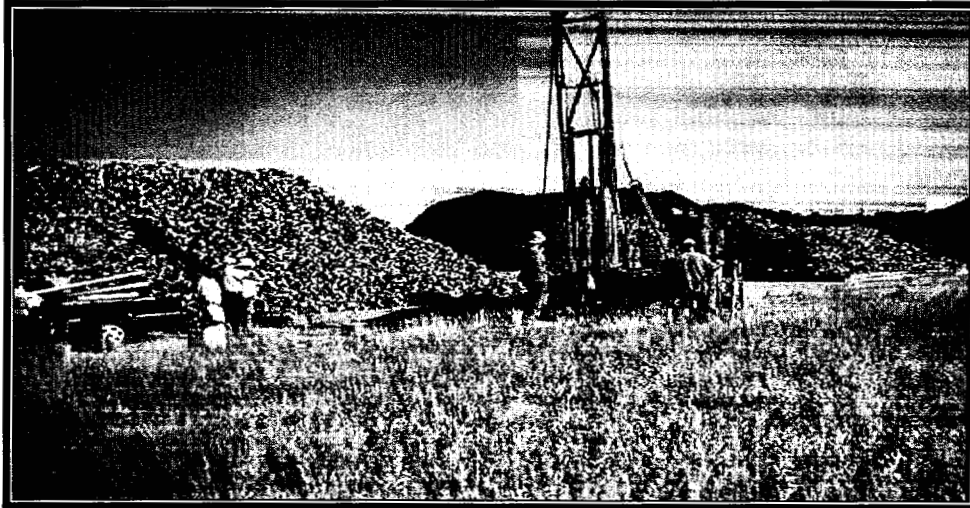
The SI score of 60.0 exceeds the EPA standard of 28.5 suggesting the need for further investigation. As described in SI Section 4.3, additional sampling and investigation is recommended for the soil, surface water, and groundwater pathways.

APPENDIX D

PHOTO DOCUMENTATION LOG

Photo Number: 13
Facing: Northwest

Date: 7/28/99



Description: Stockpile Area #1. Drill Rig at CB-GW-01.

Photo Number: 26
Facing: Southeast

Date: 7/26/99



Description: Stockpile Area #1. Soil sample - CB-SS-01.

Photo Number: 27
Facing: Northwest

Date: 7/26/99



Description: Stockpile Area #1. Soil sample - CB-SS-01-06".

Photo Number: 25
Facing: Northwest

Date: 7/26/99



Description: Stockpile Area #1. Sediment sample - CB-SED-01.

Photo Number: 22
Facing: Southwest

Date: 7/26/99



Description: Stockpile Area #2. Soil sample CB-SS-02.

Photo Number: 20
Facing: Northeast

Date: 7/26/99



Description: Stockpile Area #2. Sediment sample - CB-SED-02.

Photo Number: 21
Facing: Southeast

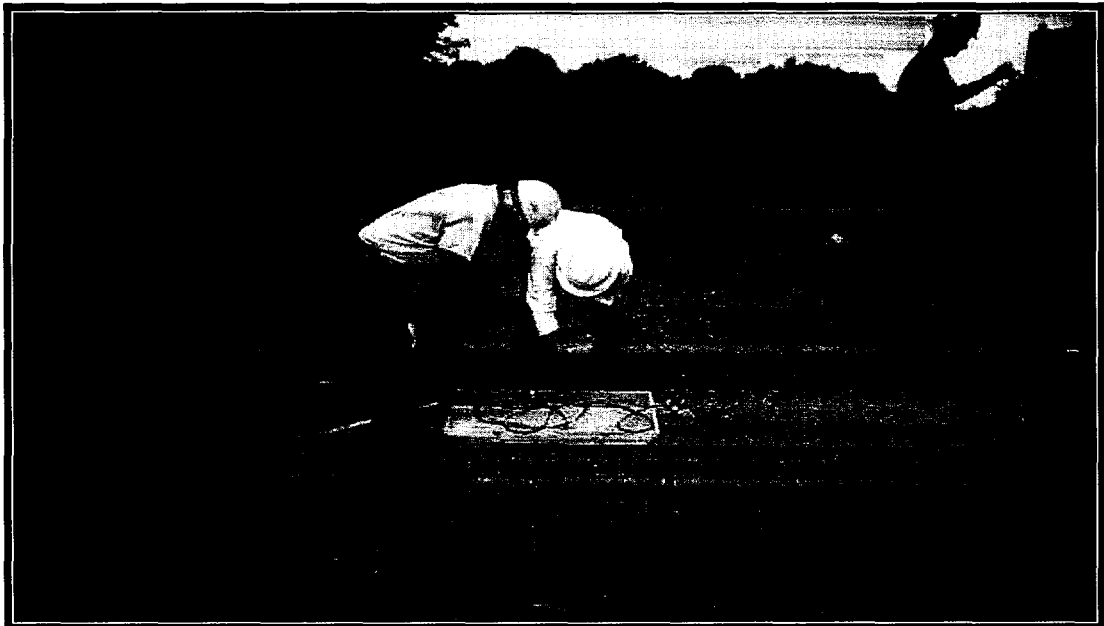
Date: 7/26/99



Description: Stockpile Area #2. Small arms ammo casing found along roadside near Stockpile #2.

Photo Number: 18
Facing: East

Date: 7/27/99



Description: Medical Supplies Waste Area. HFA with Mark 26 Forester Magnetometer near Drill Rig.

Photo Number: 17
Facing: Northwest

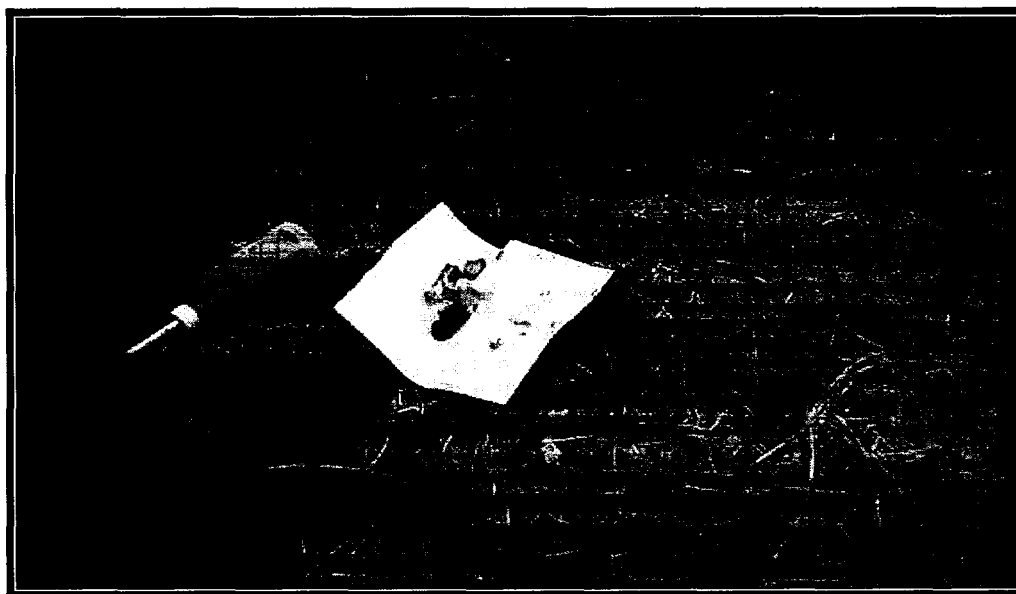
Date: 7/26/99



Description: Medical Supplies Waste Area. HFA operating Mark 26 Forester Magnetometer.

Photo Number: 15
Facing: East

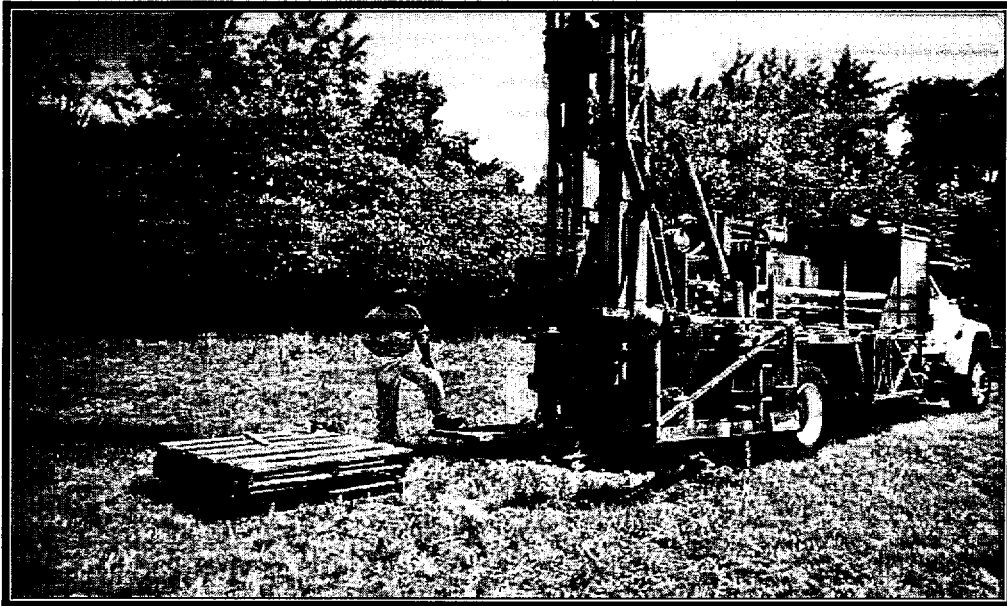
Date: 7/27/99



Description: Medical Supplies Waste Area. Various glass (labeled dextrose) and rubber seals and plugs found during the drilling of CB-GW-03.

Photo Number: 12
Facing: North

Date: 7/28/99



Description: Radioactive Waste Burial Pit. Drill Rig drilling CB-GW-04.