REMEDIAL INVESTIGATION ADDENDUM REPORT NWS EARLE NJ
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BROWN & ROOT ENVIRONMENTAL

REMEDIAL INVESTIGATION ADDENDUM REPORT

for

NAVAL WEAPONS STATION EARLE

Colts Neck, New Jersey

DEPARTMENT OF THE NAVY
UNITED STATES OF AMERICA

Northern Division
Naval Facilities Engineering Command
Contract No. N62472-90-D-1298
Contract Task Order 0231

January 1998

BROWN & ROOT ENVIRONMENTAL

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REMEDIAL INVESTIGATION ADDENDUM REPORT FOR

NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION - NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 18
Naval Facilities Engineering Command
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Lester, Pennsylvania 19223

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

Brown & Root (B&R) Environmental, a division of Halliburton NUS Corporation, under the Comprehensive Long-Term Environmental Action - Navy (CLEAN) Program, Contract Number N62472-90-D-1298, was assigned to perform the field investigation activities presented in the Remedial Investigation (RI) Addendum Work Plan for Naval Weapons Station Earle, October 1996 (RI Addendum work plan), and to prepare a comprehensive report documenting the remedial investigation of seven sites at Naval Weapons Station (NWS) Earle under Contract Task Order Number 231. This work provides additional information to support the July 1996 RI performed by B&R Environmental at 27 sites at NWS Earle. The work was performed as part of the Navy's Installation Restoration Program (IRP), a program designed to identify environmental concerns at Navy and Marine Corps facilities and to implement corrective measures if necessary.

IRP activities are typically performed in four distinct phases: 1) a preliminary assessment (PA), 2) a site investigation (SI), 3) an RI intended to characterize the physical and chemical (contaminant) parameters of the site and the associated risks to human health and the environment, and 4) a remedial action (RA) designed to control and mitigate contaminated media at the site.

The 27 sites investigated under the July 1996 RI were initially identified in either the Initial Assessment Study (IAS) of February 1983 or the Environmental Investigation Photographic Center (EPIC) studies of November 1991 and January 1992. Twenty-five of the 27 sites were investigated previously under PA or SI work. After review of the RI, it was determined that additional data were required for seven of the 27 sites (Sites 3, 6, 12, 13, 16/F, 17, and 26). This RI Addendum addresses the data collection effort for those seven sites.

The February 1983 IAS was a document prepared for the Navy that identified 29 areas of concern based on employee interviews, record searches, and site tours. Three of these 29 areas were eliminated from consideration under the IRP because they were active operations regulated under the Resource Conservation and Recovery Act (RCRA). One additional area, Site 8, was investigated on an accelerated schedule to enable timely reuse. EPA concurrence on no further investigation of this site was received in October 1994.

The EPIC studies were an analysis of historical aerial photographs performed for the United States Environmental Protection Agency (EPA) by the Environmental Photographic Interpretation Center. These studies identified 17 additional sites where there was evidence of some environmental disturbance. After an initial screening of these sites in 1992, the Navy, EPA, and New Jersey Department of Environmental Protection (NJDEP) agreed to further investigation at three sites, Sites F, L, and Q. Since Site F overlapped the existing Site 16, it was agreed that Site 16 would be expanded to include it.

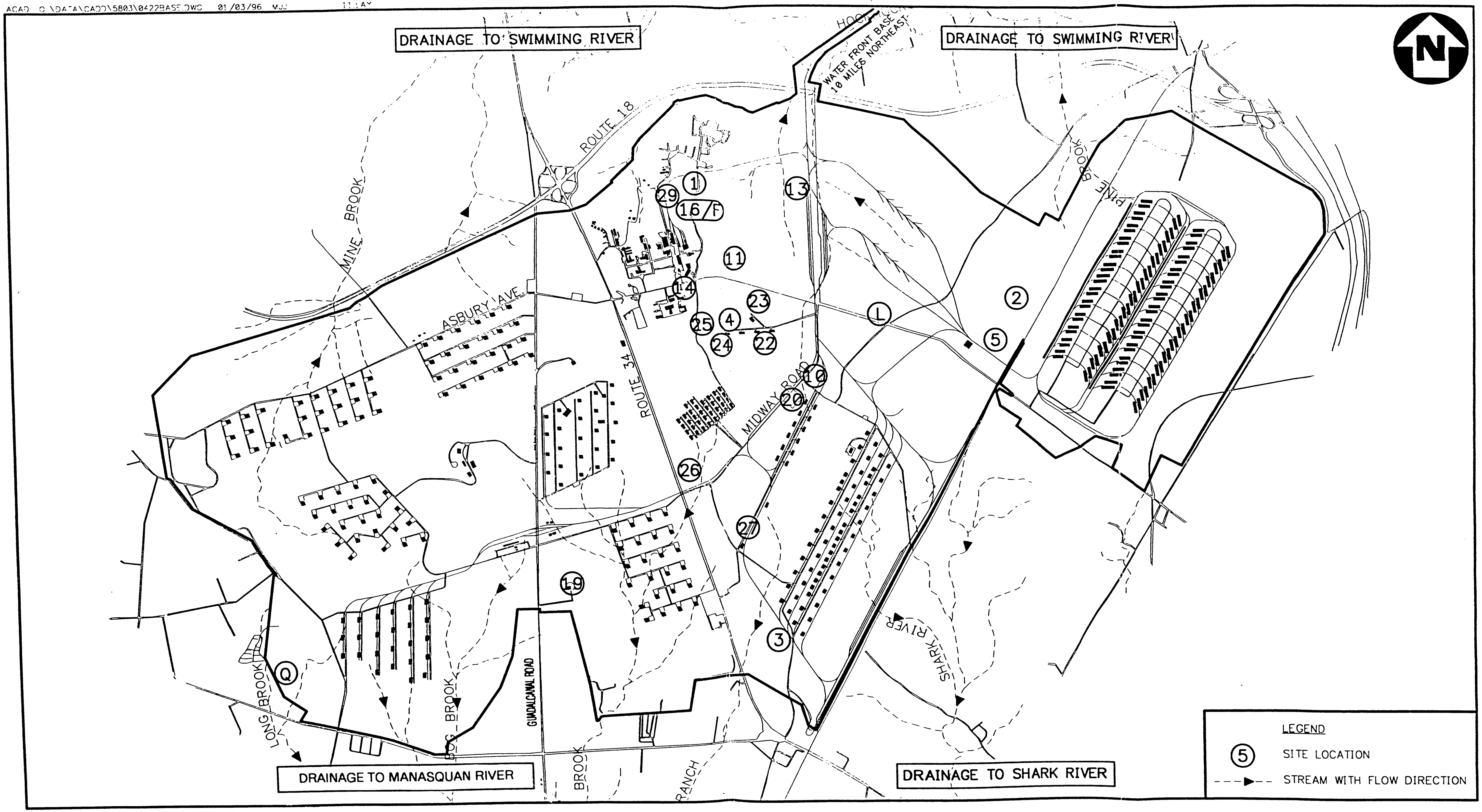
1.2 FACILITY LOCATION

NWS Earle is an 11,134-acre facility located in Monmouth County in east-central New Jersey. It includes a Mainside area, which is approximately 10 miles inland from the Atlantic Ocean at Sandy Hook Bay, and a Waterfront area, which includes an ammunition depot and associated piers. The Mainside and Waterfront areas are linked by a narrow tract of land that serves as a right-of-way for a government road and railroad. Figures 1-1 and 1-2 show the Mainside and Waterfront areas, respectively. The main entrance to NWS Earle is located off State Route 34, and the entrance to the Waterfront area is located adjacent to State Route 36.

1.3 FACILITY MISSION

NWS Earle was commissioned as a Naval Ammunition Depot on December 13, 1943, with the primary responsibility of furnishing ammunition to the Naval fleet. The station's Ordnance Department coordinates all port services and logistic support for home-ported and visiting ships, conducts safety inspections, supervises ammunition loading for the United States Coast Guard, and provides afloat firefighting capability and standby tug services. Other major active divisions include the Ammunition Distribution and Control Division, responsible for ensuring that a balanced, purified stock of ammunition is maintained in support of Navy, Coast Guard, and Marine Corps programs; the Operations Division, which performs ammunition movement, ship loading, demilitarization of obsolete ammunition, and reclaiming/renovation of various munitions; the Anti-Submarine Warfare (ASW) and Special Weapons Division, which plans and carries out station-level maintenance of air and antisubmarine weapons and provides shore-based support to various commanders; and the Port Services Division, responsible for operating the station fireboat, service craft, and oil pollution containment equipment.

ACAD O:\DATA\CADD\5803\0422BASE.DWG 01/03/96 MJJ



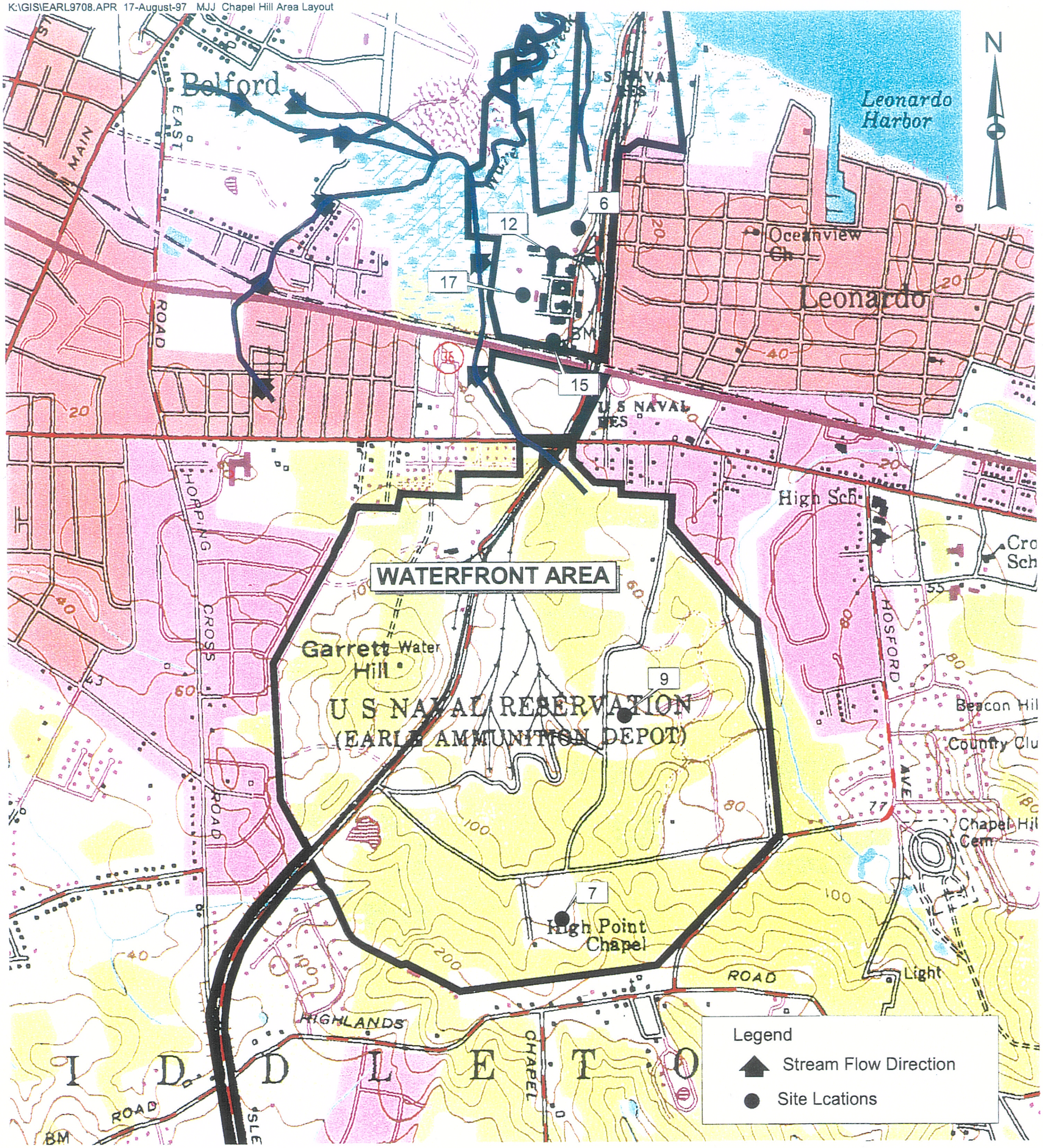
0 3000 6000
SCALE IN FEET

FIGURE 1-1

SITE LOCATIONS AND SURFACE DRAINAGE MAP
NWS EARLE, COLTS NECK, NEW JERSEY

Brown & Root Environmental

K:\GIS\EARL9708.APR 17-August-97 MJJ Chapel Hill Area Layout



WATER FRONT SITE LOCATIONS

1500 0 1500 3000 Feet

FIGURE 1-2

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Over 90 percent of the acreage at NWS Earle is dedicated to the facility's primary mission of storage and delivery of ordnance. The actual amount of land used for storage and distribution facilities is much less than this, but Explosive Safety Quantity Distance (ESQD) arcs are established around each facility. Any development within these arcs is extremely restricted by safety requirements. The formal disestablishment or reclassification of a facility is required before any development can occur within an ESQD arc.

Two areas of NWS Earle, the Mainside Administration and Housing area and the Waterfront Administrative area, are not encumbered by ESQD arcs. These areas are used for offices, base support, housing, and recreational facilities. Any future development would be expected to occur in one of these areas unless the development had an ordnance-specific use. Sites 1, 14, 16, and 29 are within the Mainside Administration and Housing area. Sites 6, 12, 15, and 17 are within the Waterfront Administration area.

Future land use is not expected to vary significantly from current land use unless a major base realignment were to occur. If this were to happen, an Environmental Baseline Survey would be conducted to evaluate the impact of any proposed land-use change.

1.4 PREVIOUS INVESTIGATIONS

Site investigation activities related to areas of potential environmental concern at NWS Earle have been undertaken by the Navy since approximately 1982. Early work included an IAS conducted by Fred C. Hart and Associates; the results are included in a report prepared in 1982. Studies and field investigation efforts continued under the IRP by Roy F. Weston, Incorporated. Several documents prepared by Weston were submitted to the Navy, NJDEP, and EPA. These documents include the Draft Report for Naval Weapons Station Earle, Colts Neck, New Jersey, Installation Restoration Program Phase II Confirmation Study, dated September 1986; the Draft Report of Current Situation and Draft Plan of Action, dated December 1988; a Draft Phase II Site Inspection Study for Naval Weapons Station Earle, Colts Neck, New Jersey, dated February 1993; and a final version of the SI report, dated December 1993. An IRP Phase II Site Inspection Work Plan was also submitted by Weston in September 1991. In addition, Weston submitted the Installation Restoration Program Remedial Investigations/Feasibility Study for 11 Sites at NWS Earle, Colts Neck, New Jersey, Volumes 1 to 3.

In 1995, B&R Environmental submitted an RI work plan and conducted RI field activities for 27 sites. The final RI report, submitted in July 1996, identified data gaps and areas for further investigation at seven of the 27 sites. The work plan for this RI Addendum, prepared by B&R Environmental, considered the results of the previous investigations, particularly the 1996 RI report, as the basis for most of the 1996 RI

Addendum field tasks. This RI Addendum document presents the results of the field tasks, the data evaluation, the human health risk assessment, and the ecological risk evaluation for the seven sites.

1.5 SURVEY INFORMATION

Over the years, the Navy has employed various survey subcontractors to perform site survey work. Appendix F of the 1996 B&R Environmental RI report contains survey data and a reconciliation of the varying benchmarks used historically.

2.0 INVESTIGATION SUMMARY

This section presents an overview of remedial investigation (RI) activities conducted at the seven sites covered in the Remedial Investigation Addendum Work Plan (October 1996) prepared for this project by B&R Environmental. The procedures used in this RI, including the data quality objective (DQO) standards that were followed and the standard operating procedure (SOP) guidelines that were adhered to [e.g., United States Environmental Protection Agency (EPA) Region I Groundwater Sampling Procedures, Low-Flow Purge and Sample (Draft Final), New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual (May 1992), and B&R Environmental SOP GH-1.3] are discussed and presented in the Remedial Investigation Work Plan for Naval Weapons Station Earle, Colts Neck, New Jersey (June 1995), Volumes I and II, and in the Remedial Investigation Addendum Work Plan for Naval Weapons Station Earle, Colts Neck, New Jersey (October 1996). Details of the field investigation tasks performed at each site are discussed in Sections 4.0 through 11.0.

2.1 SUMMARY OF ACTIVITIES

Between October 2, 1996 and January 3, 1997, field activities were conducted at seven RI sites as described below:

- Sampling and analysis of groundwater collected from eight locations (two or three depths per location) at Site 13 using Hydropunch or direct-push sampling equipment; from six locations (one depth per location) at Site 16/F; and from 28 locations (two or three depths per location) at Site 26 using direct-push sampling equipment (Section 2.1.1.1). The samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) using a Tracer Research Corporation (TRC) mobile laboratory. Select samples were submitted to IEA, a fixed-base laboratory, for TCL VOCs and semivolatile compounds (SVOCs) analyses.

- Lithologic profiling at 31 locations at Site 16/F and eight locations at Site 26 using Piezo-Electric Cone Penetration Tests (CPT) (Section 2.1.1.2). Fuel Fluorescence Detector (FFD) Tests were run in conjunction with CPT at Site 16/F.

- Drilling and installation of one permanent monitoring well at Site 13 and four permanent monitoring wells at Site 16/F (Section 2.1.1.3).

- Measurement of static water levels in the newly installed and existing monitoring wells at Site 16/F (Section 2.1.1.4).

- Sampling and analysis of groundwater from the newly installed well at Site 13 and the newly installed wells at Site 16/F. Samples from Site 13 were submitted to IEA for TCL VOCs analysis. Samples from Site 16/F were submitted to IEA for TCL VOCs and SVOCs analyses.

- Sampling and analysis of surface soils at Sites 3 and 12 (Section 2.1.2). Samples from Site 3 were submitted to IEA for TAL metals, TCL SVOCs, and TCL pesticide/PCB analysis. The sample from Site 12 was submitted to IEA for TAL metals.

- Sampling and analysis of subsurface soils at Site 12 (Section 2.1.3). Samples from Site 12 were submitted to IEA for TAL metals.

- Sampling and analysis of surface water from the marsh area adjacent to Sites 6 and 17 and at background locations (Section 2.1.4). Samples from these sites were submitted to IEA for TAL metals, TCL SVOCs, and TCL pesticide/PCB analysis.

- Sampling and analysis of sediments from the marsh area adjacent to Sites 3, 6, and 17 and at background locations (Section 2.1.5). Samples from these sites were submitted to IEA for TAL metals, TCL SVOCs, and TCL pesticide/PCB analysis.

- Sampling and analysis of railroad bed ballast material to provide background samples for Site 12 (Section 2.1.6). Samples from these locations were submitted to IEA for Synthetic Precipitation Leachate Procedure analysis.

- Surveying of the horizontal locations and vertical elevations of newly installed monitoring wells, hydropunch, CPT, and direct-push locations, and all surface soil, soil boring, surface water, and sediment sampling locations (Section 2.1.7).

- Sampling and handling of investigation-derived waste (IDW) (Section 2.1.8).

2.1.1 <u>Subsurface Investigations</u>

2.1.1.1 Hydropunch and Direct-Push Groundwater Sampling

Groundwater samples were collected at three locations (13HP-01 through 13HP-03) at Site 13 between October 21 and October 24, 1996 using Hydropunch equipment and at five locations (13HP-04 through 13HP-08) at Site 13 between December 2 and December 4, 1996 using direct-push sampling equipment to determine the extent of VOC contamination in groundwater. The collection of direct-push groundwater samples from four locations at Site 13 not covered in the Addendum Work Plan was at the request of EPA and with the concurrence of the Navy. In general, groundwater samples were collected from depths of 15, 30, and 45 feet below grade at these locations. Twenty-two groundwater samples, including two field duplicate samples, were collected from these locations and analyzed for TCL VOC using TRC's mobile laboratory. To confirm mobile laboratory analytical results, 10 of the samples, including the two field duplicate samples, were also analyzed for TCL VOCs by IEA, a fixed-base laboratory. Hydropunch and direct-push groundwater sampling activities conducted at Site 13 are summarized in Table 2-1.

Groundwater samples were collected at five locations (16HP-01 through 16HP-05) at Site 16/F between October 9 and October 15, 1996 using direct-push sampling equipment. The collection of these samples was added during field activities at the request of EPA and with the concurrence of the Navy. In general, groundwater samples were collected from about 13 feet below grade. Seven groundwater samples, including one field duplicate sample, were collected and analyzed for TCL VOCs using TRC's mobile laboratory. To confirm mobile laboratory analytical results, two of the samples, including the field duplicate sample, were also analyzed for TCL VOCs by IEA.

Groundwater samples were collected at 28 locations (26HP-01 through 26HP-28) at Site 26 between October 16 and October 25, 1996 using direct-push sampling equipment. The collection of groundwater samples from eight locations at Site 26 not covered in the Addendum Work Plan was at the request of the Navy. In general, samples were collected from two depths at each location. Sixty-four groundwater samples, including one field duplicate sample, were collected and analyzed for TCL VOCs using TRC's mobile laboratory. To confirm mobile laboratory results, 14 of the samples, including the field duplicate sample, were also analyzed for TCL VOCs by IEA.

TABLE 2-1

HYDROPUNCH AND DIRECT-PUSH GROUNDWATER SAMPLING SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Site	Number of Sample Locations	Number of Environmental Groundwater Samples(1)	Analytical Parameters
13	8	22	TCL VOC
16	5	7	TCL VOC
26	28	64	TCL VOC

(1) Includes field duplicates.

Hydropunch Groundwater Sampling

A borehole was drilled with a high-torque, truck-mounted, hollow-stem-auger drilling rig using 4.25-inch inner diameter (I.D.) augers to 2 feet above the zone to be sampled. The hydropunch tool, set in the hydrocarbon sampling mode, was then lowered into the borehole and driven approximately 2 feet below the bottom of the borehole. The hydropunch was pulled back 2 feet so that the screen was exposed permitting groundwater to enter the hydropunch. A 1-inch-diameter bailer was lowered through the rods and into the hydropunch vessel. In accordance with the Addendum Work Plan, the boreholes were not purged prior to sampling with the bailer. After sampling, the hydropunch and augers were withdrawn and those boreholes that were deeper than 25 feet were sealed by pumping a bentonite slurry into the void space. Boreholes less than 25 feet deep were allowed to collapse. Drill cuttings were spread on the ground surface at the site.

Direct-Push Groundwater Sampling

In general, the probe hole was deepened to below the zone to be sampled, the probe rods were withdrawn, and slotted polyvinyl chloride (PVC) tubing was inserted in the probe hole. The groundwater samples were collected, and the slotted PVC tubing was allowed to recharge overnight before the groundwater sample was collected. After sampling, the PVC tubing was withdrawn and the probe hole was allowed to collapse.

2.1.1.2 Piezo-Electric Cone Penetration and Fuel Fluorescence Detector Tests

Lithologic profiling was performed by Applied Research Associates, Incorporated (ARA), under subcontract to B&R Environmental, using CPT at 31 locations (16CPT-01 through 16CPT-31) at Site 16/F and eight locations (26CST-00, 26CS-01, 26CS-02, 26HP-05, 26HP-08, 26HP-10, 26CS-50, and 26CS-51) at Site 26 between October 9 and 25, 1996. The FFD was included in the tests performed at Site 16/F. ARA's report summarizing CPT and FFD tests is included in Appendix E.

Piezo-Electric Cone Penetration Tests

The penetrometer equipment was mounted inside a van body. The penetrometer probe had a conical tip and a friction sleeve that independently measured the vertical resistance beneath the tip as well as frictional resistance on the side of the probe as a function of depth. A pressure transducer in the cone measured the pore water pressure as the probe was pushed into the ground. Plots of the normalized tip resistance versus friction ratio and normalized tip resistance versus penetration pore pressure were used to determine soil classification as a function of depth. Typically, a higher friction ratio indicates a type of clay or fine silts.

Fuel Fluorescence Detector Tests

The FFD is a separate module that was attached directly behind the cone to detect subsurface hydrocarbon contamination. The excitation light from a 254 nm ultraviolet light source is focused on the groundwater at the surface of the probe through a sapphire window, and the resulting fluorescence is returned through a fiber optic conductor to the up-hole controller.

2.1.1.3 Permanent Groundwater Monitoring Well Installation

One permanent monitoring well (MW13-06) was installed at Site 13 on December 6, 1995 and four permanent monitoring wells (MW16-07 through MW16-10) were installed at Site 16/F on October 17 and 18, 1996. The monitoring well at Site 13 was installed at the request of EPA.

The wells were installed to further characterize groundwater contamination at the sites. The locations of the wells were based upon the results of groundwater sampling program.

The borings were drilled using hollow-stem-auger drilling techniques and 4.25-inch I.D. augers. An ATV-mounted drill rig was used at Site 13 and a Mobile Drill Model B57 drill rig was used at Site 16/F. Subsurface soil samples were collected continuously from the ground surface to the water table at Site 13 by driving a 2-inch outer diameter (O.D.) split-barrel sampler using a 140-pound hammer falling a distance of 30 inches. No split-spoon samples were collected during drilling at Site 16/F. The borings were drilled to approximately 8 feet below the water table and completed as cased wells, screened across the water table. The monitoring wells were constructed with National Sanitation Foundation (NSF)-certified, 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 0.01-inch slotted well screens. The annular space between the well screen and the borehole was packed with Morie No. 00 sand to a height of approximately 2 feet above the top of the screen. A 2- to 3-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot below the ground surface. The wells were completed with 2- to 2.5-foot-high stickup riser pipe.

The wells at Sites 13 and 16/F were developed approximately 1 week after installation using a 2-inch submersible pump. Groundwater temperature, conductivity, pH, and turbidity were monitored and recorded during development and all wells were developed until water turbidity was clear. The well development water was discharged directly to the ground to percolate back into the local soil in such a manner as to avoid incidental discharge to surface water bodies.

2.1.1.4 Static-Water-Level Measurements and Groundwater Sampling

Static-Water-Level Measurements

Groundwater elevations were recorded from the four newly installed (MW16-07 through MW16-10) and five (MW-1, MW16-01 though MW16-03, and MW16-06) of the seven existing monitoring wells at Site 16/F to help define local and regional groundwater flow directions. Static-water levels were measured using an electronic water-level indicator (m-scope) and were recorded to the nearest 0.01 foot.

Groundwater Sampling

One groundwater sample and an associated quality assurance/quality control (QA/QC) sample were collected on January 3, 1997 from the newly installed well (MW13-06) at Site 13 and analyzed for TCL VOCs by IEA. Five groundwater samples, including one field duplicate, and associated QA/QC samples were collected on November 7, 1996 from the newly installed wells (MW16-07 through MW16-10) at Site 16/F and analyzed for TCL VOCs and SVOCs by IEA. Groundwater samples collected at Site 13 and Site 16/F are summarized in Table 2-2.

Low-flow bladder pumps, installed in the new wells at Site 16/F, were used during purging and sampling. A low-flow bladder pump was installed in MW13-06 at Site 13 in December 1997. The sampling protocol followed was based on EPA Region I guidelines of August 10, 1994. The low-flow purge and sample technique used allowed for the collection of lower turbidity samples. Field measurements of pH, water level, pump rate (L/min), conductivity, turbidity, dissolved oxygen, temperature, and salinity were recorded during purging. The wells were purged until the field parameters stabilized. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sampling process. The purge water was discharged to the ground surface and allowed to percolate back into the local soil in such a way as to avoid incidental discharge to surface water bodies. Groundwater sample logs are provided in Appendix C.

2.1.2 Surface Soil Investigation

At Site 3, two surface soil samples (03 SS 01 and 03 SS 02) were collected by steel trowel and then placed directly into the sample container. These samples were collected at depths of 3 to 7 inches. 03 SS 01 was collected from the eastern perimeter of the landfill and 03 SS 02 was obtained from the southeastern face of the site. Samples were submitted to IEA Laboratories for TAL metals, TCL

TABLE 2-2

GROUNDWATER SAMPLING SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Site	Number of Sample Locations	Number of Environmental Groundwater Samples(1)	Analytical Parameters
13	1	5	TCL VOC
16	4	6	TCL VOCs, TCL SVOCs

(1) Includes field duplicates.

semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture analysis. B&R Environmental recorded pH, temperature, and conductivity in the field.

One surface soil sample (12 SS 04) was collected at Site 12 near the northeastern corner of the loading dock. B&R Environmental collected this sample with a stainless-steel trowel and transferred the soil directly into the sampling container. Samples were submitted to IEA Laboratories and analyzed for TAL metals and TOC.

A summary of the surface soil samples collected during the RI Addendum field investigation is presented in Table 2-3.

2.1.3 Suburface Soil Sampling Investigation

Three subsurface soil samples (12 SB 02 through 12 SB 04) were collected at Site 12. These samples were obtained at corresponding surface soil sample locations 12 SS 02 and 12 SS 03 from the 1995 RI sampling and from 12 SS 04. Samples were collected by advancing a hand auger, supplemented with a rock bar to remove larger materials, to the desired sampling depth of 3 to 3.5 feet. The sample was removed from the auger bucket by stainless-steel trowel and transferred directly into the sample container. Samples were submitted to IEA Laboratories for TAL metals and TOC analysis. A summary of the subsurface soil samples collected during the RI Addendum field investigation is presented in Table 2-4.

2.1.4 Surface Water Sampling Investigation

The RI Addendum work plan proposed the collection of six surface water samples from the marsh area adjacent to the northeastern side of the landfill. Due to low-flow conditions at three of the locations, only three surface water samples (06 SW 05 through 06 SW 07) were collected. Samples were submitted for hardness, biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total dissolved solids (TDS). B&R Environmental collected the samples by placing the sample container directly into the water. Field measurements obtained included pH, specific conductivity, salinity, and flow data (depth and width). As specified in the RI Addendum work plan, six sample locations in the wetlands area northeast of the site were selected for sampling surface water and associated sediment. Three locations either had no surface water flow or minimal flow inadequate to obtain aqueous samples; therefore, only three surface water samples (17 SW 05 through 17 SW 07) were collected. Samples were obtained from a ponded area that discharges in a westward direction to the creek (17 SW 07) and from the creek itself (17 SW 05 and 17 SW 06). Samples were collected by placing the sample container directly into the surface water. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/polychlorinated biphenyls (PCBs), TSS, alkalinity, hardness, BOD, COD, and TDS analysis.

Table 2-3
Surface Soil Sampling Summary
NWS Earle
Colts Neck, New Jersey

Site	Number of Surface Soil Sample Locations	Number of Environmental Surface Soil Samples[1]	Analytical Parameters
3	2	3	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture analysis.
12	1	1	TAL metals and TOC.

[1] Includes field duplicates

Table 2-4
Subsurface Soil Sampling Summary
NWS Earle
Colts Neck, New Jersey

Site	Number of Subsurface Soil Sample Locations	Number of Environmental Subsurface Soil Samples(1)	Analytical Parameters
12	3	3	TAL metals and TOC.

(1) Includes field duplicates

B&R Environmental also analyzed for temperature, turbidity, specific conductivity, pH, salinity, and dissolved oxygen in the field.

A summary of the surface water samples collected during the RI Addendum field investigation is presented in Table 2-5.

2.1.5 Sediment Sampling Investigation

Samples 03 SD 02 through 03 SS 04 were collected by steel trowel and then placed directly into the sample container. These samples were collected at depths of 2 to 5 inches. These samples were collected from upstream, midstream, and downstream points along the drainage ditch in the wetlands adjacent to the southeastern portion of the site. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture analysis. B&R Environmental recorded pH, temperature, and conductivity in the field.

The six sediment samples (06 SD 05 through 06 SD 10) proposed in the work plan were collected at Site 6 from the wetlands adjacent to the northeastern side of the landfill. Samples were collected by steel trowel and transferred directly into the sample container. Samples were obtained from beneath the organic material layer at depths of 10 to 18 inches. Samples were submitted to IEA Laboratories and analyzed for TAL metals, TCL pesticides/PCBs, TOC, grain size, and percent moisture. Field measurements included pH, conductivity, and temperature.

Six sediment samples (17 SD 05 through 17 SD 10) were collected various locations in the marsh northeast of the landfill. Samples 17 SD 05 through 17 SD 07 correspond to the surface water locations described in Section 9.3.2. Samples 17 SD 08 and 17 SD 09 were collected from drainage pathways leading to the creek, and 17 SD 10 was collected from the creek. All samples were obtained at depths from approximately 2 to 6 inches by stainless-steel trowel and transferred into the sample container. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture. B&R Environmental also recorded pH, conductivity, and moisture in the field.

Three sediment samples (BGSD05-OCT.96, BGSD06-OCT.96, and BGSD07) were obtained from Ware Creek marsh to provide additional background samples. Samples were analyzed by IEA Laboratories for TAL metals, TCL SVOCs, and TCL pesticides/PCBs. Laboratory parameters for sediment samples included TOC, grain size, and percent moisture. Field parameters for sediment samples included Eh, pH, conductivity, and color.

Table 2-5

Surface Water Sampling Summary
NWS Earle
Colts Neck, New Jersey

Site	Number of Surface Water Sample Locations	Number of Environmental Surface Water Samples[1]	Analytical Parameters
6	3	3	TAL metals, TCL pesticides/PCBs, suspended solids, alkalinity, hardness, BOD, COD, and TDS.
17	3	3	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TSS, alkalinity, hardness, BOD, COD, and TDS.
Background	3	4	TAL metals, TCL SVOCs and TCL pesticides/PCBs, TOC, grain size, and percent moisture.

[1] Includes field duplicates

A summary of the sediment samples collected during the RI Addendum field investigation is presented in Table 2-6.

2.1.6 Railroad Ballast Sampling Investigation

Two samples of railroad bed ballast materials (WF-RRB02 was collected at the Waterfront area near the Route 36 underpass, and 19-RRB01 was collected from the barricade at Site 19) were collected from locations outside potential impacts from the NWS Earle sites. Samples were composites of three locations each. Sample analysis by IEA was for Synthetic Precipitation Leachate Procedure to evaluate the leachability of the ballast material. A summary of the ballast samples collected during the RI Addendum field investigation is presented in Table 2-7.

2.1.7 Surveying

Surveying was conducted to establish the horizontal locations and vertical elevations of hydropunch, direct-push, and CPT locations, newly installed monitoring wells, surface soil and associated subsurface soil sample locations, and surface water and sediment locations. All work was performed by a New Jersey licensed surveyor. Horizontal locations were surveyed to the nearest 0.1 foot and vertical elevations were surveyed to the nearest 0.01 foot. Surveying for the new monitoring wells included the elevation of the ground surface adjacent to the well, the top of the PVC riser pipe, and the top of the steel protective casing. Surveying notes are attached in Appendix B.

2.1.8 Waste Handling

Investigation-derived waste (IDW) generated during the field investigation included personal protection equipment (PPE), decontamination fluids, drill cuttings, monitoring well purge water from development and sampling, and soils impacted by a hydraulic leak from the CPT rig.

PPE

Spent PPE was placed in a bag and removed off site for proper disposal.

Decontamination Fluids

Decontamination fluids were collected and placed in steel, 55-gallon drums and held in temporary storage. A total of 10 drums were generated. Samples were obtained; upon verification that the wastes were nonhazardous, the contents were moved to the on-site treatment plant operated by Foster-Wheeler and disposed. Appendix H contains the analytical results of the drummed decontamination fluids that were disposed.

Table 2-6

Sediment Sampling Summary
NWS Earle
Colts Neck, New Jersey

Site	Number of Sediment Sample Locations	Number of Environmental Sediment Samples[1]	Analytical Parameters
3	3	3	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture
6	6	6	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture
17	6	6	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture
Background	3	4	TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture

(1) Includes field duplicates

Table 2-7
Railroad Ballast Sampling Summary
NWS Earle
Colts Neck, New Jersey

Site	Number of Railroad Ballast Sample Locations	Number of Environmental Railroad Ballast Samples	Analytical Parameters
12	1	1⁽¹⁾	Synthetic Precipitation Leachate Procedure
19	1	1	Synthetic Precipitation Leachate Procedure

(1) Each sample was a composite of three locations within the same segment of railroad track.

Drill Cuttings

Drill cuttings from MW13-09 were screened with a HNU; no readings were obtained, and cuttings were spread on the ground near the borehole. Cuttings from Site 16 were containerized in Department of Transportation (DOT)-approved, steel 55-gallon drums. Four drums of cuttings were produced and their contents analyzed for toxicity characteristic leaching procedure (TCLP) parameters. Results indicated that the IDW met Land Disposal Restrictions. Appendix H contains disposal records.

Monitoring Well Purge Water

Water purged from monitoring wells at Sites 13 and 16 during development and sampling was allowed to discharge directly to the ground surface in the vicinity of the well.

Hydraulic Oil Leak

On October 18, 1996 during CPT activities at Site 26, the CPT equipment developed a hydraulic oil leak that created a small area of stained soil. Work was halted and the equipment repaired. The stained soil was excavated, stockpiled on plastic, and sampled. Results for TCLP indicate that the soil is nonhazardous; therefore, the soils were spread at the site.

2.1.9 General Sampling Operations

Each sample that was submitted to the laboratory for chemical analysis was assigned a unique sample tracking number. The sample tracking number consisted of an alpha-numeric code that identified the site, the sample medium and location, and sample depth (for subsurface soils and groundwater samples collected by hydropunch or direct push methods). Any other pertinent information regarding sample identification was recorded in the field logbooks.

The alpha-numeric code used in the sample system is explained below:

Sample Number

(NN)		(AA)		(NN)		(NN)
	-		-		-	
(Site Number)		(Medium)		(Location		(Sample Depth)

QA Samples

QA Samples

(AA)	-	(AA)	-	(NN)
(QA Type)		(Medium)		(QA Sample Number)

Character Type

A = Alpha
N = Numeric

Site (Note: This list contains the seven sites investigated during the 1996 RI Addendum field investigation).

03 = Site 3, Landfill Southwest of "F" Group
06 = Site 6, Landfill West of Normandy Road
12 = Site 12, Battery Storage Area
13 = Site 13, Defense Property Disposal Office Yard
16 = Site 16, EPIC Site F (Roundhouse)
17 = Site 17, Landfill
26 = Site 26, Explosive "D" Washout Area
BG = Background sample location
WF = Waterfront area

Medium

SS = Surface Soil
SB = Subsurface Soil
GW = Groundwater
SW = Surface Water
SD = Sediment
HP = Hydropunch/Direct-push groundwater sample
CPT = Cone Penetrometer Sample
RR = Railroad Bed Ballast

Sample Location

The sample location code was assigned based on the medium being collected, as shown below:

Subsurface soil = soil boring number
Surface soil = sample location number
Groundwater sample = well number or hydropunch sample number
Sediment/surface water = sample location number
Background sample = background sample location number

Sample Depth

For subsurface soil samples, the top of the sample interval depth in feet was used in the identification. For groundwater samples, the depth where the sample was collected was used in the identification.

QA Sample Designation

DUP = Duplicate
RB = Equipment Rinsate Blank
FB = Field Blank
TP = Trip Blank

Field Duplicate Labels

Field duplicates were designated as DUP-01, DUP-02, etc. so they were submitted to the laboratory "blind." The chain-of-custody form and other documentation submitted to the laboratory were filled out in such a way that the laboratory could not match the duplicates to the original sample. The time on the duplicate samples was noted as 00:00. The correct sample location, time, etc. were documented in the field logbook.

Quality Control Sample Labels

Quality control samples were taken periodically. These samples were used to document the effectiveness of decontamination, to determine the quality of water used for decontamination, and to identify possible cross-contamination occurring during transit. These blank samples, including trip blanks, field blanks, and equipment rinsate blanks, used the QC sample identification scheme, listed below.

Sample Number

A sequential numeric designation was assigned to each type of blank on a daily basis.

Sample Date

The format MMDDYY (M=Month, D=Day, Y=Year) was used to indicate the day the sample was generated.

Example of the Quality Control Labels

The first field blank sample collected on December 4, 1996 would have had the sample identification label FB-01-120496.

Matrix spike and matrix spike duplicate (MS/MSD) samples were designated on the field documentation forms and sample labels.

2.1.10 Sample Handling

Sample Packaging and Shipping

Samples were packaged and shipped in accordance with B&R Environmental SOP SA-6.2. The field operations leader (FOL) was responsible for completing the following forms:

- Sample labels
- Chain-of-custody forms
- Appropriate labels applied to shipping coolers
- Chain-of-custody labels
- Federal Express air bills

Sample Custody

Custody of the samples was maintained and documented in accordance with procedures described in B&R Environmental SOP SA-6.1. Chain-of-custody began with the collection of the samples in the field.

Equipment Decontamination

Equipment involved in field sampling operations, including drilling rigs, down-hole tools, augers, well casing and screens, and all sampling equipment, was decontaminated before sampling, between individual samples, and after drilling or sampling activities.

The down-hole drilling equipment and sampling tools were cleaned using a high-pressure steam generator (steam jenny) before beginning work, between sample locations (such as test pits, soil borings, soil gas points, etc), at the completion of the drilling program, and any time the drilling rig left a site before completing a boring. The NWS Earle facility provided potable water directly from fire hydrants. Additional operations followed during drilling equipment decontamination are found in HNUS SOP SA-7.1.

The sampling equipment used for collecting samples was decontaminated before the beginning of field sampling and between samples. The following decontamination steps were followed:

- Potable water rinse.
- Alconox or liquinox detergent wash.
- Potable water rinse.
- Nitric acid rinse (for carbon steel equipment used on TAL metal samples only).
- Steam distilled water rinse (for carbon steel equipment used on TAL metal samples only).
- Methanol rinse.
- Hexane rinse (pesticide grade) (only necessary for equipment used on pesticide/PCB samples).
- Steam distilled water rinse.
- Air dry.
- Wrap in aluminum foil for transport.

Field analytical equipment, such as pH, conductivity, and temperature instrument probes, was rinsed first with steam distilled water, then with the sample liquid.

2.2 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of environmental contamination at NWS Earle are presented in each site section for inorganic and organic chemicals and, where applicable, miscellaneous parameters detected in surface soil, subsurface soil, sediment, groundwater, and surface water. The validated data generated during the RI provide the basis for the nature and extent presentations. The purpose of the nature and extent of contamination subsection in each site-specific section (Sections 4.0 through 10.0) is to identify primary chemical contaminants based on their frequency of detection and concentrations, to delineate (on an areal- and depth-specific basis) the extent of contamination, and to provide indications of contaminant migration via atmospheric, overland, or subsurface pathways. Tables provided in each site section present the occurrence and distribution of the data in a particular medium at that site. These tables provide the basis for selection of chemicals of potential concern (COPCs) at each site per medium. The complete analytical database is included as Appendix A.

2.3 FACILITY-WIDE CONTAMINANT FATE AND TRANSPORT

The ultimate fate of chemicals in the environment is determined by a multitude of physical, chemical, and biologically related factors. The role and significance of different physical properties such as specific gravity, solubility, and vapor pressure in determining what environmental fate and transport processes occur for a particular chemical can depend upon numerous additional factors. For example, solubilities of metals are not truly constant in the environment but may be dramatically enhanced or reduced when certain ligand species are available for complexation or precipitation, when organic matter is present in dissolved form, or when pH is altered. Physical properties such as soil/water partition ratios and groundwater retardation factors can vary considerably from location to location, even within the same geologic regime. Chemical and biological transformational processes can also be significantly affected by localized effects such as clay or mineral catalysts, chemical or biological inhibitors, and pH, Eh, and dissolved oxygen.

This section of the report will provide a summary of the physical and chemical transport properties for the chemicals detected at the site. No distinction of location or magnitude of chemicals will be made in this section. The information presented will discuss chemical persistence and transport phenomena for the general classes of compounds detected in the environmental media sampled at the sites. Each of the site-specific fate and transport sections will address probable contaminant migration routes and qualitatively identify potential routes of human exposure.

2.3.1 Physical and Chemical Properties

Physical and chemical properties of the detected contaminants are presented and discussed in this section. These parameters are used to quantitatively describe the environmental behavior of site chemicals. Empirically determined literature values of the specific gravity, vapor pressure, solubility, octanol/water partition coefficient, organic carbon partition coefficient, soil-water partitioning coefficient, and Henry's Law constant are presented. Calculated values are presented if literature values are not available. A summary of the physical and chemical transport properties for positively detected organic chemicals is provided in Table 2-8. These data are used to evaluate contaminant migration and assess exposures in the risk assessment. A discussion of the environmental significance of each of these parameters follows.

2.3.1.1 Specific Gravity

Specific gravity is the ratio of the weight of a given volume of pure chemical at a specified temperature to the weight of the same volume of water at a given temperature. Its primary use is to determine whether a contaminant will have a tendency to float or sink in water if it is present as a pure compound or at very high concentrations. Contaminants with a specific gravity less than 1.0 will float, whereas contaminants with a specific gravity greater than 1.0 will sink.

2.3.1.2 Vapor Pressure

Vapor pressure provides an indication of the rate at which a chemical volatilizes from both soil and water. It is of primary significance at environmental interfaces, such as surface soil/air and surface water/air. Volatilization is not as important when evaluating contaminated groundwater and subsurface soils. However, in order to conservatively evaluate chemical exposures at the sites, it will be considered. Chemicals with high vapor pressures are expected to enter the atmosphere more readily than chemicals with low vapor pressures. Semivolatile organics, pesticides, and PCB compounds generally have low vapor pressures and hence are not expected to volatilize readily.

2.3.1.3 Solubility

The rate at which a chemical is leached by infiltrating precipitation is directly proportional to its water solubility. Several of the detected VOCs have relatively high water solubilities, but the low concentrations observed in soils indicate low potential for significant desorption. Pesticides and PCBs typically have low solubilities and generally do not migrate through the soil column to the water table. The solubility of inorganics is strongly influenced by their valence state(s) and forms (hydroxides, oxides, carbonates, etc.). The solubility is also strongly dependent on pH, Eh, and the presence of other ionic species in solution (the Debye-Huckel theory). Solubility products reported in the literature vary with the type of ionic species.

TABLE 2-8 (PAGE 1 OF 3)
SUMMARY OF PHYSICAL AND CHEMICAL DATA FOR CHEMICALS OF POTENTIAL CONCERN
SITEWIDE - GROUNDWATER, SURFACE WATER, SEDIMENT, SURFACE SOIL, AND SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	MOLECULAR WEIGHT	SOLUBILITY (mg/L)	Log Kow	VAPOR PRESSURE (mmHg, 20C)	HENRY'S LAW ONSTANT (atm cu. m/mol	SPECIFIC GRAVITY	Koc
VOLATILES							
1,1,1-TRICHLOROETHANE	133.41	720	2.47	1.23E2 (25C)	3.00E-02	1.35	1.52E+01
1,1,2-TRICHLOROETHANE	133.41	4500	2.17	19	7.40E-04	1.4397	5.60E+01
1,1-DICHLOROETHENE	96.94	400	1.48	5.91E+02	1.90E-01	1.218	6.50E+01
1,2-DICHLOROETHANE	98.98	8690	1.48	6.10E+01	9.14E-04	1.235	1.40E+01
1,2-DICHLOROETHENE (TOTAL)	96.94	800 (20C)	-	200 (25C)	4.08E-03	1.28	5.90E+01
2-BUTANONE	72.1	35300	0.26	7.80E+01	2.08E-05	0.805	1.70E+01
4-METHYL-2-PENTANONE	100.16	1.91E+04	1.09E+00	1.00E+01	1.49E-05	0.8	2.05E+00
BENZENE	78.12	1780	2.13	95.2 (25C)	5.50E-03	-	6.50E+01
BROMODICHLOROMETHANE	163.83	4500	1.88	5.00E+01	2.41E-03	1.98	6.10E+01
CARBON DISULFIDE	76.14	2300	1.84	2.60E+02	1.13E-02	1.263	1.42E+02
CHLOROBENZENE	112.56	500	2.84	1.17E+01	3.58E-03	1.106	3.30E+02
CHLOROFORM	119.38	8200	1.97 (20C)	1.50E+02	2.88E-03	1.489	4.40E+01
ETHYLBENZENE	106.16	152	3.15	7.00E+00	6.60E-03	0.867	1.10E+03
METHYLENE CHLORIDE	84.93	13,200-20,000	1.25	362.4	2.00E-03	1.327	8.80E+00
STYRENE	104.15	3.00E+02	3.16E+00	5.00E+00	2.60E-03	0.91	2.76E+00
TETRACHLOROETHENE	165.83	200	2.6 (20C)	1.40E+01	1.53E-02	1.626	3.64E+02
TOLUENE	92.13	534.8 (25C)	2.69 (20C)	2.87E+01	6.66E-03	0.867	3.00E+02
TRICHLOROETHENE	131.39	1100	2.53	5.79E+01	9.10E-03	1.46	1.26E+02
VINYL CHLORIDE	62.5	1,100	1.4	2,660	8.14E-02	0.9106	8.20E+00
XYLENE (TOTAL)	106.16	187	2.77-3.2	6.50E+00	4.33E-63	0.86-0.88	2.48E+02
SEMIVOLATILES							
1,2,4-TRICHLOROBENZENE	181.45	30	4.02	2.90E-01	2.30E-03	1.454	9.20E+03
1,2-DICHLOROBENZENE	147	1.40E+02	3.38E+00	1.50E+00	3.00E-03	1.3	3.23E+00
1,4-DICHLOROBENZENE	147	7.90E+01	3.39E+00	1.80E+00	4.33E-03	1.25	3.23E+00
2,4-DICHLOROPHENOL	163	4,500	2.75	0.12	-	1.383	-
2-METHYLNAPHTHALENE	142.19	26-28 (25C)	4.26	0.087 (25C)	6.00E-04	0.994	5.80E+03
2-METHYLPHENOL	108.14	3.10E+04	1.95E+00	2.40E-01	8.40E-07	1	1.38E+00
4-METHYLPHENOL	108.1	4400	1.92/1.94	4.00E-02	1.29E-06	1.0347	2.43E+01
ACENAPHTHENE	154.2	3.42 (25C)	3.92	1.55E-3 (25C)	9.10E-05	1.0242	4.60E+03
ACENAPHTHYLENE	152.2	3.93 (25C)	3.72	2.90E-02	1.45E-03	-	2.50E+03
ANTHRACENE	178.2	0.045 (25C)	4.45	1.7E-5 (25C)	8.60E-05	1.283	1.40E+04
BENZO(A)ANTHRACENE	228.28	0.0057	5.61	2.20E-08	1.00E-06	-	2.00E+05
BENZO(A)PYRENE	252	0.0038 (25C)	5.98	5.60E-09	4.90E-07	-	5.50E+06
BENZO(B)FLUORANTHENE	252.3	0.0014 (25C)	6.57	5.00E-07	1.22E-05	-	5.50E+05
BENZO(G,H,I)PERYLENE	276	0.00026 (25C)	7.23	1.03E-10 (25C)	1.44E-07	-	1.60E+06
BENZO(K)FLUORANTHENE	252.3	0.0043 (25C)	6.84	5.00E-07	3.87E-05	-	5.50E+05
BIS(2-ETHYLHEXYL)PHTHALATE	390.62	0.4 (25C)	5.3	2.00E-07	3.00E-07	0.99	2.00E+09
BUTYLBENZYLPHTHALATE	312	2.9	4.78	6.00E-05	8.30E-06	1.1 (25C)	1.70E+05
CARBAZOLE	167.21	-	3.29	400 (323C)	-	1.1	1.20E+03
CHRYSENE	228.3	0.0018 (25C)	5.61	6.3E-9 (25C)	1.05E-06	1.274	2.00E+05
DI-N-BUTYLPHTHALATE	278.35	4.00E+02	5.20E+00	1.00E-01	2.80E-07	1	5.23E+00
DI-N-OCTYLPHTHALATE	391	3 (25C)	9.2	1.40E-04	1.70E-05	0.99	3.60E+09
DIBENZ(A,H)ANTHRACENE	278.4	0.005 (25C)	5.97	1.00E-10	7.30E-08	-	3.30E+06

- = Physical or chemical properties not available for this chemical in this classification

TABLE 2-8 (PAGE 2 OF 3)
SUMMARY OF PHYSICAL AND CHEMICAL DATA FOR CHEMICALS OF POTENTIAL CONCERN
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	MOLECULAR WEIGHT	SOLUBILITY (mg/L)	Log Kow	VAPOR PRESSURE (mmHg, 20C)	HENRY'S LAW ONSTANT (atm cu. m/mol	SPECIFIC GRAVITY	Koc
SEMIVOLATILES (CONTINUED)							
DIBENZOFURAN	168.2	10	4.12	-	-	-	8.13E+03
DIETHYLPHTHALATE	222.2	210	2.47	3.5E-3 (25C)	1.20E-06	1.12	1.42E+02
FLUORANTHENE	202.3	0.26 (25C)	5.33	5E-6 (25C)	6.50E-06	1.252	3.80E+04
FLUORENE	116.2	1.69 (25C)	4.18	7.10E-04	6.40E-05	1.203	7.30E+03
HEXACHLOROETHANE	236.74	50 (22C)	-	4.00E-01	2.49E-03	-	2.00E+04
INDENO(1,2,3-CD)PYRENE	276.3	0.00053 (25C)	7.66	1.00E-10	6.95E-08	-	1.60E+06
ISOPHORONE	138.21	1.20E+04	1.70E+00	3.80E-01	5.80E-06	0.92	1.94E+00
N-NITROSODIPHENYLAMINE (1)	198.23	3.50E+01	2.79E+00	1.00E-01	3.10E+00	-	2.81E+00
NAPHTHALENE	128.2	31.7 (25C)	3.01/3.45	8.7E-3 (25C)	4.60E-04	1.152	9.40E+02
NITROBENZENE	123.11	1.90E+03	1.85E+00	1.50E-01	2.40E-05	1.2	1.56E+00
PHENANTHRENE	178.2	1.0(25C)	4.45	9.6E-4 (25C)	2.30E-04	1.025	1.40E+04
PHENOL	94.11	8.00E+04	1.46E+00	3.50E-01	1.30E-06	1.1	1.15E+00
PYRENE	202.3	0.13 (25C)	5.18	2.5E-6(25C)	5.10E-06	-	3.80E+04
PESTICIDES/PCBs							
4,4'-DDD	320.1	0.09 (25C)	1.60E+06	1.2E-7 (25C)	2.20E-08	-	7.70E+05
4,4'-DDE	318	0.04 (20C)	4.28	6.50E-06	6.80E-05	-	4.40E+06
4,4'-DDT	354.5	0.0055 (25C)	6.19 (20C)	1.9E-7 (25C)	1.58E-05	-	3.90E+06
ALDRIN	364.91	1.70E-02	5.11E+00	2.30E-06	5.00E-04	1.7	4.98E+00
ALPHA-BHC	290.83	1.63E+00	3.81E+00	6E-2 (40C)	5.30E-06	1.9	3.58E+00
ALPHA-CHLORDANE	409.8	5.60E-02	2.78E+00	1.00E-05	3.70E-05	1.11	5.15E+00
AROCLOR-1248	299.5	0.054	5.75	4.9E-4 (25C)	3.60E-03	-	2.50E+05
AROCLOR-1254	325.1	3.10E-02	6.04E+00	7.70E-05	2.60E-03	-	5.72E+00
AROCLOR-1260	375.7	0.08 (24C)	7.15	4E-5 (25C)	0.74	-	6.70E+06
BETA-BHC	290.83	7.00E-01	3.80E+00	1.70E-01	2.30E-07	1.9	3.58E+00
DELTA-BHC	290.83	2.10E+01	4.14E+00	2.00E-02	2.50E-07	1.9	3.58E+00
DIELDRIN	380.91	1.90E-01	4.09E+00	1.80E-07	5.80E-05	1.8	3.23E+00
ENDOSULFAN I	406.95	3.20E+00	3.55E+00	1.00E-05	1.00E-04	1.7	2.30E+00
ENDOSULFAN II	406.95	3.30E-01	3.62E+00	1.00E-05	1.91E-05	1.7 (20/20C)	2.30E+00
ENDOSULFAN SULFATE	422.92	2.20E-01	3.66E+00	NA	2.60E-05	-	1.62E+00
ENDRIN	380.92	2.60E-01	5.60E+00	2.00E-07	4.00E-07	1.7	3.23E+00
ENDRIN ALDEHYDE	380.92	2.60E-01	5.60E+00	2.00E-07	3.90E-07	-	2.83E+00
ENDRIN KETONE	380.92	-	-	-	4.00E-07	-	-
GAMMA-BHC (LINDANE)	290.83	7.00E+00	3.24E+00	9.40E-06	4.90E-07	1.9	3.58E+00
GAMMA-CHLORDANE	409.8	5.60E-02	2.78E+00	1.00E-05	3.70E-05	1.11	5.15E+00
HEPTACHLOR	373.32	5.60E-02	4.40E+00	3.00E-04	1.50E-03	1.6	4.08E+00
HEPTACHLOR EPOXIDE	389.32	3.50E-01	3.65E+00	2.60E-06	3.20E-05	-	2.34E+00
METHOXYCHLOR	345.65	4.00E-02	4.68E+00	-	3.00E-05	1.4	4.90E+00
EXPLOSIVES							
2,4,6-TRINITROTOLUENE	227.15	1.50E+02	2.00E+00	5.51E-06 (25C)	1.10E-08	1.654	2.72E+00
2,4-DINITROTOLUENE	182.15	500	1.98E+00	1(20c)	1.86E-07	1.3208	2.40E+00
2-AMINO-4,6-DINITROTOLUENE	197.17	-	-	-	-	-	-
4-AMINO-2,6-DINITROTOLUENE	-	-	-	-	-	-	-
HMX	296.2	5.00E+00 (25C)	2.60E-01	3.33E-14	2.60E-15	1.9	5.40E-01
NITROBENZENE	123.11	1.90E+03	1.85E+00	1.50E-01	2.40E-05	1.2	1.56E+00

- = Physical or chemical properties not available for this chemical in this classification

TABLE 2-8 (PAGE 3 OF 3)
SUMMARY OF PHYSICAL AND CHEMICAL DATA FOR CHEMICALS OF POTENTIAL CONCERN
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	MOLECULAR WEIGHT	SOLUBILITY (mg/L)	Log Kow	VAPOR PRESSURE (mmHg, 20C)	HENRY'S LAW ONSTANT (atm cu. m/mol	SPECIFIC GRAVITY	Koc
EXPLOSIVES (CONTINUED)							
NITROCELLULOSE	>504	-	-	-	-	1.35-1.6	-
RDX	222.15	60 (25C)	8.70E-01	4.03E-09	1.96E-11	1.82	2.00E+00
INORGANICS							
ALUMINUM	26.98	INSOLUBLE	-	0	-	2.708	-
ANTIMONY	121.75	-	-	1 (886C)	-	6.684	-
ARSENIC	74.92	-	-	1 (372C)	-	5.72	-
BARIUM	137.34	DECOMPOSE	-		-	3.5	-
BERYLLIUM	9.01	-	-	1 (1520C)	-	1.85	-
CADMIUM	112.4	INSOLUBLE	-	1 (1284C)	-	8.642	-
CALCIUM	40.08	DECOMPOSE	-		-	1.57	-
CHROMIUM	52	INSOLUBLE	-	0	-	7.2	-
COBALT	58.93	INSOLUBLE	-	0	-	8.9	-
COPPER	63.54	INSOLUBLE	-	1 (1628C); 10 (1870C)	-	8.92	-
IRON	55.85	INSOLUBLE	-	0	-	7.86	-
LEAD	207.19	INSOLUBLE	-	1 (980C)	-	11.35	-
MAGNESIUM	24.312	-	-	-	-	1.738	-
MANGANESE	54.94	DECOMPOSE	-	1 (1292C)	-	7.2	-
MERCURY	200.59	5.6E-03g/100cc	-	2E-03 (25C)	-	13.5939	-
NICKEL	58.71	INSOLUBLE	-	1 (1810C)	-	8.902	-
POTASSIUM	39.1	DECOMPOSE	-	-	-	0.862	-
SELENIUM	78.96	INSOLUBLE	-	0	-	4.26-4.81	-
SILVER	107.87	INSOLUBLE	-	0	-	10.5	-
SODIUM	22.9898	DECOMPOSE	-	-	-	0.97	-
THALLIUM	204.37	-	-	-	-	11.85	-
VANADIUM	50.94	-	-	-	-	5.96	-
ZINC	65.37	-	-	1 (487C)	-	7.133	-
CYANIDE	27	SOLUBLE	-	657.8 (21.9C)	-	0.699	-

- = Physical or chemical properties not available for this chemical in this classification

2.3.1.4 Octanol-Water Partition Coefficient(K_{ow})

The octanol/water partition coefficient (K_{ow}) is a measure of the equilibrium partitioning of chemicals between octanol and water. A linear relationship between the K_{ow} and the uptake of chemicals by fatty tissues of animal and human receptors (the bioconcentration factor) has been determined (Lyman et al., 1990). The K_{ow} is useful in characterizing the sorption of compounds by organic soils where experimental values are not available. Larger organic molecules such as semivolatiles, pesticides, and PCBs are very likely to partition to fatty tissues, and less complex organic chemicals have lower K_{ow} values.

2.3.1.5 Organic Carbon Partition Coefficient (K_{oc})

The soil/sediment partition (organic carbon partition) coefficient (K_{oc}) indicates the tendency of a chemical to bind to soil particles containing organic carbon. Chemicals with high K_{oc} s generally have low water solubilities and vice versa. This parameter may be used to infer the relative rates at which more mobile chemicals are transported in groundwater. Complex organic chemicals are relatively immobile and are preferentially bound to the soil phase. These compounds are not subject to rapid groundwater transport. These immobile chemicals are, however, easily transported by erosional processes when they are present in surface soils.

2.3.1.6 Distribution Coefficient (Kd)

The soil-water partitioning (distribution) coefficient (Kd) is a measure of the equilibrium distribution of a chemical or ion in soil/water systems. The distribution of organic chemicals is a function of both the K_{oc} and the amount of organic carbon in the soil. The K_{oc} and the fractional organic carbon content of the soil (FOC) may be used to determine an equilibrium distribution coefficient (Kd) for the solid and aqueous matrices:

$$Kd = K_{oc} \times FOC$$

where:

Kd = Distribution coefficient

FOC = Fractional organic carbon content of the soil

K_{oc} = Organic carbon partition coefficient

Published values exist for Kd for inorganics. These are specific to the type of mineral-clay; however, Kd values are also dependent on the complexation (ligands) present in solution with the inorganic.

2.3.1.7 Henry's Law Constant (H)

Both the vapor pressure and the water solubility are of use in determining volatilization rates from surface water bodies and groundwater. The ratio of these two parameters (the Henry's Law constant) is used to calculate the equilibrium contaminant concentrations in the vapor versus the liquid phases for dilute solutions. In general, chemicals with a Henry's Law constant below 5 x 10^{-6} atm-m^3/mole should volatilize very little and be present only in minute amounts in the atmosphere or in soil gas. Henry's Law constant will be used to calculate the equilibrium soil gas vapor concentration for VOCs in groundwater.

2.3.1.8 Bioconcentration Factor (BCF)

The bioconcentration factor (BCF) provides a measure of the accumulation tendency for chemicals in biological and ecological systems. BCFs represent the ratio of aquatic animal tissue concentration to the water concentration of a chemical. The ratio is both contaminant and species specific. When site-specific values are not measured, literature values are used or the BCF is derived from the octanol/water partition coefficient. All of the organic chemicals detected during the RI are bioaccumulative to some extent, but many of the semivolatile organics are more bioaccumulative than the volatile organics.

2.3.1.9 Summary

Table 2-8 presents a summary of the fate and transport data that are used in this RI in discussions of the nature and extent of contamination, contaminant fate and transport, and the baseline risk assessment sections.

2.3.2 Contaminant Persistence

The persistence of the classes of organic contaminants is discussed in this section. The text will address general classes of the detected chemicals because the fate of chemicals in the environment is usually similar for chemicals within a particular chemical family.

2.3.2.1 Ketones

Ketones are characterized by high aqueous solubility and volatility and are readily biodegradable in both soil and water. Hydrolysis is not considered to be a significant fate process for this class of chemicals. The bioaccumulation of ketones is not significant, due to low octanol/water partitioning coefficient. In general, ketones were not pervasive at any site. The lack of detection of acetone at many sites demonstrates that this common laboratory contaminant is actually not present. This is in direct contrast to unvalidated historical data collected at the NWS Earle sites.

2.3.2.2 Chlorinated Aliphatics

Research has demonstrated that aerobic bacteria predominantly degrade organic compounds containing zero, one, or two halogens, and anaerobic bacteria predominate when more halogens are present. Thus, highly chlorinated aliphatic hydrocarbons such as tetrachloroethene (PCE) are subject to reductive dehalogenation via the action of anaerobic bacteria. It does not appear that appreciable degradation of highly halogenated aliphatics occurs in aerobic aquatic systems or unsaturated soils (Lyman, et al., 1982).

The transformation pathways for chlorinated aliphatic hydrocarbons in soil systems have been documented by Dragun et al. (1988). PCE and trichloroethene (TCE) are transformed via reductive dechlorination to 1,1-dichloroethene (1,1-DCE) and 1,2-DCE isomers. The terminal product of the transformation series is vinyl chloride, the chlorinated ethene with highest toxicity.

2.3.2.3 Phthalate Esters

Phthalate esters are considered to be relatively persistent environmental contaminants. Although numerous studies have demonstrated that phthalate esters undergo biodegradation, it appears that this is a very slow process in both soil and surface water. Certain microorganisms have been shown to excrete products that increase the solubility of phthalate esters and enhance their biodegradation (Gibbons and Alexander, 1989). Biodegradation of bis(2-ethylhexyl) phthalate and other phthalate esters is an important fate mechanism, as is bioaccumulation. Hydrolysis of phthalate esters is very slow, with calculated half-lives of 3 years (dimethyl phthalate) to 2,000 years [bis(2-ethylhexyl) phthalate] (EPA, December 1979). Similarly, photolysis is considered to be an insignificant degradation mechanism (EPA, December 1982).

2.3.2.4 Monocyclic Aromatic Hydrocarbons

Monocyclic aromatic compounds such as benzene, toluene, ethylbenzene, and xylenes are not considered to be persistent environmental contaminants in comparison to polycyclic aromatic hydrocarbons (PAHs), phthalate esters, and metals. Monocyclic aromatics are subject to degradation in both soil and water via the action of microorganisms. The biodegradation of these compounds in the soil matrix is dependent on the abundance of microflora, macronutrient availability, soil reaction (pH), temperature, oxygen, etc.

Although these compounds are amenable to microbial degradation, the rate of degradation cannot be predicted without information on the availability of nutrients and the type of bacteria present. If these contaminants discharge to a surface water body, volatilization and biodegradation may occur relatively rapidly. For example, a reported first-order biodegradation rate constant for benzene is 0.11 day^{-1} in aquatic systems (Lyman et al., 1990). This corresponds to an aquatic half-life of approximately 6 days. Other monocyclic aromatics are subject to similar degradation processes in aquatic environments (EPA, December 1982).

Additional degradation processes such as hydrolysis and photolysis are considered to be insignificant fate mechanisms for monocyclic aromatics (EPA, December 1982). However, some monocyclic aromatic compounds, such as benzene and toluene, have been shown to undergo clay-, mineral-, and soil-catalyzed oxidation (Dragun, 1988).

2.3.2.5 Polynuclear Aromatic Hydrocarbons (PAHs)

PAHs are common constituents of oil and grease. Landspreading applications have indicated that PAHs are amenable to microbial degradation. Studies have demonstrated that PAHs are much more amenable to degradation in soil matrices than in aquatic environments (EPA, December 1979). Under existing site conditions, the rate of microbial degradation cannot be predicted without knowledge of microbial populations. PAHs do not contain functional groups that are susceptible to hydrolytic actions, and hydrolysis is considered to be an insignificant degradation mechanism. Photolysis may be a major degradation mechanism in aquatic environments but is probably insignificant in surface soil.

2.3.2.6 Pesticides

Whether pesticides are sprayed, dusted, or applied directly to the soil, the soil is the ultimate sink for these chemicals. Pesticides are subject to degradation mechanisms in the environment. Pesticides typically have a high affinity for binding to organic particulates in soil, are relatively insoluble in water, and have very low vapor pressures and Henry's Law constants. Consequently, the chemicals are some of the most immobile and persistent of environmental contaminants.

2.3.2.7 Metals

The transport and fate of metals in the environment are primarily controlled by sorption to soil/sediment material. The metal-organic relationships, both in soil and water, increase in importance as the organic carbon content increases. Fulvic and humic acids can affect sorption, but the cation exchange capacity of the clay lattice is also important. Some metals, such as arsenic, are extremely soluble and mobile in the environment. Many other metals, such as nickel, selenium, zinc, and copper, have an affinity for hydrous iron and manganese oxides, as well as for organic materials, and are therefore preferentially adsorbed to soil. The mobility of most metals increases as the soil pH decreases.

2.3.3 Contaminant Migration Routes

Based on the positively detected chemicals and associated analytical results for NWS Earle, general conclusions can be made with respect to contaminant fate and transport and the possible exposure endpoints.

Groundwater chemical contaminants can migrate from the original source of the release. The most common transport mechanism is water infiltration through a contaminated zone, where partitioning from solid to aqueous phase can occur. The potential amount of chemical dissolving into infiltration water is determined by a number of factors including residence time, solubility, partitioning factor, and pH of infiltration water.

The dissolved chemicals continue downward migration and are able to interact with stationary (soil) particles in the saturated and/or unsaturated zones. After percolation through the capillary zone, dissolved contaminants are then able to enter groundwater where transport can occur via advection. The chemical concentrations in groundwater increase significantly to a maximum level shortly after initial groundwater impact. The longer-term effects at the source are a gradual decrease in the concentrations over time as chemical removal from the source area occurs. Short-term variations in release rate and impact to groundwater can occur, but long-term trends of decreased levels are usually observed. Molecular diffusion and hydrodynamic dispersion occur in the groundwater flow regime.

As materials are transported by the groundwater, a number of processes occur that can reduce the concentration of the chemicals. Diffusion and attenuation effects are nontransformational mechanisms that result in a direct decrease in chemical concentration. Chemical and biological reactions with dissolved chemicals can also result in decreases in chemical concentration. The products of chemical/biological reactions, however, may have significantly different chemical, transport, and toxicological properties from the parent compounds.

Groundwater chemical concentration can vary over periods of time as climatic and meteorological conditions change. Also, as materials from the release (source) area are depleted, lower concentrations of contaminant are released into the groundwater. Eventually, the impacts to groundwater cease, and residual chemicals are subjected to dilution and degradation via natural mechanisms.

Groundwater chemicals can discharge to surface water bodies, carrying chemicals dissolved in groundwater to the surface water and sediments. However, this transport mechanism is not a primary migration pathway for most sites at NWS Earle. More important surface water pathways include surface water runoff and erosional dispersion, which may transport contamination from surface soils and allow limited migration of contaminated sediments. Some degree of migration in surface soil could occur also through windblown particulate emissions; however, fugitive dust exposure is controlled by vegetative cover and climatic factors that result in a limited rate of windblown migration at NWS Earle sites.

2.4 HUMAN HEALTH RISK ASSESSMENT APPROACH

This section provides a description of the human health risk assessment methods used to evaluate the NWS Earle RI data. The objectives of the risk assessment are to estimate the actual or potential risks to human health resulting from the presence of contamination in surface soil, subsurface soil, sediment, groundwater, and surface water and to provide the basis for determining the need for remedial measures for these media in the FS.

Three major aspects of chemical contamination must be considered when assessing public health risks: contaminants with toxic characteristics must be found in environmental media and must be released by either natural processes or by human action; potential exposure points must exist either at the source or via migration pathways if exposure occurs at a location other than the source; and human or environmental receptors must be present at the point of exposure. Risk is a function of both toxicity and exposure; without any one of the three factors listed above, there will be no risk.

The risk assessment estimates the potential for human health risk attributable to each NWS Earle site. Information regarding the toxicity of the compounds detected in the various media, the distribution of contamination, potential migration pathways, and a site-specific estimate of chemical intake via assumed exposure routes will be combined to estimate potential risks for each NWS Earle site. The risk assessment processes used at NWS Earle are in accordance with current EPA risk assessment guidance (EPA, 1989a; EPA, 1991a).

The human health risk assessment consists of four sections: Data Evaluation, Toxicity Assessment, Exposure Assessment, and Risk Characterization. Each section is briefly discussed below.

- Data Evaluation (Section 2.4.1) is primarily concerned with the Identification of Chemicals of Potential Concern (COPCs, Section 2.4.1.1), Distributional Analysis of the data (Section 2.4.1.2), and Representative Concentrations for the COPCs (2.4.1.3). COPCs selected in this section are representative of the type and magnitude expected for potential human health exposure. Distributional analysis of the data, contaminant concentrations relative to background levels, contaminant release and environmental transport mechanisms, exposure routes, and toxicity are all considered in order to develop a list of COPCs used to define the site-associated risks.

- The Toxicity Assessment (Section 2.4.2) presents available Health Effects (2.4.2.1) for all COPCs. Quantitative toxicity indices, where available, are presented in this section.

Dose-response parameters, such as reference doses (RfDs) and cancer slope factors (SFs), are presented in this section for each COPC. Carcinogenic chemicals are classified by EPA as Group A (human), B (probable human), or C (possible human) carcinogens. A special discussion of lead is included because of the lack of quantitative dose-response parameters for this analyte.

- The Exposure Assessment (Section 2.4.3) identifies potential human health exposure including the presentation of a Site-Conceptual Model (Section 2.4.3.1), selection of Potential Receptors (Section 2.4.3.2), and Exposure Routes (Section 2.4.3.3) either at the source area or off site. This section generally identifies potential pathways of COPC migration, selected potential receptors, and the estimated intakes of COPCs for the identified receptors.

- Risk Characterization (Section 2.4.4) presents the risks for a site including a Determination of Risks (2.4.4.1), the estimated Receptor Risks (2.4.4.2), and a presentation of Uncertainty Analysis (Section 2.4.4.3). This section estimates the risks associated with noncarcinogenic and carcinogenic effects of COPCs (established in Section 2.4.1) via estimated intakes in exposure routes (established in Section 2.4.3) compared to appropriate toxicity values (established in Section 2.4.2). A discussion of the uncertainties associated with the risk assessment is also presented in this section.

2.4.1 Data Evaluation

This section presents the approaches for identifying COPCs (Section 2.4.1.1), distributional analysis of the data (Section 2.4.1.2), and representative concentrations (Section 2.4.1.3).

2.4.1.1 Identification of Chemicals of Potential Concern

COPC selection is based on various aspects of chemical occurrence, distribution, and toxicity. Chemicals are selected to represent site contamination and will provide the framework for the quantitative risk assessment.

COPC Selection - General Rules

Inorganic and organic samples were collected from the NWS Earle sites in surface soil, subsurface soil, sediment, groundwater, and surface water media. The positively detected chemicals for each site are presented in occurrence and distribution tables in subsequent sections of this report. COPC selection is based on these tables and the following rules for inorganic and organic analytes:

- Inorganics - Inorganics in all media sampled at NWS Earle can be naturally occurring; therefore, sample results were compared to background results. Site-wide background samples were collected from locations away from any possible influence of site-related contamination for each medium type. Background sample media consist of groundwater, surface water, sediment, subsurface soil, and surface soil. Monitoring well results for a particular NWS Earle site were compared to data from the corresponding background well group. If the site-related inorganic chemical concentration range exceeded two times the average background concentration and the 95 percent upper tolerance limit, that chemical was selected as a COPC. These calculated values are shown in subsequent occurrenace and distribution tables (Sections 4 through 10) and derivation of these values in explained below. An exception to this rule is the EPA-designated Class A carcinogenic inorganic, arsenic (via ingestion, dermal contact, and inhalation). Arsenic was included as COPC at any site if it was detected in site-related media, regardless of its background concentration. Additional exceptions to the above rule for selection of inorganic COPCs are calcium, magnesium, potassium, and sodium, which are essential nutrients or common minerals and generally are not considered to be toxicologically significant and therefore were not selected as COPCs for any site.

- Organics - Because most organic chemicals on the TCL are not naturally occurring, every organic compound positively detected at an NWS Earle site was selected as a COPC. The occurrence and distribution tables in each section of this report (Sections 4 through 10) present the site-related chemical concentration range and a background concentration range for organic chemicals. The background samples were collected for the purpose of comparing inorganic concentrations at NWS Earle sites, and a similar comparison was made for organic chemicals. However, selection of COPCs for organics has not been based on a comparison of organic chemicals in background samples, in accordance with EPA risk assessment guidelines.

Special Note Concerning Background Samples

Monitoring well results for a particular NWS Earle site were compared to data from the corresponding background well group. For the groundwater pathway, monitoring wells that are upgradient from individual NWS Earle sites were grouped according to interpreted aquifer (see Section 31.2 of the RI report). This resulted in three background groundwater groups, comprising the following formations: Cohansey Sand, Kirkwood Formation, and Vincentown Formation; Red Bank Sand and Navesink Formation; and fill and Englishtown Formation. A subset of the data for subsurface soils, the 0- to 2-foot depth, is treated as background surface soil.

Background Comparison Tests

Two types of background comparisons were applied to eliminate COPCs (with the exception of arsenic, which could not be excluded from risk calculations because this metal is considered a Class A carcinogen). Nondetected results were replaced by one-half the detection limit before conducting background comparison tests.

Using a background comparison test recommended by EPA Region II, a metal was excluded from further consideration as a COPC if the arithmetic mean of the site data was not greater than twice the arithmetic mean of the background. (Unlike the parametric statistical test of means discussed in Section 2.4.1.2, the Region II test criterion is not dependent on the number of sampling points.) The results of these comparisons are presented in the tables of inorganic occurrence and distribution data for each site.

A second comparison was also performed in which additional metals were eliminated as COPCs if the maximum of the site results was not greater than the upper 95 percent tolerance limit (UTL) on the background data. The 95 percent UTL is defined as the calculated upper limit that, on the average, will be expected to include 95 percent of the background population. This limit was calculated using the t-distribution and assumed a lognormal population (geometric mean and log standard deviation), except in cases where the background data acceptably fit a normal distribution and had a distributional shape that more closely matched a normal rather than lognormal population (based on the W-test).

2.4.1.2 Distributional Analysis of the Data

Statistical analyses discussed in this section adhere to the guidance referenced in several EPA and related publications (1989a, 1989b, 1991b, and 1992c) referenced in Appendix I of the 1995 RI report. Section 2.4.5.4 discusses the general limitations and uncertainties of statistical procedures, particularly with regards to confidence and decision-making power when limited numbers of samples are involved. Before representative concentrations (Section 2.4.1.3) could be estimated for each site, the underlying statistical distribution of data was determined for each chemical in each medium. The Shapiro-Wilk W test was performed to determine if the data set of chemical concentrations matches the shape of a normal or lognormal distribution. Normally distributed data exhibit a characteristic "bell-shape" curve that is symmetrical, whereas lognormal data have a skewed shape (more results at the high-concentration tail). For each chemical in each medium at a site, the W test was performed once using the original data and once after data were converted to their logarithms. A five percent level of significance was used to determine if the data deviate from either hypothesized distribution. If the W test indicated a normal distribution, then the estimation of the reasonable maximum exposure point concentration (using the upper 95th percentile, as discussed in the next section) was based upon a normal distribution and standard deviation. If taking the logarithms of the data provided a better match to the data than a normal distribution, a lognormal transformation of data was used before the upper 95th percentile concentrations were computed. In most cases, the distribution of data fit one of the above two categories. If neither distribution matched well, the default assumption of an underlying lognormal distribution was followed (EPA, 1989a). Results of the Shapiro-Wilk tests are provided in Appendix I of the 1995 RI report.

2.4.1.3 Representative Concentrations

The risk assessment for NWS Earle was performed using a representative concentration for each COPC in each medium identified at the particular site of interest. Only current concentrations detected at each site medium were evaluated. Usability of results is discussed below. The representative concentration was calculated using the latest risk assessment guidance from EPA (EPA, 1989a).

The validated data were used to calculate representative concentrations. All data were collected by B&R Environmental during the summer and fall of 1995. For chemicals with at least one positive detection, non-detects were assumed to be one-half the detection limit (sample quantitation limit). Rejected values (R) were eliminated from further consideration. Estimated and biased values (J, K, L) were used as the reported value.

Duplicate samples were averaged together and considered as one result. For duplicates, where one result was positive and the other result was a non-detect, the problem of calculating an average result selectedarose whenever half the detection limit exceeded the positive result. It was considered undesirable for the average to exceed the positive result; therefore, the positive result was used to represent the non-detect in such cases.

The calculation of the representative concentration is a two-step process. First, the distribution of the data must be determined, as discussed in the preceding section. Then, based on the distribution of the data, a representative concentration is either calculated or

Several important points are associated with distribution of the data:

- The distribution of a data set is determined using a Shapiro-Wilk test.
- The distributions are classified as either lognormal, normal, or unknown.
- Environmental data are usually determined to be lognormally distributed (default).
- If the data are not determined to be either a lognormal or normal distribution, they are classified as an unknown distribution and a lognormal distribution is assumed.

If the data are considered to be lognormally distributed, then the standard deviation of the log transformed sample set must be determined, as follows:

$S = [\Sigma (X_i-X_m)^2/(n-1)]^{0.5}$

where: S = Standard deviation of the log-transformed data

X_i = Individual sample value (log-transformed)

X_m = Arithmetic mean of the log-transformed n samples

n = Number of samples

The one-sided upper 95 percent confidence limit (UCL_{LOG}) is then calculated as follows:

$UCL_{LOG} = \exp[X_m + (0.5S^2) + (SH)/(n-1)^{0.5}]$

where: exp = exponential function

X_m = Arithmetic mean of the log-transformed data

H = H-statistic (e.g., from table published in Gilbert, 1987)

S = Standard deviation of the log-transformed data

n = Number of samples

The representative concentration is then selected as the lesser value of the two-sided 95 percent UCL and the maximum positive value in the data set.

If the data are determined to be normally distributed, then the standard deviation of the sample set is used to calculate the one-sided 95 percent UCL, as follows:

First, the standard deviation of the sample set must be determined:

$S = [\Sigma (X_i-X_m)^2/(n-1)]^{0.5}$

where: S = Standard deviation

X_i = Individual sample value

X_m = Arithmetic mean for the n samples

n = Number of samples

The one-sided upper 95 percent confidence limit (UCL_{NOR}) is then calculated:

$$UCL_{NOR} = X_m + (tS)/(n^{0.5})$$

where:
X_m = Arithmetic mean
t = One-sided t distribution factor
S = Standard deviation
n = Number of samples

For small sample sets or sample sets in which all positive results equal less than one-half the detection limit, the UCL can exceed the maximum detected concentration. In these cases, the maximum concentration was selected as the representative concentration.

2.4.2 Toxicity Assessment

The purpose of this section is to identify the potential health hazards associated with exposure to each of the COPCs. A toxicological evaluation characterizes the inherent toxicity of a compound. The literature indicates that the COPCs have the potential to cause carcinogenic and/or noncarcinogenic health effects in humans. Although the COPCs may cause adverse health effects, dose-response relationships and the potential for exposure must be evaluated before the risks to receptors can be determined. Dose-response relationships correlate the magnitude of the intake with the probability of toxic effects, as discussed below. Quantitative toxicity parameters for the COPCs at all sites at NWS Earle are presented in Table 2-9. In evaluating the likelihood for effects from chemical exposures, it is also important to consider qualitative toxicity information, such as the cancer weight-of-evidence criteria presented for chemicals in Table 2-10 and also the target organs potentially affected by chronic (noncarcinogenic) toxicity for chemicals in Table 2-11. Appendix I of the 1995 RI report contains detailed toxicological information regarding each chemical detected at NWS Earle.

2.4.2.1 Health Effects

An important component of the risk assessment process is the relationship between the intake of a compound (the amount of a chemical that is absorbed by a receptor) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts can be quantified. The published information of doses and responses is used in conjunction with information on the nature and magnitude of human exposure to develop an estimate of potential health risks.

Reference doses (RfDs) and slope factors (SFs) have been developed by EPA and other sources for many organics and inorganics. This section provides a brief description of these parameters.

TABLE 2-9

DOSE-RESPONSE PARAMETERS - POTENTIAL CHEMICALS OF CONCERN (ORGANICS)

NWS EARLE, COLTS NECK, NEW JERSEY

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SUBSTANCE	Fraction of COPC Absorbed in the Gastrointestinal Tract (unitless)**	TOXICITY VALUES						
		RfD* Oral (mg/kg)/day	RfD Dermal (mg/kg)/day	RfD* Inhalation (mg/kg)/day	SF* Oral 1/(mg/kg)/day	SF Dermal 1/(mg/kg)/day	SF* Inhalation 1/(mg/kg)/day	Weight of Evidence
4,4'-DDD	0.80	-	-	-	2.40E-01	3.00E-01^^	-	B2
4,4'-DDE	0.80	-	-	-	3.40E-01	4.25E-01^^	-	B2
4,4'-DDT	0.80	5.00E-04	4.00E-04^^	-	3.40E-01	4.25E-01^^	3.40E-01	B2
ALDRIN	0.50	3.00E-05	1.50E-05^^	-	1.70E+01	3.40E+01^^	1.70E+01	B2
ALPHA-BHC	1.00	-	-	-	6.30E+00	6.30E+00^^	6.30E+00	B2
BETA-BHC	1.00	-	-	-	1.80E+00	1.80E+00^^	1.80E+00	C
DELTA-BHC	1.00	-	-	-	-	-	-	D
GAMMA-BHC	1.00	3.00E-04	-	-	1.30E+00 H	1.30E+00^^	-	C
ALPHA-CHLORDANE	0.80	6.00E-05	4.80E-05^^	-	1.30E+00	1.63E+00^^	1.29E+00	B2
GAMMA-CHLORDANE	0.80	6.00E-05	4.80E-05^^	-	1.30E+00	1.63E+00^^	1.29E+00	B2
DIELDRIN	0.50	5.00E-05	2.50E-05^^	-	1.60E+01	3.20E+01^^	1.61E+01	B2
HEPTACHLOR	0.40	5.00E-04	2.00E-04^^	-	4.50E+00	1.13E+01^^	4.55E+00	B2
HEPTACHLOR EPOXIDE	0.40	1.30E-05	5.20E-06^^	-	9.10E+00	2.28E+01^^	9.10E+00	B2
ENDOSULFAN I	0.60	6.00E-03	3.60E-03^^	-	-	-	-	-
ENDOSULFAN II	0.60	6.00E-03	3.60E-03^^	-	-	-	-	-
ENDOSULFAN SULFATE	1.00	-	-	-	-	-	-	-
ENDRIN	0.65	3.00E-04	1.95E-04^^	-	-	-	-	D
ENDRIN KETONE	1.00	-	-	-	-	-	-	-
ENDRIN ALDEHYDE	1.00	-	-	-	-	-	-	-
METHOXYCHLOR	0.90	5.00E-03	4.50E-03^^	-	-	-	-	D
AROCLOR 1248	0.85	-	-	-	7.70E+00	9.06E+00^^	-	B2
AROCLOR 1254	0.85	2.00E-05	1.70E-05^^	-	7.70E+00	9.06E+00^^	-	B2
AROCLOR 1260	0.85	-	-	-	7.70E+00	9.06E+00^^	-	B2
1,1,1-TRICHLOROETHANE	0.50	9.00E-02 W	4.50E-02^^	2.86E-01 W	-	-	-	D
1,1,2-TRICHLOROETHANE	0.50	4.00E-03	2.00E-03^^	-	5.70E-02	1.14E-01^^	5.60E-02	C
1,1-DICHLOROETHENE	1.00	9.00E-03	9.00E-03^^	-	6.00E-01	6.00E-01^^	1.75E-01	C
1,2-DICHLOROETHANE	1.00	-	-	2.86E-03 E	9.10E-02	9.10E-02^^	9.10E-02	B2
1,2-DICHLOROETHENE (TOTAL)	1.00	9.00E-03 H	9.00E-03^^	-	-	-	-	D
2-BUTANONE	1.00	6.00E-01	6.00E-01^^	2.86E-01	-	-	-	-
4-METHYL-2-PENTANONE	1.00	8.00E-02	8.00E-02^^	2.29E-02	-	-	-	-
BENZENE	1.00	-	-	1.71E-03 E	2.90E-02	2.90E-02^^	2.90E-02	A
BROMODICHLOROMETHANE	1.00	2.00E-02	2.00E-02^^	-	6.20E-02	6.20E-02^^	-	B2
CARBON DISULFIDE	0.50	1.00E-01	5.00E-02^^	2.00E-01	-	-	-	-
CHLOROBENZENE	0.30	2.00E-02	6.00E-03^^	5.71E-03 A	-	-	-	D
CHLOROFORM	1.00	1.00E-02	1.00E-02^^	-	6.10E-03	6.10E-03^^	8.05E-02	B2

- = No dose-response value is available for this chemical in this classification

* = All toxicity values are from Integrated Risk Information System (IRIS) unless otherwise noted

** = Modifying factor applied only to the dermal RfDs and SFs, from ATSDR

H = Health Effects Assessment Summary Tables (HEAST, 1995)

A = HEAST Alternative (HEAST, 1995)

E = EPA-NCEA Regional Support provisional service (EPA, 1995c)

^ - Corrected value.

^^ - Value does not apply to soil dermal exposure for sites with refined risk assessment.

W = Withdrawn from IRIS or HEAST

DOSE-RESPONSE PARAMETERS - POTENTIAL CHEMICALS OF CONCERN (ORGANICS)
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 3

SUBSTANCE	Fraction of COPC Absorbed in the Gastrointestinal Tract (unitless)**	TOXICITY VALUES						
		RfD* Oral (mg/kg)/day	RfD Dermal (mg/kg)/day	RfD* Inhalation (mg/kg)/day	SF* Oral 1/(mg/kg)/day	SF Dermal 1/(mg/kg)/day	SF* Inhalation 1/(mg/kg)/day	Weight of Evidence
ETHYLBENZENE	0.80	1.00E-01	8.00E-02^^	2.86E-01	-	-	-	D
METHYLENE CHLORIDE	1.00	6.00E-02	6.00E-02^^	8.57E-01 H	7.50E-03	7.50E-03^^	1.64E-03	B2
STYRENE	1.00	2.00E-01	2.00E-01^^	2.86E-01	-	-	-	C
TETRACHLOROETHENE	1.00	1.00E-02	1.00E-02^^	-	5.20E-02 E	5.20E-02^^	2.03E-03 E	-
TOLUENE	1.00	2.00E-01	2.00E-01^^	1.14E-01	-	-	-	D
TRICHLOROETHENE	1.00	6.00E-03 E	6.00E-03^^	-	1.10E-02 W	1.10E-02^^	6.00E-03 E	B2
VINYL CHLORIDE	1.00	-	-	-	1.90E+00 H	1.90E+00^^	3.00E-01 H	A
XYLENE (TOTAL)	0.90	2.00E+00 H	1.80E+00^^	8.57E-02 W	-	-	-	D
1,2,4-TRICHLOROBENZENE	1.00	1.00E-02	1.00E-02^^	5.71E-02 H	-	-	-	D
1,2-DICHLOROBENZENE	1.00	9.00E-02	9.00E-02^^	4.00E-02 A	-	-	-	D
1,4-DICHLOROBENZENE	1.00	-	-	2.29E-01	2.40E-02 H	2.40E-02^^	-	C
2,4-DICHLOROPHENOL	1.00	3.00E-03	3.00E-03^^	-	-	-	-	D
2-METHYLNAPHTHALENE	0.50	-	-	-	-	-	-	-
2-METHYLPHENOL	1.00	5.00E-02	5.00E-02^^	-	-	-	-	C
4-METHYLPHENOL	0.60	5.00E-03 H	3.00E-03^^	-	-	-	-	C
ACENAPHTHENE	0.50	6.00E-02	3.00E-02^^	-	-	-	-	-
ACENAPHTHYLENE	1.00	-	-	-	-	-	-	D
ANTHRACENE	0.65	3.00E-01	1.95E-01^^	-	-	-	-	D
BENZO(A)ANTHRACENE	0.50	-	-	-	7.30E-01 E	1.46E+00^^	6.10E-01 E	B2
BENZO(A)PYRENE	0.15	-	-	-	7.30E+00	4.87E+01^^	6.10E+00 W	B2
BENZO(B)FLUORANTHENE	0.50	-	-	-	7.30E-01 E	1.46E+00^^	6.10E-01 E	B2
BENZO(G,H,I)PERYLENE	0.50	-	-	-	-	-	-	D
BENZO(K)FLUORANTHENE	0.50	-	-	-	7.30E-02 E	1.46E-01^^	6.10E-02 E	B2
BIS(2-ETHYLHEXYL)PHTHALATE	0.50	2.00E-02	1.00E-02^^	-	1.40E-02	2.80E-02^^	-	B2
BUTYLBENZYLPHTHALATE	1.00	2.00E-01	2.00E-01^^	-	-	-	-	C
CARBAZOLE	1.00	-	-	-	2.00E-02 H	2.00E-02^^	-	B2
CHRYSENE	0.50	-	-	-	7.30E-03 E	1.46E-02^^	6.10E-03 E	B2
DI-N-BUTYLPHTHALATE	0.90	1.00E-01	9.00E-02^^	-	-	-	-	D
DI-N-OCTYLPHTHALATE	1.00	2.00E-02 H	2.00E-02^^	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	0.10	-	-	-	7.30E+00 E	7.30E+01^^	6.10E+00 E	B2
DIBENZOFURAN	1.00	4.30E-03 E	4.30E-03^^	-	-	-	-	D
FLUORANTHENE	0.50	4.00E-02	2.00E-02^^	-	-	-	-	D
FLUORENE	0.50	4.00E-02	2.00E-02^^	-	-	-	-	D
HEXACHLOROETHANE	1.00	1.00E-03	1.00E-03^^	-	1.40E-02	1.40E-02^^	1.40E-02	C
INDENO(1,2,3-CD)PYRENE	0.50	-	-	-	7.30E-01 E	1.46E+00^^	6.10E-01 E	B2

- = No dose-response value is available for this chemical in this classification

* = All toxicity values are from Integrated Risk Information System (IRIS) unless otherwise noted

** = Modifying factor applied only to the dermal RfDs and SFs, from ATSDR

H = Health Effects Assessment Summary Tables (HEAST, 1995)

A = HEAST Alternative (HEAST, 1995)

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W = Withdrawn from IRIS or HEAST

TABLE 2-9

DOSE-RESPONSE PARAMETERS - POTENTIAL CHEMICALS OF CONCERN (INORGANICS)

NWS EARLE, COLTS NECK, NEW JERSEY

PAGE 3 OF 3

SUBSTANCE	Fraction of COPC Absorbed in the Gastrointestinal Tract (unitless)**	TOXICITY VALUES						
		RfD* Oral (mg/kg)/day	RfD Dermal (mg/kg)/day	RfD* Inhalation (mg/kg)/day	SF* Oral 1/(mg/kg)/day	SF Dermal 1/(mg/kg)/day	SF* Inhalation 1/(mg/kg)/day	Weight of Evidence
ISOPHORONE	1.00	2.00E-01	2.00E-01^^	-	9.50E-04	9.50E-04^^	-	C
N-NITROSODIPHENYLAMINE	0.50	-	-	-	4.90E-03	9.80E-03^^	-	B2
NAPHTHALENE	0.50	4.00E-02 W	2.00E-02^^	-	-	-	-	D
NITROBENZENE	1.00	5.00E-04	5.00E-04^^	5.71E-04 A	-	-	-	D
PHENANTHRENE	1.00	-	-	-	-	-	-	D
PHENOL	1.00	6.00E-01	6.00E-01^^	-	-	-	-	D
PYRENE	0.65	3.00E-02	1.95E-02^^	-	-	-	-	D
2,4,6-TRINITROTOLUENE	1.00	5.00E-04	5.00E-04^^	-	3.00E-02	3.00E-02^^	-	C
2,4-DINITROTOLUENE	1.00	2.00E-03	2.00E-03^^	-	-	-	-	B2
2-AMINO-4,6-DINITROTOLUENE	1.00	-	-	-	-	-	-	-
4-AMINO-2,6-DINITROTOLUENE	1.00	-	-	-	-	-	-	-
HMX	1.00	-	-	-	-	-	-	D
NITROBENZENE	1.00	5.00E-04^	-	5.71E-04^	-	-	-	B2
NITROCELLULOSE	1.00	-	-	-	-	-	-	-
RDX	1.00	-	-	-	-	-	-	C
ALUMINUM	0.05	1.00E+00 E	5.00E-02^^	-	-	-	-	-
ANTIMONY	0.05	4.00E-04	2.00E-05^^	-	-	-	-	D
ARSENIC, TOTAL	0.95	3.00E-04	2.85E-04	-	1.50E+00	1.58E+00	1.51E+01	A
BARIUM	0.04	7.00E-02	2.80E-03^^	1.43E-04 A	-	-	-	D
BERYLLIUM	0.01	5.00E-03	5.00E-05^^	-^	4.30E+02	4.30E+04^^	8.40E+00	B2
CADMIUM	0.10^	5.00E-04	5.00E-05^	5.71E-05 E	-	-	6.30E+00	D
CHROMIUM, TRIVALENT	0.02	1.00E+00	2.00E-02^^	5.71E-07 W	-	-	-	D
CHROMIUM, HEXAVALENT	0.02	5.00E-03	1.00E-04^^	-	-	-	4.20E+01	A
COBALT	0.05	6.00E-02 E	3.00E-03^^	-	-	-	-	-
COPPER	0.60	4.00E-02 E	2.40E-02^^	-	-	-	-	D
IRON	0.05	3.00E-01 E	1.50E-02^^	-	-	-	-	-
LEAD, TOTAL	0.50	-	-	-	-	-	-	B2
MANGANESE	0.03	5.00E-03	1.50E-04^^	1.43E-05	-	-	-	-
MERCURY, TOTAL	0.07	1.00E-04^ H	7.00E-06^^	8.57E-05 H	-	-	-	D
NICKEL (SOLUBLE SALTS)	0.15	2.00E-02	3.00E-03^^	-	-	-	-	D
SELENIUM, TOTAL	0.80	5.00E-03	4.00E-03^^	-	-	-	-	-
SILVER	0.20	5.00E-03	1.00E-03^^	-	-	-	-	D
THALLIUM	0.05	8.00E-05	4.00E-06^^	-	-	-	-	-
VANADIUM	0.01	7.00E-03 H	7.00E-05^^	-	-	-	-	D
ZINC	0.25	3.00E-01	7.50E-02^^	-	-	-	-	D

- = No dose-response value is available for this chemical in this classification

* = All toxicity values are from Integrated Risk Information System (IRIS) unless otherwise noted

** = Modifying factor applied only to the dermal RfDs and SFs, from ATSDR

H = Health Effects Assessment Summary Tables (HEAST, 1995)

A = HEAST Alternative (HEAST, 1995)

E = EPA-NCEA Regional Support provisional service (EPA, 1995c)

W = Withdrawn from IRIS or HEAST

^ - Corrected value.

Table 2-10

EPA WEIGHT-OF EVIDENCE CARCINOGENIC CLASSIFICATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

EPA Category	Description of Group	Description of Evidence
Group A	Human carcinogen	Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.
Group B1	Probable human carcinogen	Limited evidence of carcinogenicity in humans from epidemiologic studies.
Group B2	Probable human carcinogen	Sufficient evidence of carcinogenicity in animals; inadequate evidence of carcinogenicity in humans.
Group C	Possible human carcinogen	Limited evidence of carcinogenicity in animals.
Group D	Not classified	Inadequate evidence of carcinogenicity in animals.
Group E	No evidence of carcinogenicity in humans	No evidence for carcinogenicity in at least two adequate animal tests or in both epidemiologic and animal studies.

Source: EPA, 1992b

Table 2-11
TARGET ORGANS - CHEMICALS OF POTENTIAL CONCERN (ORGANICS)
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 1 OF 3

	Target Organ																
	Cardiovascular System						Respiratory System			Digestive System							
Substance	Blood	Hematopoietic System	Erythrocyte	Heart	Skin	Kidney	Respiratory Tract	Lung	Liver	Pancreas	Gastrointestinal Tract	Central Nervous System	Peripheral Nervous System	Eyes	Skeletal Muscle	Reproductive System	Thyroid
4,4'-DDD																	
4,4'-DDE																	
4,4'-DDT									X								
ALDRIN									X			X				X	
ALPHA-BHC																	
BETA-BHC																	
DELTA-BHC																	
GAMMA-BHC						X			X								
ALPHA-CHLORDANE									X			X				X	
GAMMA-CHLORDANE									X			X				X	
DIELDRIN									X			X				X	
HEPTACHLOR									X								
HEPTACHLOR EPOXIDE									X								
ENDOSULFAN I	X					X											
ENDOSULFAN II	X					X											
ENDOSULFAN SULFATE																	
ENDRIN									X			X				X	
ENDRIN KETONE																	
ENDRIN ALDEHYDE									X			X				X	
METHOXYCHLOR																X	
AROCLOR 1248					X				X							X	
AROCLOR 1254					X				X							X	
AROCLOR 1260					X				X							X	
1,1,1-TRICHLOROETHANE				I								I					
1,1,2-TRICHLOROETHANE																	
1,1-DICHLOROETHENE						X			X								
1,2-DICHLOROETHANE						X		I	X			I					
1,2-DICHLOROETHENE (TOTAL) a			X	I				I	X			I					
ACETONE						X											
2-BUTANONE							X					X				X	
4-METHYL-2-PENTANONE												X					
BENZENE		X										X					
BROMODICHLOROMETHANE						X			X								
CARBON DISULFIDE				X	X	X			X			X	X	X		X	
CHLOROETHANE																	
CHLOROBENZENE				I		X		X	X			I					
CHLOROFORM				I		X			X			I					
ETHYLBENZENE						X	I		X							X	
METHYLENE CHLORIDE									X								
STYRENE			X			X			X			I					
TETRACHLOROETHENE									X			I					

Blank - Target organ is not cited regarding chronic exposure, noncarcinogenic toxicity.
X - Value is applicable to oral route of exposure (and, where applicable RfD exists, inhalation or dermal route).
I - Value is applicable only to the inhalation route of exposure.
D - Value is applicable only to the dermal route of exposure.
a - Value represents all target organs for cis- and trans- isomers.

Table 2-11

TARGET ORGANS - CHEMICALS OF POTENTIAL CONCERN (ORGANICS)
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 3

Substance	Target Organ																
	Cardiovascular System				Skin	Kidney	Respiratory System		Liver	Digestive System		Central Nervous System	Peripheral Nervous System	Eyes	Skeletal Muscle	Reproductive System	Thyroid
	Blood	Hematopoietic System	Erythrocyte	Heart			Respiratory Tract	Lung		Pancreas	Gastrointestinal Tract						
TOLUENE						X			X			I					
TRICHLOROETHENE				X								X					
VINYL CHLORIDE									X			X					
XYLENE (TOTAL)												X					
1,2,4-TRICHLOROBENZENE																	
1,2-DICHLOROBENZENE																	
1,3-DICHLOROBENZENE																	
1,4-DICHLOROBENZENE									X								
2,4-DICHLOROPHENOL																	
2,4-DIMETHYLPHENOL																	
2-METHYLNAPHTHALENE																	
2-METHYLPHENOL						X	X		X			X					
4-METHYLPHENOL						X	X		X			X					
ACENAPHTHENE						X			X								
ACENAPHTHYLENE																	
ANTHRACENE																	
BENZO(A)ANTHRACENE																	
BENZO(A)PYRENE																	
BENZO(B)FLUORANTHENE																	
BENZO(G,H,I)PERYLENE																	
BENZO(K)FLUORANTHENE																	
BIS(2-CHLOROETHYL)ETHER																	
BIS(2-ETHYLHEXYL)PHTHALATE									X							X	
BUTYLBENZYLPHTHALATE																	
CARBAZOLE																	
CHRYSENE																	
DI-N-BUTYLPHTHALATE																X	
DI-N-OCTYLPHTHALATE						X			X							X	
DIBENZ(A,H)ANTHRACENE																	
DIBENZOFURAN																	
DIETHYLPHTHALATE																	
FLUORANTHENE	X					X			X								
FLUORENE			X									X					
HEXACHLOROETHANE						X			X								
INDENO(1,2,3-CD)PYRENE																	
ISOPHORONE																	
N-NITROSODIPHENYLAMINE																	
NAPHTHALENE			X			X											
NITROBENZENE	X				X	X			X								
PHENANTHRENE																	
PHENOL						X										X	
PYRENE						X											

Blank - Target organ is not cited regarding chronic exposure, noncarcinogenic toxicity.
X - Value is applicable to oral route of exposure (and, where applicable RfD exists, inhalation or dermal route).
I - Value is applicable only to the inhalation route of exposure.
D - Valu [illegible] only to the dermal route of exposure.

TABLE 2-11
TARGET ORGANS - CHEMICALS OF POTENTIAL CONCERN (EXPLOSIVES AND INORGANICS)
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 3 OF 3

Substance	Target Organ																
	Cardiovascular System				Skin	Kidney	Respiratory System		Liver	Digestive System		Central Nervous System	Peripheral Nervous System	Eyes	Skeletal Muscle	Reproductive System	Thyroid
	Blood	Hematopoietic System	Erythrocyte	Heart			Respiratory Tract	Lung		Pancreas	Gastrointestinal Tract						
1,3,5-TRINITROBENZENE																	
2,4,6-TRINITROTOLUENE									X					X			
2,4-DINITROTOLUENE	X								X			X					
2-AMINO-4,6-DINITROTOLUENE																	
4-AMINO-2,6-DINITROTOLUENE																	
HMX						X			X								
NITROCELLULOSE																	
RDX						X			X			X		X			
ALUMINUM																	
ANTIMONY				X	D		I										
ARSENIC, TOTAL					X												
BARIUM				X							X				X	X	
BERYLLIUM								I									
CADMIUM						X	I										
CHROMIUM, TRIVALENT																	
CHROMIUM, HEXAVALENT					D	X	I										
COBALT			X	X	D		I	I									X
COPPER			X			X		I	X								
IRON							I		X	X							
LEAD, TOTAL			X									X					
MANGANESE							I					X					
MERCURY, TOTAL						X						X				X	
NICKEL (SOLUBLE SALTS)												X					
SELENIUM, TOTAL					X		I					I					
SILVER					X												
SODIUM																	
THALLIUM					X	X			X			X					
VANADIUM							I										
ZINC	X																

Blank - Target organ is not cited regarding chronic exposure, noncarcinogenic toxicity.
X - Value is applicable to oral route of exposure (and, where applicable RfD exists, inhalation or dermal route).
I - Value is applicable only to the inhalation route of exposure.
D - Value is applicable only to the dermal route of exposure.

Reference Doses (RfDs)

RfDs are developed by EPA for assessing chronic or subchronic human exposure to hazardous chemicals and are based solely on the noncarcinogenic effects of chemical substances. The subchronic RfD, which is the RfD used for human health risk assessment at NWS Earle sites, is defined as an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (as a Superfund program guideline, 7 years to lifetime). The RfD is usually expressed as a dose (mg) per unit body weight (kg) per unit time (day).

The RfD is generally derived by dividing a No-Observed-(Adverse)-Effect-Level (NOAEL or NOEL) or a Lowest-Observed-Adverse-Effect-Level (LOAEL) by an appropriate uncertainty factor. NOAELs, etc. are 1determined from laboratory or epidemiological toxicity studies. EPA evaluates available studies to determine their scientific merit, to identify the animal model most relevant to humans, and to determine the critical toxic effect that occurs at the lowest administered dose. The NOAEL is selected based in part on the assumption that if the critical toxic effect is prevented, then all toxic effects are prevented. Thus, the RfD is derived in a manner that is protective against the most sensitive adverse effect(s); i.e., those that occur at the lowest levels of exposure.

Uncertainty factors are generally applied as multiples of 10 to represent specific areas of uncertainty in the available data. A factor of 10 is used to account for variations in the general population (to protect sensitive subpopulations), when test results from animals are extrapolated to humans (to account for interspecies variability), when a NOAEL derived from a subchronic study (instead of a chronic study) is used to develop the RfD, and when a LOAEL is used instead of a NOAEL. In addition, EPA reserves the use of a modifying factor of up to 10 for professional judgment of uncertainties in the database not already accounted for. The default value of the modifying factor is 1.

The RfD incorporates the surety of the evidence for chronic human health effects. Even if applicable human data exist, the RfD (as diminished by the uncertainty factor) still maintains a margin of safety so that chronic human health effects are not underestimated. Thus, the RfD is an acceptable guideline for evaluation of noncarcinogenic risk, although the associated uncertainties preclude its use for precise risk quantitation. RfDs for NWS Earle site contaminants are provided in Table 2-9. RfDs for chemicals were generated following the hierarchy of references specified by EPA (EPA, 1989a). (Note that information sources for RfDs obtained from Heast alternative references are identified in the references at the end of this section.) For some chemicals that have no inhalation RfDs in IRIS, RfDs have been calculated by EPA based upon the reference concentration (RfC) with modifications to reflect specific exposure assumptions (70-kilogram adult, a 20 m^3/day inhalation rate, and an appropriate absorption factor) (EPA, 1995d).

Noncarcinogenic risks for lead were not quantitated and compared to RfDs, because EPA has implemented an approach to evaluating lead risks that goes beyond providing a single-point estimate output. If lead was selected as a COPC, expected blood-lead increases were estimated, and a discussion of these results is presented in the site-specific section. Soil screening values for lead were compared to the value of 400 ppm as discussed in OSWER directive 9355.4-12, and groundwater lead concentrations were compared to the 15 ug/L EPA action level [Maximum Contaminant Level (MCL)].

Cancer Slope Factors (SFs)

SFs are applicable for estimating the lifetime probability (assumed 70-year lifespan) of human receptors developing cancer as a result of exposure to known or potential carcinogens. This factor is generally reported in units of 1/(mg/kg/day) and is derived through an assumed low-dosage linear relationship of extrapolation from high to low dose responses determined from animal studies. The value used in reporting the slope factor is the upper 95 percent confidence limit. SFs for NWS Earle site contaminants are provided in Table 2-9. SFs for chemicals were generated following the hierarchy of references specified by EPA (EPA, 1989a). (Note that information sources for SFs obtained from Heast alternative references are identified in the references at the end of this section.) In addition, SFs for PAHs were obtained from EPA provisional guidance that applies the toxicity equivalent factor (TEF) approach, based upon potency relative to benzo(a)pyrene (EPA, 1993b). Inhalation SFs for chemicals that have unit risk values in IRIS are calculated by EPA based upon specific exposure assumptions (70-kilogram adult, a 20 m^3/day inhalation rate, and an approporiate absorption factor) (EPA, 1995d).

Carcinogenic risks for lead were not quantitated, because no EPA consensus currently exists with respect to an inorganic lead SF. Instead, if lead was selected as a COPC, potential lead exposures were calculated using a biokinetic model to estimate expected blood-lead increases, and a discussion of these results is presented in the site-specific section. In addition, soil screening values for lead were compared to the value of 400 ppm as discussed in OSWER directive 9355.4-12, and groundwater lead concentrations were compared to the 15 ug/L EPA action level.

EPA Weight-of-Evidence

The weight-of-evidence designations indicate the preponderance of evidence regarding carcinogenic effects in humans and animals. The categories are defined in Table 2-10 and are listed for each chemical in Table 2-9.

Adjustment of Dose-Response Parameters

In accordance with EPA (1989a, Appendix A), the dose-response parameters were adjusted when the estimated dose was dermally absorbed, but the original toxicity value was derived based on oral intake.

Dermal RfDs and SFs are obtained from oral RfDs and SFs via the following relationships:

$$RfD_{dermal} = RfD_{oral} \times Gi_{adjusted}$$

and

$$SF_{dermal} = SF_{oral} / GI_{adjusted}$$

where: $GI_{adjusted}$ = Fraction of COPC absorbed in the gastrointestinal tract (same as the dermal modifying absorption factor)

The absorption factors for this adjustment are shown on Table 2-9 (ATSDR, 1996). Based upon evaluation of recent EPA guidance and memoranda (EPA, 1992f; EPA, 1993e), EPA Region II recommends quantitative evaluation of dermal exposure to soil/sediment only for five chemicals. Of these chemicals, only arsenic, cadmium, and PCBs were detected at NWS Earle sites. Therefore, cancer and noncancer risks for the dermal soil/sediment pathways only present these three chemicals. In addition, the soil-to-skin absorption factors for the above three chemicals were modified (EPA, 1993e) and a revised value was applied to cadmium for the gastrointestinal (GI) absorption fraction, which is used to extrapolate dermal toxicity constants from oral toxicity constants.

2.4.2.2 Summary

The available dose-response parameters (carcinogenic and noncarcinogenic) and target organs for noncarcinogenic health effects for each COPC are presented on Table 2-9 and Table 2-11, respectively. If the concentration or intake of a chemical exceeds these standards or guidelines, the possibility exists that a potential receptor may experience adverse health effects. Expected intakes of each chemical are presented in Section 2.4.3.

2.4.3 Exposure Assessment

The purpose of this section is to evaluate the potential for human exposure to the chemicals detected in the environmental media at the NWS Earle sites investigated under this RI. This section presents a general site-conceptual model (Section 2.4.3.1), characterizes the exposed populations (Section 2.4.3.2), identifies actual or potential exposure routes (Section 2.4.3.3), and summarizes the methods used to generate exposure estimates (Section 2.4.3.4). The nature and extent of contamination upon which the exposures are based are presented in subsequent site-specific sections.

To determine whether there is an actual or potential exposure, the most likely pathways of contaminant release and transport, as well as the human and environmental activity patterns, must be considered. A complete exposure pathway has three components: a source, a route of transport, and an exposure point for receptors. These components are addressed in the following subsections.

2.4.3.1 Conceptual Site Model

The conceptual site model for NWS Earle incorporates information on the potential chemical sources, affected media, release mechanisms, routes of migration, and known or potential human receptors. The purpose of the conceptual site model is to provide a framework in which to identify potential exposure pathways occurring at the sites. Information provided on site characterization, chemical characterization, local land and water uses, and potential receptors is used to identify potential exposure pathways for the site. The general conceptual site model for NWS Earle is presented in Figure 2-1.

2.4.3.2 Potential Receptors

The receptors chosen for the sites are presented in this section. All of the receptors listed below are not applicable to every site. The receptors are chosen based on sampled media per site. Section 2.1 identifies the media sampled at each site.

- Current Industrial Employee

A current industrial employee is an adult who currently works at NWS Earle. This receptor is potentially exposed via ingestion of, dermal contact with, and inhalation of COPCs in surface soil. Carcinogenic and noncarcinogenic risks are estimated for the current industrial employee receptor who does not engage in soil- or dust-contact-intensive activities on a regular basis. Examples of such activities include grass cutting, fertilizing, outdoor equipment repair (automotive, locomotive, and small equipment), loading and unloading of vehicles, surveying, outdoor painting, and above-ground utility repair. (This scenario does not include short-term activities categorized as soil contact-intensive, as discussed in Section 2.4.5.3.)

- Future Industrial Employee

A future industrial employee is an adult who is assumed to work at NWS Earle in the future. This receptor is potentially exposed via ingestion of COPCs in subsurface soil (as

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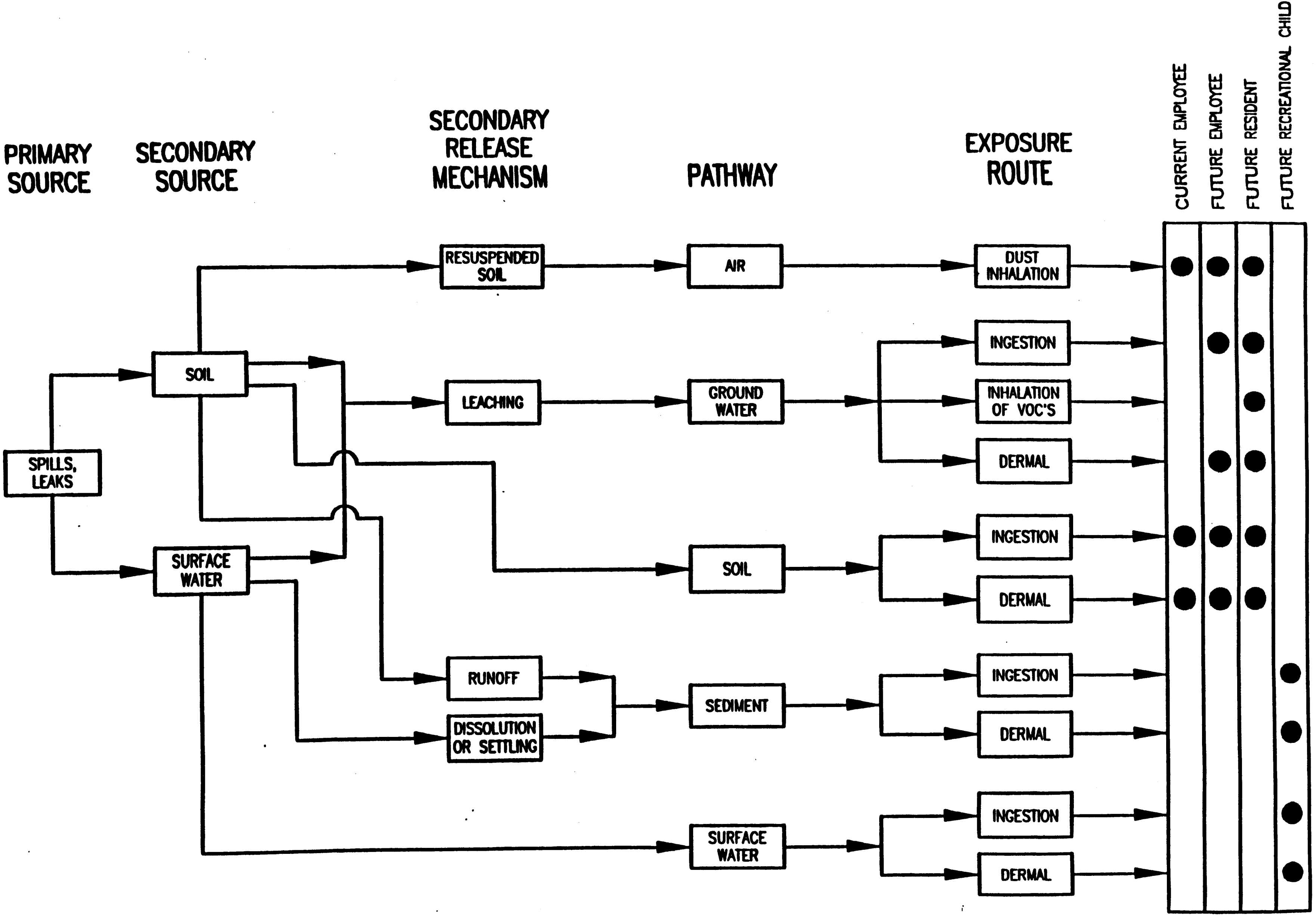

FIGURE 2-1 GENERAL CONCEPTUAL SITE MODEL FOR NWS EARLE

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future surface soil) and groundwater; dermal contact with COPCs in subsurface soil (as future surface soil) and groundwater (hand washing); and inhalation of COPCs in fugitive dust from subsurface soil (as future surface soil). Carcinogenic and noncarcinogenic risks are estimated for the future industrial employee receptor who does not engage in soil- or dust-contact-intensive activities on a regular basis. Examples of noncontact-intensive activities for the future industrial worker include grass cutting, fertilizing, outdoor equipment repair (automotive, locomotive, and small equipment), loading and unloading of vehicles, surveying, outdoor painting, and above-ground utility repair. (This scenario does not include temporary, short-term activities categorized as soil contact-intensive, as discussed in Section 2.4.5.6.)

- Future Resident

A future resident is a person who will live in a residence at or near NWS Earle in a hypothetical future scenario. This receptor resides at the residence for 30 years, 0 through 6 years as a child and the remaining 24 years as an adult. This receptor is potentially exposed via ingestion of COPCs in surface soil, subsurface soil (as future surface soil), and groundwater; dermal contact with COPCs in surface soil, subsurface soil (as future surface soil), and groundwater (child, during bathing; adult, during showering); inhalation of COPCs in fugitive dust from surface soil and subsurface soil (as future surface soil); and inhalation of COPCs present in groundwater vapors during showering (adult only, 24-year exposure).

Carcinogenic risks are estimated for a lifetime residential receptor. This exposure is based on the full 30 years as a resident at the site. Note that the showering scenario for carcinogenic risks is estimated using a residential adult over the 24-year span (children ages 0 through 6 years are not expected to bathe via showering).

Noncarcinogenic effects to future residents are estimated for a residential child (0 through 6 years) and residential adult (24 years). The residential child (0 through 6 years) lives in a future residence for 6 years (equal to the child receptor in the lifetime resident scenario presented above). This receptor is potentially exposed via ingestion of COPCs in surface soil, subsurface soil (as future surface soil), and groundwater; dermal contact with COPCs in surface soil, subsurface soil (as future surface soil), and groundwater (bathing); and inhalation of COPCs in fugitive dust from surface soil and subsurface soil (as future surface soil). The residential adult lives in a future residence for 24 years. This receptor is potentially exposed via inhalation of COPCs present in groundwater vapors during showering.

- Future Recreational Child (age 6 to 12 years)

  The future recreational child will live in a future residence at or near NWS Earle. This receptor wades in surface water/sediment present at NWS Earle. This receptor is potentially exposed via ingestion of COPCs in sediment and surface water and dermal contact with COPCs in sediment and surface water. Noncarcinogenic and carcinogenic risks are estimated for the recreational child receptor.

One receptor scenario that was considered, but not selected, was the "current hunter." The current hunter would spend several days each year in the wooded areas of the station, kill one deer annually, and eat the meat and other processed products, such as sausage. The current hunter would be exposed to two types of exposure pathways: direct contact to site media (air, surface soil, surface water, and sediments) while hunting, and ingestion of the deer meat.

The direct contact to side media exposure scenario results in very little potential exposure for the hunter because the surface media capable of driving an appreciable health risk exist only at the industrial/commercial zones (where hunting is not permitted) or in groundwater at the industrial sites, to which the hunter has no access. The primary media of concern to which the hunter can be exposed, surface water and sediments, are of very low concern for human health (note that the future recreational child risk scenario, playing in streams/sediments, did not result in a health risk above the EPA target acceptable range).

The ingestion of deer meat exposure pathway depends on the intake of compounds of concern by plants and a resultant bioaccumulation in the deer. Past experience and documented studies of this type in the past (e.g., Sierra Army Depot study of bioaccumulation in beef cattle) indicate that this risk will be two orders of magnitude (1×10^{-2}) or more, lower than other risk scenarios, such as direct soil and groundwater ingestion, which generally drive human health risk assessment.

Considering these factors, it was concluded that the current hunter is not a reasonable risk scenario, and it was not pursued further in calculation of human health risks.

2.4.3.3 Exposure Routes by Medium

There are five environmental media at NWS Earle through which potential receptors (see previous section) can be either directly or indirectly exposed to site-related COPCs: surface soil, subsurface soil, sediment, groundwater, or surface water. All five media have not been sampled at all of the NWS Earle sites. Potential exposure routes include ingestion, dermal contact, and inhalation.

Surface Soil

Surface soil exposure routes include incidental ingestion, dermal contact, and inhalation of fugitive dust. All scenarios are based on current COPC concentrations in surface soils. All three exposure routes were evaluated using industrial employees (current scenario) and residential receptors (future scenario). These receptors were chosen because it is unknown whether NWS Earle will remain open to industrial employees only or whether NWS Earle (or a portion of it) might become a residential area in the future. For fugitive dust emissions under the current industrial scenario, the assumption of surface cover would resemble the type of vegetation, paving, and buildings that are currently in place. For fugitive dust emissions under a future residential scenario, the assumptions of vegetative cover would resemble a typical residential setting different from the current industrial setting. For surface soil, low levels of VOCs did not warrant full-scale modeling and an estimation of the exposure. VOCs were generally not detected in surface soil samples, with the exception of a single result for PCE at 3 ug/kg in one surface soil sample at Site 12. Therefore, exposure to volatilized chemicals is expected to be negligible at NWS Earle, and ingestion and dermal contact would contribute to the bulk of the risk.

Subsurface Soil

Because there is currently no direct contact with subsurface soil, only potential future incidental ingestion, dermal contact, or inhalation of fugitive dusts could be evaluated. All three exposure routes were evaluated using industrial employees (future scenario) and residential receptors (future scenario). The exposure scenarios for subsurface soil are based on the assumption that subsurface soil could eventually become surface soil if excavations, erosion, construction, or landscaping activities occurred. Exposure scenarios based on the concentrations in subsurface soil are conservative based on this assumption. The receptors were chosen because it is unknown whether NWS Earle will remain open to industrial employees only or whether it might become a residential area in the future. For fugitive dust emissions from subsurface soil under the future industrial scenario, the assumption of surface cover would be based on the type of vegetation, paving, and buildings that are currently in place. For fugitive dust emissions from subsurface soil under a future residential scenario, the assumptions of vegetative cover would be based on a typical residential setting, different from the current industrial setting.

Subsurface soil contamination may also have an impact upon future groundwater quality, especially for relatively mobile contaminants such as VOCs. This risk assessment does not take into account future loading of COPCs from subsurface soils to groundwater. It is assumed that loading of COPCs from subsurface soils to groundwater is currently occurring; therefore, groundwater exposure to potential receptors will adequately characterize this phenomenon.

Sediment

Sediment exposure routes include incidental ingestion and dermal contact. These exposure routes were evaluated using recreational child receptors. It was assumed that a child in this recreational scenario would be older than the standard 15-kilogram child (approximately 3 years old) used in residential soil scenarios. For sediment exposure, a 30-kilogram child (6 to 12 years old; represented by mean body weight and surface area for age 9 years) was used. Inhalation of chemicals in sediment was eliminated as a pathway because the sediment is not expected to be in a dry streambed frequently. Furthermore, the frequency of contact with surface water and sediment by the recreational children is expected to be low.

Groundwater

Groundwater beneath NWS Earle is not currently used for drinking purposes. The NWS Earle sites are all located within the boundaries of the New Jersey Coastal Plain Sole Source Aquifer, a groundwater protective designation conferred by Section 1424(e) of the Safe Drinking Water Act. Groundwater at the sites is therefore classified as at least Class IIA Current Source of Drinking Water. However, in order to evaluate groundwater quality, potential future groundwater exposure scenarios using current groundwater conditions were evaluated. It was assumed that the theoretical exposure to industrial employees would be via ingestion and dermal contact (hand washing) routes; exposure to adult residents would occur via ingestion, dermal contact (showering), and inhalation of vapors (showering) routes; and exposure to child residents would occur via ingestion and dermal contact (bathing) routes.

Future groundwater conditions were not evaluated for the risk assessment. Groundwater conditions at the site were not modeled. Migration of COPCs in groundwater to surface water was also not modeled. For this risk assessment, it is assumed that migration of COPCs in groundwater is currently occurring and current groundwater conditions adequately represent this phenomenon.

Surface Water

Surface water exposure routes include incidental ingestion and dermal contact. These exposure routes were evaluated using recreational child receptors. It was assumed that a child in this recreational scenario would be older than the standard 15-kilogram child (approximately 3 years old) used in residential groundwater scenarios. For surface water exposure, a 30-kilogram child (approximately 9 years old) was used. Inhalation of VOCs in surface water was eliminated as a pathway because the VOCs were detected infrequently in surface water. Furthermore, the frequency of contact with surface water by the recreational child is expected to be low.

2.4.3.4 Exposure Estimates

The estimation methods and models used in this section are consistent with current EPA risk assessment guidance (EPA, 1989a; EPA, 1991a). Exposure estimates associated with each exposure route are presented below. All exposure scenarios incorporate the representative concentrations in the estimation of intakes.

Noncarcinogenic risks are estimated using the concept of an average annual exposure. The intake incorporates terms describing the exposure time and/or frequency that represent the number of hours per day and the number of days per year that exposure occurs. This is used with the "averaging time," which converts the daily exposure frequency and duration to an annual exposure by dividing by 365 days per year of exposure. Noncarcinogenic risks for some exposure routes (e.g., soil) are generally greater for children than for adults because of the much lower body weights of children and their similar or higher ingestion rates. Carcinogenic risks, on the other hand, are calculated as an incremental lifetime risk and, therefore, incorporate terms to represent the exposure duration (years) over the course of a lifetime (70 years).

<u>**Surface Soil Exposure**</u>

Three potential exposure routes are associated with direct exposure to surface soil at the NWS Earle sites. These exposure routes include ingestion, dermal contact, and inhalation of fugitive dust. The methods used to assess these routes of exposure are discussed in the following text.

Incidental surface soil ingestion exposure is estimated from the following equation (EPA, 1989a):

$$IEX = (C \times IR \times FI \times EF \times ED)/(BW \times AT \times CF)$$

where: IEX = Ingestion exposure [mg/(kg-day)]

C = Chemical concentration in soil (mg/kg soil)

IR = Soil ingestion rate (mg soil/day)

FI = Fraction ingested from contaminated source

EF = Exposure frequency (days/yr)

ED = Exposure duration (yrs)

BW = Body weight (kg)

AT = Averaging time (days)

CF = Conversion factor (mg soil/kg soil: 1E+06)

A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-12. As discussed in Section 2.4.3, the potential receptors for this scenario were adult employees, adult residents, and child residents. EPA values were used for all input parameters.

Dermal exposure to surface soil is estimated from the following equation (EPA, 1989a; EPA, 1992f):

DEX = (C X SA x AF x ABS x EF x ED x CF)/(BW x AT)

where: DEX = Dermal exposure dose (mg/kg/day)

C = Chemical concentration in soil (mg/kg soil)

SA = Skin surface area available for contact (cm^2/day)

AF = Soil-to-skin adherence factor (mg/cm^2)

ABS = Fraction from contaminated source

EF = Exposure frequency (days/yr)

ED = Exposure duration (yrs)

BW = Body weight (kg)

CF = Conversion factor (kg soil/mg soil: 1E-06)

AT = Averaging time (days)

A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-13. As discussed in Section 2.4.3, the potential receptors for this scenario were adult employees, adult residents, and child residents. EPA or conventional values were selected for most input parameters. It was assumed that the primary areas of skin available for contact would be the hands and arms of adult residents and employees and the arms, hands, and legs of residential children. For the initial baseline risk assessment, absorption factors were assumed to be as follows: 0.1 for VOCs, 0.05 for SVOCs/pesticides, 0.06 for PCBs, and 0.01 for metals (Feldman and Maibach, 1970; Wester and Maibach, 1985; EPA, 1984a).

TABLE 2-12

EXPOSURE INPUT PARAMETERS - SOIL INGESTION
NWS EARLE, COLTS NECK, NEW JERSEY

Incidental Ingestion of Soil				
Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed (EPA, 1989a, 1993)
IR	Ingestion rate	100 mg/day (industrial employee) 100 mg/day (residential adult) 200 mg/day (residential child)	50 mg/day (industrial employee) 50 mg/day (residential adult) 100 mg/day (residential child)	(EPA, 1991a; EPA, 1993)
FI	Fraction ingested from contaminated source	1.0	1.0	Professional judgement based on current and projected future land use and observed activity patterns
EF	Exposure frequency	250 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (recreational child)	234 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (recreational child)	(EPA, 1991a; EPA, 1993)
ED	Exposure duration	25 years (industrial employee) 24 years (residential adult) 6 years (residential child)	4.5 years (industrial employee) 7 years (residential adult) 2 years (residential child)	90th / 50th percentile time at one residence (EPA,1991a; EPA, 1989a; EPA, 1993) Ave.duration of employment, (Maguire, 1993)
BW	Body weight	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	(EPA, 1991a; EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

TABLE 2-13

EXPOSURE INPUT PARAMETERS - DERMAL CONTACT WITH SOIL
NWS EARLE. COLTS NECK, NEW JERSEY

Dermal Contact with Soil

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data (EPA, 1989a, 1993)
SA	Skin surface area available for contact	3,120 sq. cm/day (industrial employee) 3,120 sq. cm/day (residential adult) 3,910 sq. cm/day (residential child)	3,120 sq. cm/day (industrial employee) 3,120 sq. cm/day (residential adult) 3,910 sq. cm/day (residential child)	Industrial employee and adult: arms and hands Child: arms, hands, and legs (EPA, 1989a)
AF	Soil-to-skin adherence factor	1.0 mg/sq. cm	1.0 mg/sq. cm	(EPA, 1992f)
ABS	Absorption factor (Applied to initial risk evaluation - see text)	Inorganics = 0.01 Volatile Organic Chemicals = 0.1 Semivolatile Organic Chemicals = 0.05 Pesticides = 0.05 Polychlorinated Biphenyls = 0.06	Inorganics = 0.01 Volatile Organic Chemicals = 0.1 Semivolatile Organic Chemicals = 0.05 Pesticides = 0.05 Polychlorinated Biphenyls = 0.06	Feldman and Maibach (1970) Webster and Maibach (1985) EPA (1984a)
ABS	Absorption factor (Applied to sites with refined risk evaluation)	Arsenic = 0.03 Cadmium = 0.001 PCBs = 0.2 No other COPCs applicable	Arsenic = 0.03 Cadmium = 0.001 PCBs = 0.2 No other COPCs applicable	(Wester, 1993) (Wester, 1992) (EPA, 1993)
EF	Exposure frequency	250 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (residential child)	234 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (residential child)	(EPA, 1991a; EPA, 1993)
ED	Exposure duration	25 years (industrial employee) 24 years (residential adult) 6 years (residential child)	4.5 years (industrial employee) 7 years (residential adult) 2 years (residential child)	90th / 50th percentile time at one residence (EPA,1991a; EPA, 1989a; EPA, 1993) Ave.duration of employment, (Maguire, 1993)
BW	Body weight	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	(EPA, 1991a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

Exposure to fugitive dust emissions can be estimated by first estimating the rate of distribution and COPC emission from the site and then relating this to the exposure rate for the receptors. For sites such as NWS Earle, considered to have unlimited erosion potential (generally sites with small particle size and low vegetative cover), emission factors can be estimated as follows:

$$E_{10} = (0.036) \times (1\text{-}V) \times (U/Ut)^3 \times F(x)$$

where: E_{10} = PM_{10} emission factor (g/m^2 hr)

V = vegetative cover

U = mean annual wind speed (m/s)

Ut = threshold value of wind speed at 7 m (m/s)

$F(x)$ = function based on $x = 0.886 \times Ut/U$

Ut = $U^* \times (1/0.4) \times \ln (z/z_0)$

Ut = wind speed at height z (m/s)

z = height above surface (cm)

z_0 = roughness height (cm)

U^* = friction velocity (m/s)

From the emission flux, the emission rates are as follows:

$$R_{10} = \alpha \times E_{10} \times A \times CF$$

where: R_{10} = Emission rate of a COPC (g/sec)

α = mass fraction of a COPC in soil

E_{10} = PM_{10} emission flux ($g/(m^2hr)$)

A = source area (m^2)

CF = conversion factor (1 hr/3,600 sec)

To estimate the annual average air concentration to receptors near the site, a screening air dispersion model was used, as described in detail in Appendix I of the 1995 RI Report. The screening model parameters were selected consistent with conservative assumptions (a 100-meter-squared source area and a receptor located 200 meters downwind located along the axis of most probable dispersion). Annual average air concentrations were estimated as follows:

$$Q_I = R_{10} / P_R$$

where: Q_I = wind erosion scaling factor (g/sec)

R_{10} = PM_{10} emission rate of a COPC (g/sec)

P_R = fraction of time wind erosion occurs (0.296)

$X = Q_I \times F_I \times CF$

where: X = average annual downwind respirable concentration (mg/m^3)

Q_I = wind erosion scaling factor (g/sec)

F_I = unscaled conc. due to unit erosion rate[3] [(ug/m^3)/(g/sec)]

CF = conversion factor (1 mg/1,000 ug)

From that concentration, exposure to fugitive dust was then estimated using the following equations:

IEXr = (X x IR x ET x EF x ED x IF-R)/(BW x AT)

and

IEXo = (X x IR x ET x EF x ED x IF-O)/(BW x AT)

where: IEXr = cancer dose from inhaled fraction retained in lungs for adult employee over 25-year period (mg/kg/day)

and

IEXo = cancer dose from inhaled fraction that is eventually swallowed for adult employee over 25-year period (mg/kg/day)

X = Downwind air concentration (mg/m^3)

IR = Inhalation rate (m^3/hr)

ET = Exposure time (hr/day)

EF = Exposure frequency (day/yr)

ED = Exposure duration (yr)

BW = Body weight (kg)

AT = Averaging time (days)

IF-R = inhaled fraction retained in lungs (0.125)

IF-O = inhaled fraction eventually swallowed (0.625)

A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-14. As discussed in Section 2.4.3, the potential receptors for this scenario were adult employees, adult residents, and child residents. The input parameters were generally those provided in the Cowherd model, which allows limited parameter choices for area and distance to the site. Conservative estimates used for all sites include an area of contamination of 10,000 m^2, terrain factors for a light industrial and suburban residential/institutional type setting, and meteorological factors for the local geographic area. The cover factor was conservatively estimated as approximately 80 percent (0.8). For all sites, a conservative model parameter was chosen: the nearest future residences were considered to be 200 m southeast (this is the prevailing wind direction; this parameter is used to derive the unscaled concentration from the erosion rate). For employees, the assumed distance from the site was zero (< 200 m), and therefore the strongest wind direction at 200 m was used to determine the unscaled concentration from the erosion rate. A median particle size of 0.25 mm was assumed for the study area (see Appendix I of the 1995 RI report); this particle size was used to derive the threshold friction velocity.

Subsurface Soil Exposure

Three potential exposure routes are associated with direct exposure to subsurface soil (as future surface soils) at the NWS Earle sites: ingestion, dermal contact, and inhalation of fugitive dust. The methods used to assess these routes of exposure are the same as the assumptions and equations for surface soil presented in the previous section.

Sediment Exposure

Two potential exposure routes are associated with direct contact with sediment at the NWS Earle sites: ingestion and dermal contact during wading (swimming was determined not to be applicable in any of the streams at NWS Earle). The methods used to assess these routes of exposure are discussed in the following text. These scenarios were evaluated in the same way as ingestion and dermal exposures for surface soil, which were explained above.

Table 2-14

EXPOSURE INPUT PARAMETERS - SOIL DUST INHALATION
NWS EARLE, COLTS NECK, NEW JERSEY

Inhalation of Fugitive Dust Emissions

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed (EPA, 1989a, 1993)
V	Vegetative cover factor	0.8	0.8	Estimate from site visit, assuming future conditions would approximate present conditions.
A	Source surface area	10,000 sq. m	10,000 sq. m	Estimate from site visit.
IR	Inhalation rate	Adult: 0.83 cu. m/hour Child: 0.5 cu. m/hour	Adult: 0.83 cu. m/hour Child: 0.5 cu. m/hour	(EPA, 1989a)
ET	Exposure time	Industrial employee: 8 hours/day Residential adult: 24 hours/day Residential child: 24 hours/day	Industrial employee: 8 hours/day Residential adult: 24 hours/day Residential child: 24 hours/day	Conventional
EF	Exposure frequency	Industrial employee: 250 days/year Residential adult: 350 days/year Residential child: 350 days/year	234 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (residential child)	(EPA, 1991a; EPA, 1993)
ED	Exposure duration	Industrial employee: 25 years Residential adult: 24 years Residential child: 6 years	4.5 years (industrial employee) 7 years (residential adult) 2 years (residential child)	90th / 50th percentile time at one residence (EPA,1991a; EPA, 1989a; EPA, 1993) Average duration of employment, (Maguire, 1993)
BW	Body weight	Adult: 70 kg Child: 15 kg	Adult: 70 kg Child: 15 kg	(EPA, 1989a; EPA, 1991a)
LT	Lifetime	70 years	70 years	Conventional
AF	Absorption factor	GI tract: 0.625 Respiratory tract: 0.125	GI tract: 0.625 Respiratory tract: 0.125	(Cowherd et al, 1984) (ICRP, 1968)
U	Mean annual wind speed	2.01 m/sec	2.01 m/sec	(Cowherd et al, 1984, Table 4-1 for Baltimore, MD)
PR	Regional climate factor	0.296	0.296	(Cowherd et al, 1984 Figures 4-5 and 4-7, Region 7)
Fi	Unscaled concentration from erosion rate	3.837 (ug/cu. m) / (g/sec)	3.837 (ug/cu. m) / (g/sec)	(Cowherd et al, 1984, Appendix D for Region 7, 100m x 100m, 200m downwind of source)
U*t	Threshold friction velocity	35 cm/sec	35 cm/sec	(Cowherd et al, 1984, Figure 3-4, Median particle size 0.25 mm)
Z0	Roughness height	70 cm	70 cm	(Cowherd et al, 1984, Figure 3-6, suburban area, medium buildings)

Sample calculations are provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-15 (ingestion) and Table 2-16 (dermal). As discussed in Section 2.4.3, the potential receptors were children weighing 30 kilograms who play at the site. The input parameters for sediment are the same as those for soil, with notable exceptions. Children involved in wading activities would be expected to be older than the typical 15-kilogram child (approximately 3 years old). Therefore, the recreational child in the wading scenario was assumed to play at the site over a 6-year period (age 6 through 12 years, weighing 30 kilograms). Exposure to sediment during wading was expected to involve almost exclusively the feet; therefore, the exposed surface area for the feet of a 30-kilogram child was used.

Groundwater Exposure

Three potential exposure routes are associated with direct contact with groundwater at the NWS Earle sites: ingestion, dermal contact, and inhalation of vapors during showering. The methods used to assess these routes of exposure are discussed in the following text.

Ingestion of groundwater was evaluated using the following equation (EPA, 1989a):

$$IEX = (C \times IR \times EF \times ED)/(BW \times AT)$$

where: IEX = Ingestional exposure dose (mg/kg/day)

C = Water concentration (mg/L)

IR = Ingestion rate (L/day)

EF = Exposure frequency (days/yr)

ED = Exposure duration (yr)

BW = Body weight (kg)

AT = Averaging time (days)

A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-17. As discussed in Section 2.4.3, the potential receptors for this scenario were adult employees, adult residents, and child residents. EPA values were used for all input parameters.

Dermal exposure to groundwater was evaluated using the following equations (EPA, 1992f):

$$DAD = (DA \times EV \times EF \times ED \times SA)/(BW \times AT)$$

where: DAD = Dermally absorbed dose (mg/kg/day)

Table 2-15
EXPOSURE INPUT PARAMETERS - SEDIMENT INGESTION
NWS EARLE, COLTS NECK, NEW JERSEY

Incidental Ingestion of Sediment

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a; 1993)
IR	Ingestion rate	200 mg/day (recreational child	100 mg/day (recreational child	(EPA, 1991a; EPA, 1993)
FI	Fraction ingested from contaminated source	1.0	1.0	Professional judgement based on current and. projected future land use and observed activity patterns
EF	Exposure frequency	7 days/year (recreational child)	7 days/year (recreational child)	(EPA, 1991a)
ED	Exposure duration	6 years (recreational child)	2 years (recreational child)	RME - (EPA, 1991a) Central tendency - prof. judgement
BW	Body weight	30 kg (recreational child)	30 kg (recreational child)	Child approximately 3 years old (15kg) usually used as a receptor; however, wading is expected to occur for older children (age 6 or older)(25 kg) (EPA, 1991a; EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

Table 2-16

EXPOSURE INPUT PARAMETERS - DERMAL CONTACT WITH SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

Dermal Contact with Sediment

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a, 1993)
SA	Skin surface area available for contact	792 sq. cm/day	792 sq. cm/day	Feet only; child; sediment (EPA, 1991g)
AF	Soil-to-skin adherence factor	1.0 mg/sq. cm	1.0 mg/sq. cm	(EPA, 1992f)
ABS	Absorption factor (Applied to initial risk evaluation - see text)	Inorganics = 0.01 Volatile Organic Chemicals = 0.1 Semivolatile Organic Chemicals = 0.05 Pesticides = 0.05 Polychlorinated Biphenyls = 0.06	Inorganics = 0.01 Volatile Organic Chemicals = 0.1 Semivolatile Organic Chemicals = 0.05 Pesticides = 0.05 Polychlorinated Biphenyls = 0.06	Feldman and Maibach (1970) Webster and Maibach (1985) EPA (1984a)
ABS	Absorption factor (Applied to sites with refined risk evaluation)	Arsenic = 0.03 Cadmium = 0.001 PCBs = 0.2 No other COPCs applicable	Arsenic = 0.03 Cadmium = 0.001 PCBs = 0.2 No other COPCs applicable	(Wester, 1993) (Wester, 1992) (EPA, 1993)
EF	Exposure frequency	7 days/year (recreational child)	7 days/year (recreational child)	(EPA, 1991a)
ED	Exposure duration	6 years (recreational child)	2 years (recreational child)	RME - (EPA, 1991a) Central tendency - professional judgement
BW	Body weight	30 kg (recreational child)	30 kg (recreational child)	Wading is expected to occur for older children (age 6 through 12; weight - 25 kg) (EPA, 1991a; EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

Table 2-17
EXPOSURE INPUT PARAMETERS - GROUNDWATER INGESTION
NWS EARLE, COLTS NECK, NEW JERSEY

Incidental Ingestion of Groundwater				
Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a; 1993)
IR	Ingestion rate	1 L/day (industrial employee) 2 L/day (residential adult) 1 L/day (residential child)	0.7 L/day (industrial employee) 1.4 L/day (residential adult) 0.7 L/day (residential child)	RME - (EPA, 1991a) Central tendcy., adult - (EPA, 1993) Central tendency - child / industrial - professional judgement
EF	Exposure frequency	250 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (residential child)	219 days/year (industrial employee) 234 days/year (residential adult) 234 days/year (residential child)	(EPA, 1991a; EPA, 1993)
ED	Exposure duration	25 years (industrial employee) 24 years (residential adult) 6 years (residential child)	4.5 years (industrial employee) 7 years (residential adult) 2 years (residential child)	90th / 50th percentile time at one residence (EPA,1991a; EPA, 1989a; EPA, 1993) ave.duration of employment. (Maguire, 1993)
BW	Body weight	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	70 kg (industrial employee) 70 kg (residential adult) 15 kg (residential child)	(EPA, 1991a; EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

DA = Dose absorbed per event (mg/cm^2/event)

EV = Event frequency (events/day)

EF = Exposure frequency (days/yr)

ED = Exposure duration (yr)

SA = Skin surface area available for contact (cm^2)

BW = Body weight (kg)

AT = Averaging time (days)

$DA = CF \times K \times Cv \times t$ for inorganics

where: DA = Dose absorbed per event (mg/cm^2/event)

CF = Conversion factor (L/cm^3: 1/1000)

K = Permeability coefficient from water (cm/hr)

Cv = Concentration in water (mg/L)

t = Duration of event (hr/event)

$DA = 2 \times CF \times Kp \times Cv\ [((6 \times \tau \times t)/\pi)^{0.5}]$ for organics, $t < t^*$

$DA = Kp \times CF \times Cv\ [t/(1 + B) + [2 \times \tau\ ((1 + 3B)/(1 + B))]]$ for organics, $t > t^*$

where: DA = Dose absorbed per event (mg/cm^2/event)

CF = Conversion factor (L/cm^3: 1000)

Kp = Permeability coefficient from water (cm/hr)

Cv = Concentration in water (mg/L)

t = Duration of event (hr/event)

t* = Compound specific, maximum duration of time for steady-state

τ = Lag time (hr)

B = Partition coefficient

π = mathematical constant, approximately 3.1416

This approach is based on the assumption that water contaminants are present in dilute solution and that percutaneous absorption is controlled by the flux of water. A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-18. As discussed in Section 2.4.3, the potential receptors for this scenario were adult employees (hand washing), adult residents (showering), and child residents (bathing). Adult and child residents were assumed to take daily showers and baths, respectively, and therefore their total body surface areas were used. Employees were assumed to wash their hands for approximately 30 minutes per day at the workplace, and the surface area of their hands and forearms was used. EPA values were used for most input parameters. K, Kp, B, τ, and t* were chemical-specific values obtained from EPA (1992e) or derived from the molecular weight and K_{ow} as demonstrated therein. As recommended by the guidance, default K values of 1E-3 cm/hr were used for metals for which experimental values had not been obtained (EPA, 1992f).

Inhalation exposure to groundwater (during showering) was calculated for adult residents only using the following equations (EPA, 1989a; Foster and Chrostowski, 1987):

$$DI = D \times EF \times ED / AT$$

where: DI = Inhalation dose (mg/kg/day)

D = Inhalation dose (mg/kg/shower)

EF = Exposure frequency (showers/yr)

ED = Exposure duration (yrs)

AT = Averaging time (days)

Inhalation of vapors in groundwater was evaluated using the following equations (Foster and Chrostowski, 1987):

The term D is estimated as follows:

$$D = [(IR \times S) / (BW \times Ra \times CF)] \times Q$$

where: D = Inhalation dose (mg/kg/shower)

TABLE 2-18

EXPOSURE INPUT PARAMETERS - DERMAL CONTACT WITH GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

Dermal Contact with Groundwater

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentratio	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a; EPA, 1993)
SA	Skin surface area available for contact*	820 sq. cm/day (industrial employee 19,400 sq. cm/day (residential adult 5,910 sq. cm/day (residential child)	820 sq. cm/day (industrial employee 19,400 sq. cm/day (residential adult 5,910 sq. cm/day (residential child)	Industrial employee: hands Adult and child: body (EPA, 1989b)
ET	Exposure time*	0.5 hours/day (industrial employee) 0.25 hours/day (residential adult) 0.33 hours/day (residential child)	0.5 hours/day (industrial employee) 0.117 hours/day (residential adult) 0.33 hours/day (residential child)	Industrial employee: 30 minutes/day (Professional judgment) Adult: 15 min./day (7 - Central Tndcy.) Child: 20 minutes/day EPA (1991a)
EF	Exposure frequency	250 days/year (industrial employee) 350 days/year (residential adult) 350 days/year (residential child)	219 days/year (industrial employee) 234 days/year (residential adult) 234 days/year (residential child)	(EPA, 1991a; EPA, 1993)
ED	Exposure duration	25 years (industrial employee) 24 years (residential adult) 6 years (residential child)	4.5 years (industrial employee) 7 years (residential adult) 2 years (residential child)	90th / 50th percentile time at one residence (EPA,1991a; EPA, 1989a; EPA, 1993) Average duration of employment, (Maguire, 1993)
BW	Body weight	Adult: 70 kg Child: 15 kg	Adult: 70 kg Child: 15 kg	(EPA, 1991a; EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)
K, Kp	Permeability coefficients (cm/hour)	Contaminant-specific	Contaminant-specific	(EPA, 1992f)
τ	Lagtime (hours)	Contaminant-specific	Contaminant-specific	(EPA, 1992f)
B	Partition coefficient	Contaminant-specific	Contaminant-specific	(EPA, 1992f)

* Adult residents assumed to shower daily; child residents assumed to bathe daily; industrial employee assumed to wash hands daily.

Q = Function of air exchange rate and time in shower and shower room (min)

IR = Inhalation rate (L/min)

S = Indoor VOC generation rate (ug/m^3/min)

BW = Body weight (kg)

Ra = Rate of air exchange (min^{-1})

CF = Conversion factor: 10^6 ug x L / (mg x m^3)

The term Q is calculated:

$$Q = Ds + [(\exp(-Ra \times Dt))/Ra] - [(\exp(Ra \times (Ds-Dt)))/Ra]$$

where:

Q = Function of air exchange rate and time in shower and shower room (min)

Ds = Duration of shower (min)

Dt = Total time in shower room (min)

Ra = Rate of air exchange (min^{-1})

The term S is estimated as follows:

$$S = Cwd \times FR / SV$$

where:

S = Indoor voc generation rate (ug/m^3/min)

Cwd = Concentration leaving water droplet (ug/L)

FR = Shower flow rate (L/min)

SV = Shower room air volume (m^3)

The term Cwd is calculated:

$$Cwd = C \times CF \times (1-\exp[(-KaL \times ts)/60d])$$

where:

Cwd = Concentration leaving water droplet after time ts (ug/L)

C = Concentration in water (mg/L)

CF = Conversion factor (1000 ug/1 mg)

KaL = Adjusted overall mass transfer coefficient (cm/hr)

ts = Shower droplet time (sec)

d = Shower droplet diameter (mm)

The term KaL is calculated:

$$KaL = KL / [(T_1 \times \mu_S)/(T_s \times \mu_1)]^{0.5}$$

where: KaL = Adjusted overall mass transfer coefficient (cm/hr)

KL = Mass transfer coefficient (cm/hr)

T_1 = Calibration water temperature of KL °K)

Ts = Shower water temperature (°K)

μ1 = Water viscosity at T1 (centipoise)

μS = Water viscosity at Ts (centipoise)

The term KL is calculated as follows:

$$KL = 1/[(1/kl) + ((R \times T)/(H \times kg))]$$

where: KL = Mass transfer coefficient (cm/hr)

R = Ideal gas law constant atm (m^3/mol/°K)

T = Absolute temperature (°K)

H = Henry's Law constant (atm-m^3/mole)

kg = Gas-film mass transfer coefficient (cm/hr)

kl = Liquid-film mass transfer coefficient (cm/hr)

The terms kg and kl are calculated:

$$kg = kH \times (MWH / MW)^{0.5}$$

where: $kl = kC \times (MWC / MW)^{0.5}$

kg = Gas-film mass transfer coefficient (cm/hr)

kl = Liquid-film mass transfer coefficient (cm/hr)

kH = kg for water (cm/hr)

kC = kl for carbon dioxide (cm/hr)

MWH = Molecular weight of water (g/mole)

MWC = Molecular weight of carbon dioxide (g/mole)

MW = Molecular weight of the chemical (g/mole)

The volatile chemical generation rate was estimated using the Foster and Chrostowski mass transfer model, which is based on two-phase film theory. The model employs contaminant-specific mass transfer coefficients, Henry's Law constants, droplet drop time, viscosity, temperature, etc. Specific details regarding the application of the mass transfer model can be found in the source documents (Foster and Chrostowski, 1987).

A sample calculation is provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-19. It was assumed that small children would take baths rather than showers and that employees would not shower at work; therefore, only adult residents were selected as potential receptors for this pathway. (The assumption that employees would not shower at the workplace on a frequent basis is consistent with the worker habits of the vast majority of the working population and with typical behavior patterns in the occupations listed in Section 2.4.3.2.) EPA input parameters were used.

Surface Water Exposure

Two potential exposure routes are associated with surface water exposure at the NWS Earle sites: ingestion and dermal contact during wading. The methods used to assess these routes of exposure are discussed in the following text. These scenarios were evaluated in the same way as ingestion and dermal exposures for groundwater, which were explained in the previous section.

Sample calculations are provided in Appendix I of the 1995 RI report. The input parameters for this exposure route, along with the rationale for the selection of each value, are presented in Table 2-20 (ingestion) and Table 2-21 (dermal). As discussed in Section 2.4.3, the potential receptors were children weighing 30 kilograms who play at the site. The input parameters for surface water are the same as those for groundwater, with notable exceptions. Children involved in wading activities would be expected to be older than the typical 15-kilogram child (approximately 3 years old). Therefore, the recreational child in the wading scenario was assumed to play at the site over a 6-year period (age 6 through 12 years, weighing 30 kilograms). Exposure to sediment during wading was expected to involve the feet only.

Blood-Lead Modeling

As outlined in OSWER directive 9355.4-12, EPA has implemented an approach to evaluating lead risks that recognizes the multimedia nature of lead exposures, incorporating absorption and pharmacokinetic information. Research has been done concerning lead intake and resultant blood-lead levels. Determinations of lead uptake from soil, sediment, drinking water, and surface water were considered. For the purposes of this risk assessment, each pathway was evaluated separately so that the contribution of lead from each source and each exposure route could be evaluated. Potential blood-lead level

Table 2-19

EXPOSURE INPUT PARAMETERS - GROUNDWATER INHALATION
NWS EARLE, COLTS NECK, NEW JERSEY

Inhalation of Volatile Emissions During Showering (Residential adults only)

Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximu value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a, 1993) Used to calculate volatile chemical generation rate (ug/cu. m/min)
H	Henry's law constant	Contaminant-specific	Contaminant-specific	Required for model application
Kg, Kl	Gas and liquid phase mass transfer coefficients	Contaminant-specific	Contaminant-specific	Required for model application
Ds	Shower duration	15 minutes	7 minutes	(EPA,1991a)
Dt	Total time in bathroom	20 minutes	11 minutes	Professional judgement
Sv	Shower room air volume	6 cu. m	6 cu. m	Professional judgement
FR	Shower flow rate	20 L/min	20 L/min	Professional judgement
Ts	Shower water temperature	318 degrees Kelvin	318 degrees Kelvin	(Foster and Chrostowski, 1987)
Ra	Air exchange rate	0.01667/min	0.01667/min	(Foster and Chrostowski, 1987)
IR	Inhalation rate	14 L/min	14 L/min	(EPA, 1989a)
EF	Exposure frequency	0.96/day	0.96/day	One shower per day, 350 days/year (EPA, 1991a)
ED	Exposure duration	30 years	9 years	90th / 50th percentile at one residence (EPA, 1989a, 1993)
BW	Body weight	70 kg	70 kg	Conventional (EPA, 1989a)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

Table 2-20

EXPOSURE INPUT PARAMETERS - SURFACE WATER INGESTION
NWS EARLE, COLTS NECK, NEW JERSEY

Incidental Ingestion of Surface Water (Recreational Children)				
Input Parameter	Description	Parameter Value		Rationale
		RME	Central Tendency	
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a; 1993)
IR	Ingestion rate	0.2 L/day	0.2 L/day	(EPA, 1989a)
EF	Exposure frequency	7 days/year	7 days/year	(EPA, 1989a)
ED	Exposure duration	6 years	2 years	RME - (EPA, 1991a) Central tendcy. - prof. judgement
BW	Body weight	25 kg	25 kg	Professional judgement, child age 6 or older (EPA, 1989b)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)

Table 2-21

EXPOSURE INPUT PARAMETERS - DERMAL CONTACT WITH SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

Dermal Contact with Surface Water

Input Parameter	Description	Parameter Value RME	Parameter Value Central Tendency	Rationale
C	Exposure concentration	Representative concentration (mg/kg) Upper 95% UCL or maximum value (whichever less)	Representative concentration (mg/kg) Upper 95% UCL or average value (whichever less)	Upper 95% confidence limit on arithmetic average (based upon normal or log-transformed data distribution) (EPA, 1989a; 1993)
SA	Skin surface area available for contact	3,580 sq. cm/day	3,580 sq. cm/day	Wading: legs, feet, and hands (EPA, 1989b)
ET	Exposure time	2.6 hours/day	2.6 hours/day	(EPA, 1989a)
EF	Exposure frequency	7 days/year	7 days/year	(EPA, 1989a)
ED	Exposure duration	6 years	2 years	RME - (EPA, 1991a) Central tendcy. - prof. judgement
BW	Body weight	25 kg	25 kg	Professional judgement, child age 6 or older (EPA, 1989b)
AT	Averaging time	ED x 365 days/year	ED x 365 days/year	Noncarcinogens (EPA, 1989a)
		70 years x 365 days/year	70 years x 365 days/year	Carcinogens (EPA, 1989a)
K, Kp	Permeability coefficients (cm/hour)	Contaminant-specific	Contaminant-specific	(EPA, 1992f)
TAU	Lagtime (hours)	Contaminant-specific	Contaminant-specific	(EPA, 1992f)
B	Partition coefficient	Contaminant-specific	Contaminant-specific	(EPA, 1992f)

increases were estimated and are discussed, along with the potential implications of blood-lead results for each NWS Earle site. The following paragraphs present information that is useful in estimating lead exposure.

No threshold has been defined for effects related to blood-lead increases. The estimated increases at this site are well below the concentrations at which effects such as anemia and neuropathy occur (40 ug/dL and above) (Doull et al., 1986). Effects below 10 ug/dL are difficult to define. Inhibition of certain enzymes involved in red blood cell metabolism has been reported to occur at 10 to 15 ug/dL and possibly lower (EPA, 1991e). Small increases in blood pressure have been related to adults with blood-lead levels down to 7 ug/dL (EPA, 1991e). Probably the most sensitive subpopulation to effects at the 3 to 7 ug/dL range (where the concentrations estimated for this study area would fall) would be infants, whose early neurological development can be affected by blood-lead concentrations reportedly down to 5 ug/dL (EPA,1991e). Lead is also a fairly common environmental contaminant and, for this reason, typical blood-lead levels in the population at large may already exceed the concentrations discussed here.

For drinking water exposure, children 0 through 6 months old are expected to experience blood-lead increases at the rate of 0.26 ug/dL per ug/L lead in water up to 15 ug/L and at the rate of 0.04 ug/dL for every ug/L lead in water above 15 ug/L (EPA, 1991e). For older children, the ratio is 0.12 ug/dL blood lead per ug/L lead in water up to 15 ug/L and 0.06 ug/dL for every ug/L lead in water above 15 ug/L (EPA, 1991e). For adults, the ratio is approximately 0.06 ug/dL blood lead per ug/L in water (EPA, 1991e).

Dietary intake of lead is assumed to produce increases of 0.02 to 0.04 ug/dL blood lead per ug/day ingested by adults and 0.16 ug/dL blood lead per ug/day ingested by infants (EPA, 1986a).

Blood-lead levels are estimated to increase by 0.6 to 6.8 ug/dL per 1,000 mg/kg lead in soil (EPA, 1986a).

Estimates of blood-lead levels in residential children (age 0 through 6 years) were made using the Integrated Exposure and Uptake Biokinetic (IEUBK) Model (version 0.99) developed by EPA. The model was applied to any site where at least one of the media (surface soil, subsurface soil, or groundwater) was sampled and at least one detection of lead was present. Note that the model was run more than once for a site whenever two distinct exposure scenarios were considered (e.g., future exposure to surface soil; future exposure to subsurface soil that becomes surface soil). If groundwater was not sampled at a site, then the concentration of lead in background groundwater samples was used as the input into the IEUBK Model. Conversely, the concentration of lead in background soil was used as input into the model when neither surface nor subsurface soil was sampled at a site. The output for each run of the IEUBK Model is a histogram that presents the estimated percentage of residential children (age 0 through 6 years) with a blood-lead level above 10 ug/dL (considered to be the significance cutoff level above which adverse effects cannot be ruled out). When the percentage of the population estimated to have blood-levels above

10 ug/dL is greater than five percent, then EPA considers the potential for adverse effects to be significant (EPA, OSWER 9355.4). These histograms, along with input information particular to each run of the IEUBK model, are presented in Appendix D. The estimated percentage of residential children (age 0 through 6 years) with a blood-lead level above 10 ug/dL is also presented in the site-specific text contained in subsequent sections of this report. Uncertainties associated with the IEUBK model are discussed in Section 2.4.5.9.

2.4.4 Risk Characterization

Potential human health risks resulting from the exposures outlined in the preceding sections are characterized on a quantitative and qualitative basis in this section. Quantitative risk estimates are generated based on risk assessment methods outlined in current EPA guidance (EPA, 1989a).

2.4.4.1 Determination of Risks

Noncarcinogenic risk estimates are presented in the form of Hazard Quotients (HQs) and Hazard Indices (HIs) that are determined through comparison of estimated intakes with published RfDs. Incremental cancer risk estimates are provided in the form of dimensionless probabilities based on SFs.

Estimated human intakes were developed for each of the specific exposure routes discussed in the preceding sections. Both carcinogenic and noncarcinogenic risks are summarized for each exposure route on a series of tables in this section.

Carcinogenic Risks

Incremental cancer risk estimates are generated for each of the exposure pathways using the estimated intakes and published SFs, as follows:

$$\text{Risk} = \text{Intake} \times \text{SF}$$

If the above equation results in a risk greater than 0.01, the following equation is used:

$$\text{Risk} = 1 - [\exp(-(\text{Intake} \times \text{SF}))]$$

The risk determined using these equations is a unitless expression of an individual's increased likelihood of developing cancer as a result of exposure to carcinogenic chemicals. An incremental cancer risk of 1E-06 indicates that the exposed receptor has a one in a million chance of developing cancer under the exposure assumptions defined for that receptor. These specific assumptions for exposure frequency, duration, and dose represent a reasonable maximum exposure (RME) estimate (defined as the highest exposure that is reasonably expected to occur at a site). The calculated cancer risks should therefore be recognized as upper-limit estimates. SFs are the upper 95 percent confidence limit of a dose-response curve generally derived from animal studies. Actual human risk, while not identifiable, is not expected to exceed the upper limit based on the SFs and may, in fact, be lower.

For each chemical, carcinogenic risks are calculated separately (using different SFs) for oral, inhalation, and dermal exposures. Carcinogenic risks for ingestion, inhalation, and dermal exposures are then summed for each receptor exposure pathway and compared to target risk ranges.

In the National Contingency Plan, EPA has defined risks in the range of 1E-04 to 1E-06 as being acceptable for most hazardous waste facilities addressed under CERCLA. For CERCLA activities, residual risks on the order of 1E-06 are the primary goal but are often modified by such regulatory requirements as MCLs or chemical-specific clean-up goals.

Noncarcinogenic Risks

Noncarcinogenic risk is assessed using the concept of HQs and HIs. The HQ is the ratio of the estimated intake and the RfD for a selected chemical of concern, as follows:

$$HQ = Intake/RfD$$

HIs are generated by summing the individual HQs for the COPCs. If the value of the HI exceeds unity (1.0), the potential for noncarcinogenic health risks associated with exposure to that particular chemical mixture cannot be ruled out (EPA, 1986b). In that case, particular attention should be paid to the critical effects (i.e., the most sensitive toxicity effects that were selected as the basis for the RfD) and the associated target organ(s) affected by each chemical. In particular, it should be noted that toxic effects for different organs are not truly additive. Thus, the HI is not a mathematical prediction of the severity of toxic effects; it is simply a numerical indicator of the possibility of the occurrence of noncarcinogenic (threshold) effects.

To account for the potential additivity of exposures to multiple chemicals, noncancer risks were grouped and summed together by target organ/organ system. Summed noncancer risks with HI greater than one are identified and discussed in the amended risk assessment. Note that, for target organs belonging to the same organ system (for example, heart and hematopoietic system are both part of the cardiovascular system), effects were considered as additive for the purposes of this amended baseline risk assessment.

Table 2-13 presents available data for the principle target organs affected by chronic exposure to each substance detected at NWS Earle. These data have been extracted from the toxicological profiles presented in Appendix I of the 1995 RI report and from IRIS and Heast. Only the target organs considered to be affected by chronic (as opposed to acute) exposures have been included in this table. The table distinguishes effects that are cited only for one route of exposure (for example, inhalation) when RfDs exist for more than one route of entry. When multiple target organs may be affected, the critical effect that is the basis of the RfD can be examined for that chemical (see Appendix I of the 1995 RI report).

Lead Risks

EPA's approach to evaluating lead risks goes beyond providing a single point estimate output and incorporates absorption and pharmacokinetic properties. Section 2.4.3.4 discusses background information related to blood-lead estimation methods. Soil concentrations for lead were compared to the value of 400 ppm as discussed in OSWER directive 9355.4-12, and groundwater results were compared to the 15 ug/L EPA action level. Results above these guidelines are assessed for each applicable NWS Earle site.

2.4.4.2 Receptor Risks

Receptor risks are presented for each NWS Earle site in the form of tables and summary text. Each of these sections includes summaries of risks estimated by the exposure scenarios. It should be noted that, in each risk summary table where HQs are reported as "N/A," the HQs were not calculable because no RfD has been established. Usually in such cases, carcinogenicity is considered to be more important, since carcinogenicity will generally be seen at lower doses than noncarcinogenic effects. Cancer risks of zero or "N/A" generally indicate that the chemical is not carcinogenic or that an SF has not yet been developed. Non-cancer risks which have been grouped according to target organ indicate "N/A" for cases where the literature indicates a potential toxic effect for that organ but no RfD has been established.

Initial risk estimations for each site are based on reasonable maximum exposure (RME). Input values for RME are considered conservative and the risks are estimated under the assumptions that the exposure estimated is unlikely (representing of 90% of the population) to be exceeded by a potential receptor at an NWS Earle Site. If the cancer risk for a receptor pathway exceeded 1 X 10^{-4} or the noncancer risk (HI) was greater than one, then a further estimation of risk was performed using central tendency assumptions (CTE) (EPA, 1993a). The central tendency approach uses exposure input parameters associated with average or 50th percentile behavior patterns rather than upper 90th percentile values, so that a more realistic expectation of risk can be estimated. In contrast, the high end risks that were estimated using reasonable maximum exposure (RME) assumptions in the initial risk assessment may be overestimated to an extent. The central tendency estimate can be considered alongside the RME risk and used in the decision-making process to help evaluate the need for remedial actions. The default exposure assumptions used for evaluation of central tendency risks are presented in Tables 2-14 through 2-23 alongside the counterpart exposure assumptions that were used for the initial RME risk evaluation.

2.4.5 Risk Assessment Uncertainties

As discussed in EPA (1989a), the risk measures used in Superfund site risk assessments are not fully probabilistic estimates of risk but rather are conditional estimates based on a considerable number of assumptions about exposure and toxicity. There are uncertainties associated with each aspect of risk assessment, from environmental data collection through risk characterization. To support decision-making processes, significant uncertainties in the risk assessment for NWS Earle are noted in the following sections.

2.4.5.1 Uncertainties in the Physical Setting and Receptor Exposure Pathways

Land Use Designation

Reliable information on current land uses at NWS Earle sites (discussed in Section 1.3 and in each site evaluation) was gathered from previous investigations and from communications with Navy personnel. Many areas are within explosive safety zones that prohibit offices or residential dwellings, but eight NWS Earle sites are within areas allowing administrative or housing land uses. Although future residential and future industrial land use scenarios were both considered in the risk assessment for each NWS Earle site, the Navy believes it is unlikely that future land use would vary significantly from current descriptions unless a major base realignment were to occur.

Receptor Pathways and Activity Patterns

Sections 2.4.3.2 and 2.4.3.3 discuss the rationale for including specific potential receptors and exposure routes by medium. Based on known and projected activity patterns, current and future receptors in the NWS Earle setting were considered to engage in a range of activities adequately approximated by default exposure parameter assumptions. For the future industrial worker, a separate exposure pathway was not included for workers engaged in soil-contact-intensive activities (this scenario is compared to the soil noncontact-intensive scenario as part of the discussion of intake parameter uncertainties). In addition, a separate hunter scenario was not considered, for the reasons discussed in Section 2.4.3.2.

2.4.5.2 Environmental Data Collection Uncertainties

Selection of Locations and Number of Samples

For each site, the areal extent of the samples (including the number collected and location of the sampling points) in a particular medium impacts the calculation of representative concentrations. Every effort was made to collect samples that reflect actual site conditions and to include areas thought to contain the most significant contamination or exposure problems. Therefore, the magnitude of this uncertainty on risks is expected to be low because, during the planning stages of the RI, the quantities of samples to be collected were selected to allow a reasonable characterization of site-related contamination.

Focused, Nonrandom Sampling

At certain NWS Earle sites, areas of concern were previously identified that are currently slated to undergo remediation/removal. The use of biased sampling in the 1995 RI allows the risk assessment calculations to focus not on these areas but on data gaps and other surrounding potentially affected areas. This does not increase the uncertainty in the risk assessment per se but instead makes the risk assessment conditional on the assumptions of a planned clean-up action.

Selection of Samples with Naturally Occurring Background Levels

As discussed in the RI report, background samples were collected in order to measure the range of concentrations of substances in each medium that are associated with non-site-related sources within the vicinity of NWS Earle. The diversity and abundance of inorganics in soil and sediment samples are determined by the soil's content in bedrock or other deposits, the effects of climatic and biological factors, and agricultural and industrial influences. However, if native soil types are encountered in site-related samples that are unlike those of background samples, then the evaluation of naturally occurring levels could be biased and might lead to overestimation of the amount of contamination attributable to NWS Earle activities.

The abundance of inorganics in groundwater is determined by, among other things, the particular geological formation in which the well is screened. If monitoring well results from a particular NWS Earle site are compared to background wells situated in a different formation, then this could lead to an over- or underestimation of the amount of contamination attributable to NWS Earle activities. The risk assessment provides an evaluation of background groundwater samples grouped by formation in order to minimize the chances of this type of bias.

2.4.5.3 Analytical Data Uncertainties

Incorporation of Data from Different Investigations

Analytical data were evaluated from the 1992 RI and the 1995 RI. The impact of including both data sets in fate and transport evaluations at many sites and of using the older 1992 RI data for risk assessment at one site is considered to be minimal because analytical methods were generally similar and both data sets were subjected to laboratory QC review and data validation processes.

Analytical Data Usability

Established data validation procedures were applied to define analytical uncertainties in terms of qualifying data as inaccurate or imprecise and to eliminate data points that are unusable for risk assessment. This treatment does not eliminate all uncertainty but focuses attention on potential areas of concern regarding accuracy, precision, and data gaps. As discussed in Section 2.5, the overall percentages of rejected data points were acceptably low on a site-by-site basis, and data rejection was limited to substances that were neither associated with site activities nor present at high levels.

2.4.5.4 Data Evaluation Uncertainties

Accuracy of Upper Tolerance Limits Used in Background Comparisons

When a limited number of points are sampled, reduced accuracy is expected for the upper 95 percent tolerance limit. In such cases, this statistic is still expected to, on the average, estimate the upper 95 percentile of the population. However, for an individual case, the true percentage of the population that exceeds the calculated tolerance limit will be more likely to differ markedly from the predicted five percent when too few samples are collected. In the event that the upper 95 percent tolerance limit for background samples is overestimated, this could defeat the attempt to identify site-related samples with levels greater than naturally occurring background and may lead to an underestimate of the risk attributable to a site. To avoid this consequence, the amended risk assessment restricted the application of the upper tolerance limit approach when there were only two or three background samples and the tolerance limits were computed to be inappropriately large.

Statistically Representative Exposure Concentrations

Uncertainties exist regarding selection of a concentration for input into the quantitative risk assessment. The use of the representative concentration to estimate risk is generally regarded as a conservative estimate since this entails using either the upper 95 percent confidence limit on the arithmetic mean (based on normal or log-transformed data distribution) or the maximum concentration. The choice of the representative concentration as the value for input into the risk assessment generally lowers the chances of under estimation of the actual risk present in a pathway at a particular site to a potential receptor. However, the use of the representative concentration may overestimate the actual risk present in an exposure pathway at a particular site. To help avoid this problem, the maximum value was used in place of the upper 95 percent limit when the latter was larger. As an additional step, if the initial risk calculation yielded a borderline high risk, the amended risk assessment provided a supplemental risk calculation using a central tendency approach, which utilizes the arithmetic average rather than the maximum value as the alternative to the statistically derived exposure concentration.

Distributional Shape of the Sample Population

The ability (power) of the W test to be able to correctly identify genuine differences between the shape of a sample population versus a reference normal or lognormal population is reduced when too few samples are collected. If an incorrect distributional assumption is made based on this test, this could lead to an over- or underestimate of the upper 95 percent concentration, which in turn would create some additional uncertainty as to whether the calculated risk is a reasonable approximation of high end exposure. To help avoid potentially overestimating risk, the maximum value was used in place of the upper 95 percent limit when the latter was larger.

2.4.5.5 Exposure Model Applicability and Assumptions

Uncertainties in Chemical Specific Properties

The chemical-specific parameters such as K_{oc} were literature-derived values that are measured under conditions that may or may not be representative of on-site conditions. Parameters such as vapor pressure and solubility were not always obtainable at the desired temperature.

Groundwater Concentration Uncertainties

Uncertainties associated with the lack of groundwater modeling at the site include the assumption that current conditions are indicative of future concentrations of contaminants. Contaminants may increase (due to migration, loading, or chemical transformation) or decrease (due to migration or transformation) over time and vary from site to site and within the mixing zone.

The use of unfiltered monitoring well data for the evaluation of groundwater inorganics provides in all probability an overestimation of exposure and risk. Comparison with the filtered data reveals how many of the metals may have been attributable to suspended sediment.

Fugitive Dust Emissions Model Assumptions

Exposure to fugitive dust emissions conservatively assumes that residents and workers will be exposed to the same concentration indoors as outdoors (a very conservative assumption), that soils within an area have unlimited erosion potential, that emissions can be estimated from mean annual windspeed and vegetative cover, and that dispersion concentrations can be estimated from source area, downwind distance to receptors, and region-wide meteorological factors. For receptors exposed to fugitive dust emissions, it was assumed that future conditions would approximate present conditions in terms of the estimated fraction vegetative cover. If future vegetative cover changes, then dust exposures could be lower or higher than estimated by the model. However, the impact of this error would not be significant because a worst-case (no vegetative cover) scenario would only increase exposures calculated by the model by a factor of 5, while inhalation exposures at NWS Earle sites were estimated as several orders of magnitude below levels of concern.

Future Subsurface Soil Disturbance and Exposure

For the future industrial and future residential receptors, the use of current subsurface soil concentrations to represent future surface soil concentrations assumes two things that add to the uncertainty of this risk assessment: that soil would erode or be excavated to the sampling depth that, once the soil is eroded or excavated to the subsurface soil sampling depth, no degradation of the chemicals in the future surface soil would take place. These uncertainties may cause overestimation of the exposure at a particular site.

Soil Dermal Absorption Model Applicability

The model for dermal exposure to soil and sediment assumes that only a very thin, constant thickness layer of soil is available for contaminant transfer to the stratum corneum and that a constant amount of contaminant, proportional to the soil concentration, will be absorbed per unit area of skin and per exposure event. However, adherence to skin varies with such factors as particle size, soil type, and organic carbon content. As estimated by EPA (1992e), the absorbed dermal dose could vary by as much as a factor of 50 from the model estimates, even assuming that activity patterns lead to the exposure duration applied in the experimental trials used to develop absorption factors. Because of the lack of reliable data regarding dermal absorption factors, the amended risk assessment provides dermal soil exposure estimates only for three chemicals for which well documented absorption factors are available (arsenic, cadmium, and PCBs). Even so, considerable uncertainty exists with the accuracy of estimates applied for these three chemicals. For other chemicals, the initial risk assessment calculations included estimates of dermal exposure using chemical class-specific absorption factors that are to be considered even more uncertain and useful primarily for a qualitative assessment of dermal exposure.

Dermal Absorption from Contaminant Exposures in Aqueous Media

Prediction of absorption rates for lipophilic compounds is difficult due to, among other reasons, the possibility of a second absorption pathway that depends on the lipid content of the stratum corneum at the application site. Experimental determination of absorption rates indicates that interspecies differences are considerable, which, along with other variabilities related to condition and age of skin, differences in lag time, and site of application effects, yields appreciable uncertainty in estimated dermal exposures by using published chemical-specific permeation functions. In addition, literature data indicate a variation by as much as a factor of 300 in chemical absorption rates for skin in different anatomical areas of the body. It should also be noted that children generally have greater absorption rates than adults.

Model Assumptions for Inhalation of VOCs During Showering

Uncertainties exist in the exposure model for the inhalation of volatiles during showering such as chemical-specific rates of volatilization, droplet size, and droplet residence time in the shower. Most of the inputs into the models were considered conservative; therefore, the output may overestimate the exposure for this route.

2.4.5.6 Exposure Intake Parameter Uncertainties

Standard Default Exposure Assumptions

Exposure assumptions can add uncertainty into the risk assessment process based on input values selected for each exposure route. For example, not all people weigh 70 kilograms, drink 2 liters of water per day, and live at the same residence for 30 years. The rationale for each assumption was provided in each table of input parameters. Receptor characteristics, such as age and body weight, were based on published values. Conservative values (based on reasonable maximum exposure or professional judgment) were used in most exposure equations, except where average values were expected to better correspond to actual site conditions.

Soil Ingestion Rates

In the case of current and future occupational workers, soil ingestion rates were based on noncontact-intensive activities described in Section 2.4.3.2. A higher level of short-term incidental soil ingestion by NWS Earle workers could occur as a result of soil-contact-intensive activities such as excavation, underground utility work, road repair/construction, and heavy landscaping (tree and shrub planting, drainage routing, land re-sloping, or embankment construction). However, contact-intensive activities are typically event driven or seasonal and so should average out to less than 6 months duration per year for a given worker. Assuming that exposures that are equal in terms of total dose over time are equivalent in their potential to cause an effect (i.e., Haber's Rule), a noncontact intensive, 100 mg/day incidental soil ingestion rate averaged over 250 days per year might provide an order-of-magnitude similar risk as an annual exposure comprised of 6 months at a 100 mg/day ingestion rate plus 6 months at a higher (480 mg/day) soil ingestion rate (EPA, 1991i; EPA, 1992i).

2.4.5.7 Toxicity Assessment Uncertainty

There is uncertainty associated with the RfDs and SFs. The uncertainty results from the extrapolation of animal data to humans, the extrapolation of carcinogenic effects from the laboratory high-dose to the environmental low-dose scenarios, and interspecies and intraspecies variations in toxicological endpoints caused by chemical exposure. The use of EPA SF values is generally considered to be conservative because the doses are based on no-effect or lowest-observed-effect levels and then further reduced with uncertainty factors to increase the margin of safety by a factor in the neighborhood of 10 to 1,000-fold. The RfDs and SFs of some chemicals have not been established, and therefore toxicity could not be quantitatively assessed. In most cases, where RfDs were unavailable for carcinogens, the carcinogenic risk is considered to be much more significant since carcinogenic effects usually occur at much lower doses.

Additional uncertainties were associated with the adjustment of oral dose-response parameters for dermally absorbed doses. As noted, when absorption factors were not available, the chemical was assumed to be 100 percent absorbed during the RfD or SF study. While this is likely to be realistic for volatile compounds, the assumption could be underprotective for chemicals absorbed less than 100 percent.

For six chemicals (coded with a "W" in Table 2-9), toxicity constants were utilized that have been withdrawn from IRIS, pending further agency review. In these cases, there may be additional uncertainty in the associated SFs or RfDs, based on the original or new studies that were the basis for considering a reevaluation of toxicological properties. If the uncertainty related to using a withdrawn toxicity constant is critical (i.e., found to drive a significant risk at a site), then additional information be can obtained on the exact reasons for withdrawal from the EPA Environmental Criteria and Assessment Office (ECAO), Cincinnati, Ohio.

2.4.5.8 Risk Characterization Uncertainty

From a toxicological standpoint, it is not strictly correct to add HQs for a total HI, because RfDs are based on effects to various target organs. However, if the HI is less than 1.0, this demonstrates that, even when this conservative calculation is performed, the noncarcinogenic HI does not indicate a hazard for a particular exposure pathway. This is a conservative approach that will generally overestimate the HI for a particular pathway. To reduce the extent of overestimation when significant risks occurred at a site, a less conservative approach was used in the amended risk assessment wherein noncancer risks were grouped and summed together for only those chemicals affecting the same target organ/organ system. One additional source of uncertainty in the HI approach is that these models assumed that chemicals did not interact synergistically (a possible underestimate of the actual risk) or antagonistically (a possible overestimate of the actual risk).

2.4.5.9 IEUBK Modeling Uncertainty

The IEUBK model accounts for the multimedia nature of lead exposure, incorporates absorption and pharmacokinetic information, and allows the risk manager to consider the potential distributions of exposure and risk likely to occur at a site (the model goes beyond providing a single point estimate output). Although uncertainties are associated with blood lead modeling using the IEUBK model, these uncertainties are considered lower than those that conceivably would result from similar lead evaluations performed using a traditional toxicity slope-based approach. Important uncertainties and limitations in the use of the IEUBK model are as follows:

The IEUBK model is predictive of blood lead for residential children in the range of 6 months to 7 years of age, which typically is considered to be a more sensitive subpopulation than adults. The model does not apply to adults in either residential or occupational settings. In addition, the IEUBK model does not predict the blood lead levels of pregnant women and does not include an exposure component based on the transfer of lead from the mother's blood to the fetus before birth, although a significant potential exists for adverse effects of prenatal lead exposure on neurobehavioral and physical development (EPA, 1994a).

The IEUBK model uses a default of 30 percent lead absorption from soil. However, the bioavailability of lead from different sources may be variable due to differences in lead speciation, particle size, and mineral matrix and may also vary as a function of physiological parameters such as age, nutritional status, gastric pH, and transit time. For example, lead absorption from paint chips in soil may be different than lead absorption from other chemical forms.

Blood-lead variability in the IEUBK model is characterized by a single number, the geometric standard deviation, which is set to a default value of 1.6. This value represents the aggregate uncertainty in all sources of population variability, including biological, uptake, exposure, sampling, and analytical components.

Child blood-lead level predictions obtained using the IEUBK model reflect only the contributions of sources entered into the model and do not take into account any existing body burden that may be the result of prior exposures or any exposures that may have taken place at alternate locations away from the household or neighborhood level, such as parks or daycare centers.

2.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

The objective of this section is to evaluate data quality of field quality control blanks, field duplicate precision, laboratory quality control analyses and precision, accuracy, representatives, comparability, and completeness (PARCC).

2.5.1 Field Quality Control Blanks

Field quality control blanks are generally used to measure success of the program to avoid extraneous contamination during sample collection, storage, and transport. Possible contaminant sources within the field sampling process may include bottleware, sampling equipment, rinsate water, solvent vapors, and items (e.g., gloves) that may contact samples or sample containers.

Field Blanks

Field blanks were obtained to estimate incidental or accidental contamination from field sampling techniques and to determine if cross-contamination of samples had occurred. Field blanks were taken separately from each source of equipment decontamination water (potable water and bottled deionized water) and analyzed for TCL volatiles, semivolatiles, and pesticides/PCBs; selected explosives; TAL metals and cyanide; hexavalent chromium; and other miscellaneous (wet chemistry) parameters in accordance with NFESC guidelines.

Trip Blanks

Trip blanks were used to determine if contamination was introduced during sample storage and transport. Trip blanks were prepared in the field each morning from analyte-free water provided by the laboratory and preserved with hydrochloric acid (HCl) (no longer than 24 hours prior to each sampling event). Trip blanks remained with the sample containers in the field at all times, were returned unopened at the conclusion of each day's field activities, and were included in each cooler of VOC samples shipped to the laboratory. Trip blanks were analyzed for TCL VOCs only.

Rinsate Blanks

Equipment rinsate blanks were utilized to determine if contamination had been introduced through contact with the sampling equipment. Equipment rinsate blanks were prepared by running analyte-free water provided by the laboratory through sample collection equipment (bailer, split-spoon, hand auger bucket, etc.) after decontamination. Rinsate blanks were generated for each type of non-dedicated sampling equipment at a frequency of one per day per medium for each day of sampling and were analyzed every other day per medium. Equipment rinsate blanks were analyzed for the same suite of parameters as the associated environmental samples.

2.5.2 Discussion of Field Quality Control Blank Impact

Table 2-22 summarizes the frequency and concentration of contaminants detected in each type of field quality control blank collected at NWS Earle, including all data used for risk assessment. In most cases, blank contamination occurred at very low frequencies and was restricted to concentration ranges near the detection or quantitation limits. During data validation, the concentrations of compounds detected in laboratory and field quality control blanks were compared to concentrations found in the corresponding environmental samples to determine potential impacts on the analytical data. Organic compound results from environmental samples were qualified as "non-detected" if the compound was not found at a concentration within five times (10 times for certain common laboratory contaminants) the concentration in the associated blank. Inorganics were qualified as "rejected" if the analyte was found at a concentration greater than the contract-required detection limit (CRDL) and at least five times greater than the associated field blank concentration or 10 times greater than the associated laboratory blank concentration.

Methylene chloride and acetone were detected in several trip blanks and rinsate blanks at concentrations below or near the contract-required quantitation limit (CRQL). These compounds are common laboratory contaminants and were detected more frequently in laboratory blanks than in field quality control blanks. This caused many of the positive field quality control blank results for acetone and methylene chloride to be qualified as not detected due to laboratory blank contamination. The positive results in Table 2-22 represent only those compounds remaining after data validation. Methylene chloride and acetone were not used in the field; therefore, laboratory sources are likely to be responsible for the sporadic detection of low levels of these compounds in field quality control blanks.

2.5.3 Field Duplicate Precision

Field duplicate pairs were analyzed in order to assess the overall precision of the sampling and analysis process. Field duplicate pairs consisted of two field samples of identical media sampled at the same field location using the same sampling process. Duplicate pairs were stored and transported together to the laboratory for analyses. The relative percent differences (RPDs) for the duplicate pairs were calculated and reported by the laboratory and evaluated by the data validator in order to quantitate any imprecision. In a few cases, inorganic duplicate pair results were qualified as estimated because of field duplicate imprecision. No qualifiers were required for organic field duplicates. In general, the majority of the field duplicate results exhibited acceptable precision and there were no consistent trends to indicate improper sampling technique.

TABLE 2-22
SUMMARY OF FIELD QUALITY CONTROL BLANK RESULTS
NWS EARLE, COLTS NECK, NEW JERSEY

ANALYTE	RINSATE BLANKS		TRIP BLANKS		FIELD BLANK	
	Frequency	Maximum	Frequency	Maximum	Frequency	Maximum
Metals		ug/L		N/A		N/A
Calcium	2/6	58.4				
Copper	1/6	2.9				
Manganese	1/6	1.7				
Potassium	2/6	865				
Sodium	1/6	797				
Thallium	1/6	4.2				
Vanadium	1/6	35.2				
Zinc	1/6	14.9				
Volatile Organic Compounds		N/A		ug/L		ug/L
Acetone			2/5	4.0	1/1	5.0
Bromodichloromethane			1/5	3.0	1/1	21.0
Chloroform					1/1	92.0
Dibromochloromethane					1/1	4.0
Methylene Chloride					1/1	3.0
Semivolatile Organic Compounds		ug/L		N/A		N/A
Bis(2-ethylhexyl)phthalate	2/6	4.0				
Diethyl phthalate	1/6	2.0				
Di-N-Butylphthalate	1/6	3.0				
Di-N-Octylphthalate	1/6	1.0				
Miscellaneous Parameters		mg/L		N/A		N/A
Total Organic Carbon	2/6	1.0				

Two field duplicates for VOCs, four for SVOCs, three for pesticides, three for PCBs, three for metals, and three field duplicates for miscellaneous parameters were collected and submitted for laboratory analysis.

2.5.4 Laboratory Quality Control Analyses

Laboratory quality control samples were analyzed as required by each specific analytical protocol and NFESC requirements. Quality control data from organic analyses included laboratory blank results, surrogate, matrix spike, and matrix spike duplicate recoveries, internal standard recoveries, initial calibration relative standard deviations and minimum response factors, continuing calibration percent differences and response factors, laboratory control spikes, mass spectral tuning ratios, clean-up column recoveries, pesticide performance evaluation recoveries, pesticide analyte degradation percentages, and compound identification criteria (mass ratios, retention time windows, and two-column percent differences). In general, the frequency of analytical problems in each of these areas was very low and indicated overall acceptable method performance for each type of analysis. Organic analysis laboratory blanks revealed limited contamination, with low concentrations (near or below the CRQL) of common laboratory contaminants such as methylene chloride, acetone. Analytical results were qualified as estimated for a limited number of results based upon calibration relative standard deviations or percent differences and internal standard, matrix spike, or surrogate recoveries.

Quality control data from inorganic analyses included laboratory blank results, matrix spike recoveries, laboratory duplicate RPDs, serial dilution percent differences, initial calibration, continuing calibration, and CRDL standard percent accuracies, laboratory control sample recoveries, and interference check standard accuracies. The frequency of analytical problems in each of these areas was low and indicated overall acceptable method performance for each type of analysis. Inorganic analysis laboratory blanks revealed low frequencies of contamination generally restricted to concentrations below the CRDL, which do not require qualification based on Region II guidelines. Several serial dilution results exceeded maximum percent difference criteria and resulted in the qualification of data as estimated or rejected. These problems are typically attributed to sample matrix interference effects caused by high background levels of other minerals in the sample. A few results were qualified as estimated or rejected because of CRDL standard recoveries above or below Region II control limits. Very few problems occurred in other areas.

Miscellaneous parameters quality control data were acceptable in most sample delivery groups. A limited number of results were qualified as estimated or rejected due to out-of-control matrix spike recoveries orlaboratory duplicate RPDs.

2.5.5 Field Analytical Methods and Quality Control

Groundwater samples were collected using the direct-push sampling techniques by Tracer Research Corporation in October and December 1996 and analyzed using a gas chromatograph (GC) located in an on-site mobile laboratory. Twenty ml of each groundwater sample was placed in a 40 ml VOC vial, leaving a 20 ml headspace. After vigorous shaking, samples were allowed to settle for 2 minutes to ensure that air and water concentrations reached stable equilibrium. Up to 500 μl of headspace (or a smaller volume, if a sample was heavily contaminated) was withdrawn via syringe and injected onto a temperature-programmed GC column. Benzene, toluene, ethylbenzene, and xylenes (BTEX) were analyzed on a GC equipped with a flame ionization detector (FID). Samples were also analyzed for chlorinated VOCs (TCE, PCE, breakdown products, and selected solvents) using a second injection onto a GC coupled to an electron capture detector (ECD). Detection limits for the field analyses were generally in the low parts-per-billion (ppb) range for BTEX constituents and in the low parts-per-trillion (ppt) range for tri- or tetra-chlorinated VOCs. The field ECD was more sensitive (had lower detection limits) than the gas chromatograph/mass spectrometer (GC/MS) used by the fixed-base laboratory.

The field analysis methods were required to meet New Jersey Data Quality Level 2 requirements. The field laboratory's quality assurance/quality control (QA/QC) program included an initial calibration with aqueous headspace standards which averaged the response of three standards at similar concentrations, continuing calibration standards at the beginning of each day and after every 5 samples, and replicate injections for each set of 10 samples or once per day. Laboratory water headspace blanks were analyzed with each initial calibration, ambient air samples were run twice per day or once per site, and system air blanks were analyzed once per day. Equipment rinsate blanks and field blanks were also analyzed.

The mobile laboratory utilized a method detection limit approach which reports detection limits that are considered optimum or "best case" values. Method detection limits were calculated from background noise levels and were not verified by actual standards run at levels near the lowest reported limits. Initial calibrations met laboratory standard operating procedure (SOP) precision criteria (percent relative standard deviation) and subsequent calibration checks met criteria for instrument drift (percent difference). However, the SOP did not require a true calibration curve using multiple concentrations. Instead, calibration linearity was controlled and verified by performing multiple dilutions on all samples exhibiting concentrations greater than 10 times the calibration level. In at least one instance, non-linearity was indicated by diluted sample results that disagreed with the undiluted sample results by more than a factor of three. Despite these limitations, field analytical results are regarded as usable for risk assessment. However, the uncertainties discussed earlier qualify the accuracy of chlorinated VOC results, particularly for values in the ppb range rather than ppt range.

Method blanks were compliant with the laboratory SOP and revealed only occasional contamination at sub-ppb levels for chlorinated VOCs. The equipment rinsate blank (designated IB) was inadvertently analyzed immediately following a 9000-ppb sample and exhibited false positives from residual traces of chlorinated VOCs remaining in the instrument. Based on the order of sample injections and dilutions, this problem did not occur during the reporting of results for most environmental samples. The only sample result qualified due to this type of carryover was TCE in 26HP03-24. All laboratory duplicate sample analyses exhibited acceptable precision. The laboratory SOP did not require surrogate compounds and matrix spikes; however such QC tests are considered on a case-by-case basis and are not always required for New Jersey Data Quality Level 2 methods.

2.5.6 Field Analytical Data Comparability

The method accuracy and data comparability of mobile laboratory results from the October and December, 1996 sampling event was determined by collecting a total of 17 replicate (split) groundwater samples for confirmation analysis by an off-site laboratory. Field laboratory results were qualitatively and quantitatively compared to confirmation laboratory results to determine inter-method comparability and relative bias. Two compounds, 1,2-dichloroethene and trichloroethene, were frequently detected and could therefore be used for a quantitative comparison of data. Most compounds detected by the confirmation laboratory were generally detected by the mobile laboratory, but the converse was not true due to the lower detection limits of the field laboratory.

For 1,2-dichloroethene, positive results occurred in four out of 17 replicate samples analyzed by both laboratories. A linear regression of the field analysis results (as the dependent variable) against the confirmation laboratory results (independent variable) was performed and is presented in Figure 2-2. The linear regression was weighted to minimize relative error; i.e., so that minor deviations from the fitted line at high concentration data points are treated equally to similar percent deviations at very low concentrations. As demonstrated by the 0.948 correlation coefficient, the field analytical method is concluded to be in general agreement with confirmation laboratory results. No significant bias is indicated by the 0.91 slope of the fitted regression line. The lack of detection of 1,2-dichloroethene in sample 13HP01-45 may be related to the field ECD's reduced detection sensitivity for VOCs with only two chlorine atoms. Trichloroethene and tetrachloroethene have much lower ECD detection limits and may not be affected by this problem.

Individual results for trichloroethene from the field analysis were regressed against corresponding results from the confirmation analysis in the same manner. As shown in Figure 2-3, the field and confirmation

Figure 2-2
NWS Earle, Colts Neck, New Jersey
1,2-Dichloroethene Field Analysis vs. Confirmation Laboratory Results

Sample I.D.	1,2-DCE, UG/L	
	Confirm. Lab.	Mobile Lab.
26HP13-14	22	7
26HP02-16	23	22
26HP03-10	73	48
13HP01-45	14	2 U
26HP02-68	10 U	0.2 U
26HP03-68	10 U	0.2 U
13HP02-15	10 U	0.2 U
13HP03-30	10 U	0.2 U
26HP02-24	10 U	0.4 U
26HP03-24	10 U	0.4 U
26HP23-23	10 U	9 U
26HP27-24	10 U	12 U
26HP23-15	10 U	19 U
26HP25-21	10 U	19 U
13HP07-15	10 U	0.03 U
13HP06-28	10 U	0.0024 U
13HP05-48	10 U	0.004 U

X - RANGE	Y - RANGE
22	7
23	22
73	48
14	2

Y = MX + B Regression Output:	
Slope (M)	0.9101
Constant (B)	-8.9929
Correlation coefficient:	0.9481
Root mean square relative % error	25.4%
Weighted Linear Regression	
1/X^2 weight for minimum relative % error	
No. of Observations	4
Degrees of Freedom	2

X-VALUE	Y-Predicted
10	0.1
50	36.5

X-Predicted	Y-VALUE
252	220.0

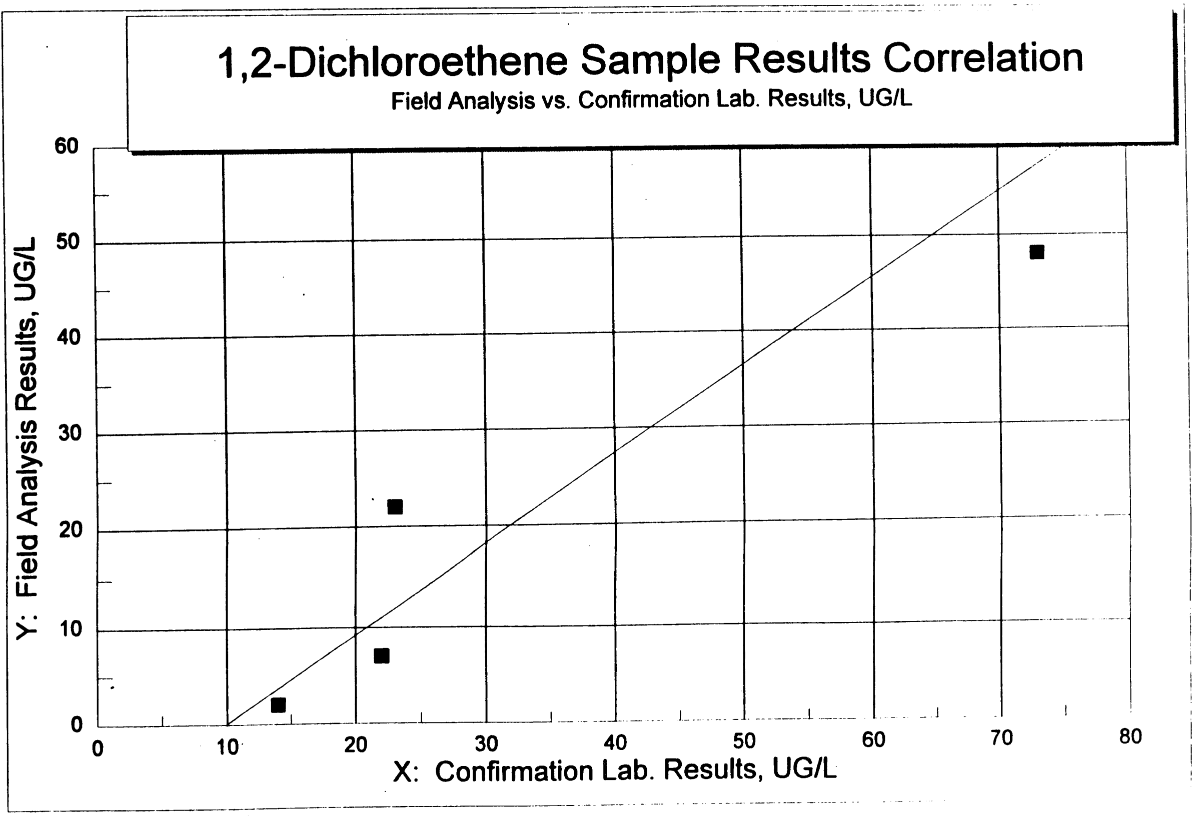


Figure 2-3
NWS Earle, Colts Neck, New Jersey
Trichloroethene Field Analysis vs. Confirmation Laboratory Results

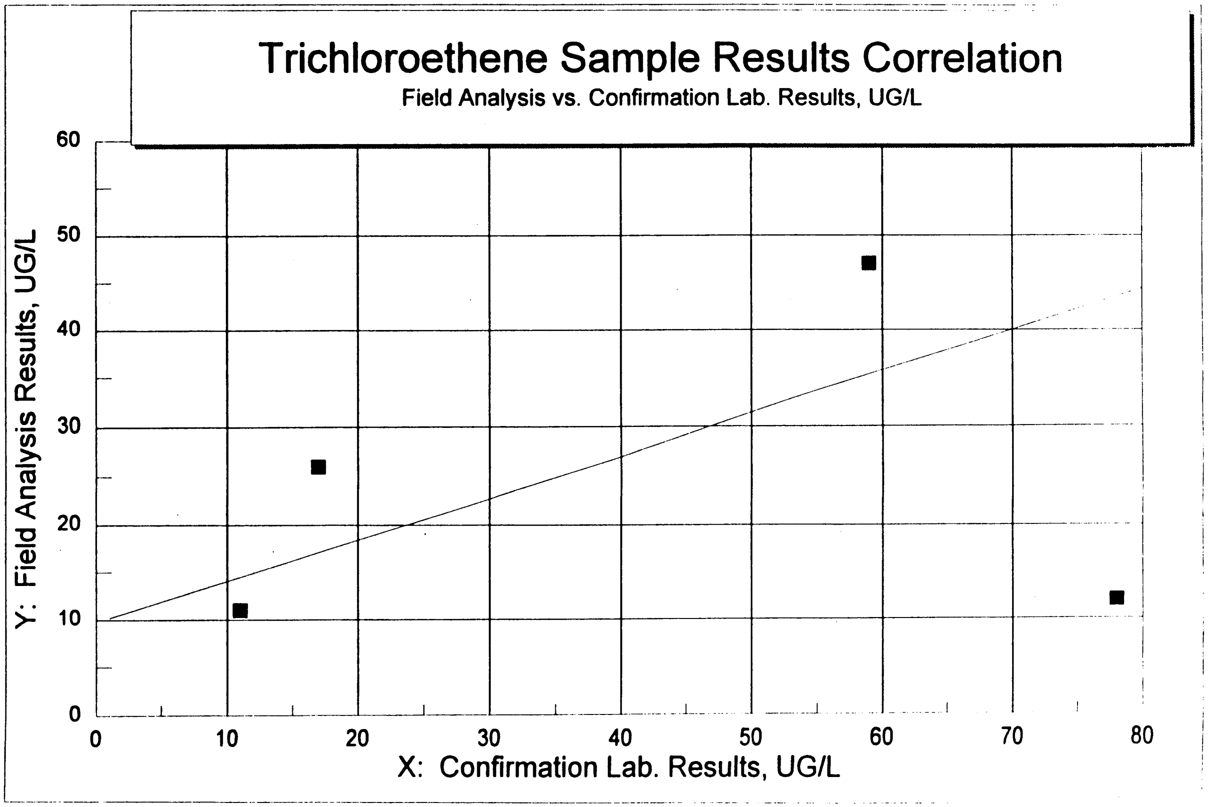
Sample I.D.	TRICHLOROETHENE, UG/L	
	Confirm. Lab.	Mobile Lab.
13HP01-45	11	11
26HP02-16	78	12
26HP03-10	17	26
26HP13-14	59	47
13HP02-15	10 U	0.004 U
13HP03-30	10 U	0.01 U
26HP03-24	10 U	0.1 N
26HP23-23	10 U	0.1 U
26HP23-15	10 U	0.2 U
26HP25-21	10 U	0.2 U
26HP27-24	10 U	0.2 U
26HP02-68	10 U	0.3
26HP03-68	10 U	0.3
26HP02-24	10 U	1
13HP07-15	10 U	0.01 U
13HP06-28	10 U	0.0007 U
13HP05-48	10 U	0.001 U

X - RANGE	Y - RANGE
11	11
78	12
17	26
59	47

Y = MX + B Regression Output:	
Slope (M)	0.4323
Constant (B)	9.7518
Correlation Coefficient:	0.1906
Root mean square relative % error:	38.0%
Weighted Linear Regression	
1/X^2 weight for minimum relative % error	
No. of Observations	4
Degrees of Freedom	2

X-VALUE	Y-Predicted
10	14.1
50	31.4

X-Predicted	Y-VALUE
486	220.0



results exhibited a 38 percent root mean square relative error, which indicates that the mobile laboratory results are in fair agreement. In the case of trichloroethene, a lower correlation coefficient was achieved (0.19) and the slope of the line (0.43) would suggest a possible low bias. However, the direction of bias inferred from only four positive data points may be attributable to random, rather than systematic variations. The observed bias may be entirely attributable to one outlier point, sample 26HP02-16, which appears to exhibit a low bias in the mobile laboratory analysis. However, no systematic error was found that would explain this discrepancy, and it is not possible to conduct outlier testing to remove one point from a limited set of only four points. A single observed outlier for trichloroethene should not form the basis for a rejection of mobile laboratory performance. Therefore, the hypothesis that the field method has acceptable accuracy cannot be rejected.

In conclusion, the adherence to a field analytical QA/QC program and the successful verification of the comparability of data for 1,2-dichloroethene indicate that the field analytical data are usable for risk assessment and for delineation of contamination at this site. In addition, since the mobile laboratory detection limits for TCE and PCE are much lower than the fixed-base laboratory, data are also usable to determine clean areas for these compounds, even given some degree of uncertainty in the mobile laboratory detection limits.

2.5.7 Parameters

The quality of the data set is measured by certain characteristics of the data, namely the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. Precision and accuracy are expressed quantitatively, and the others are expressed qualitatively.

Precision

Precision characterizes the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for a sample under the same or similar conditions. Precision is expressed as a range (the difference between two measurements of the same parameter) or as an RPD (the range relative to the mean, expressed as a percent). Precision is measured quantitatively. Range and RPD values are calculated as follows:

Range = OR - DR

RPD = (OR - DR) / [(OR + DR) / 2] x 100%

where: OR = original sample result

DR = duplicate sample result

The internal laboratory control limits for precision are three times the standard deviation of a series of RPD or range values. RPD values are also calculated for field duplicates and are compared to the control limits as a QA check. Data validation field duplicate control limits and actions required as a result of exceedances are discussed in Section 2.5.3.

Accuracy

Accuracy is the comparison between experimental and known or calculated values expressed as a percent recovery (%R). Percent recoveries are derived from analysis of standards spiked into deionized water (standard recovery) or into actual samples (matrix spike or surrogate spike. recovery). Recovery is calculated as follows:

For a surrogate spike or laboratory control spike or standard

$$\%R = E / T \times 100\%$$

where: E = experimental result

T = true value (theoretical result)

For a sample matrix spike

$$\%R = (SSR - SR) / SA \times 100\%$$

where: SSR = sample spike result

SR = sample result (unspiked)

SA = spike concentration added

and

SA = (spike aliquot)(spike concentration)/(sample aliquot + spike aliquot)

Internal laboratory control limits for accuracy are set at the mean plus or minus three times the standard deviation of a series of %R values. Organic %R values are set at the mean plus or minus two times the standard deviation. Accuracy for aqueous and solid samples was evaluated by use of surrogate and matrix spikes at the CLP-required frequencies. CLP acceptance criteria and corrective actions were applied. Out-of-criteria results were reviewed in accordance with EPA Region II data validation guidelines to determine the need for qualification or rejection.

Representativeness

All data obtained should be representative of actual conditions at the sampling location. The work plan was designed so that the samples taken present an accurate representation of actual site conditions. The rationale discussed in the work plan were designed to ensure this. All sampling activities conformed to the protocols given in Section 4.0 of the work plan. The use of CLP analytical protocols and data deliverables ensured that analytical procedures were consistently performed to generate results that are considered representative.

The use of low-flow dedicated sampling pumps in conjunction with monitoring of turbidity and other parameters ensured that monitoring well data were as representative of the formation as possible. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, at some wells, low turbidity samples could not be collected. Where use of the EPA Region II low-flow purge method did not result in stabilized turbidity readings, filtered results were obtained from the same location. Filtered and unfiltered metals results were then compared to achieve a more accurate perspective of contaminant fate and transport.

Comparability

Comparability is achieved by using standardized sampling and analysis methods and data reporting procedures. The use of standard analytical procedures and sample collection techniques maximized the comparability of new data. Additionally, consideration was given to field environmental conditions that could influence analytical results.

Completeness

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. For relatively clean, homogeneous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase, completeness may decrease. Where analysis is precluded or where DQOs are compromised, effects on the overall investigation must be considered. Whether any particular sample is critical to the investigation is evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

Critical data points were not evaluated until all the analytical results were evaluated. If in the evaluation of results it becomes apparent that the data for a specific medium are of insufficient quality (for example, completeness less than 95 percent), either with respect to the number of samples or an individual analysis, resampling of the deficient data point(s) may be necessary. The site- and medium-specific completeness percentages are summarized in Table 2-23. These data represent all investigation results used in this risk assessment.

The overall percentages of rejected data points in Table 2-23 were generally low and within acceptable ranges. Most of the rejected data were attributed to sample matrix effects in either pesticides or metals analysis. Imprecision between dual-column pesticide results (greater than the 90 RPD allowed by Region II protocol) occurred in the analysis of some soil samples. This problem occurs when a variety of compounds remain in the pesticide sample extract (despite proper analytical clean-up efforts) and interferences graphically overlap or obscure the measurement region assigned to a particular pesticide. Rejected pesticide results are considered unreliable and may be biased low or biased high or may be false positives.

The other main cause of data rejection was imprecision in serial dilutions for metals. This problem occurs when very high levels of common minerals or certain anions remain in the sample after digestion and the measurement signal for a given metal is suppressed or biased. In such cases, a one-to-five dilution of the sample can yield a response that differs from the predicted value (one-fifth of the original result). Serial dilution results that disagreed from the expected results by more than 90 percent difference were considered unreliable and were rejected according to Region II protocol. Depending upon whether the sample concentration is close to the detection limit, this may be interpreted as indicating that the metal in question is present but the reported value is associated with poor accuracy.

2.5.8 Summary of the Data Validation Process

The preceding discussion of field quality control blanks, field duplicate precision, laboratory quality control analyses, and PARCC parameters was based upon the findings from a comprehensive validation of all NWS Earle sample data packages following the protocols of EPA Region II and the National Functional Guidelines. An overview of the data validation process is presented as follows:

Table 2-23
Summary of Rejected Data
CTO 231, NWS Earle

	Groundwater Samples			Surface Water Samples			Aqueous Waste Samples			Subsurface Soil Samples			Surface Soil Samples			Sediment Samples		
Site Number	No. of Rejected Results	Total No. of Results	Percent Rejected Data	No. of Rejected Results	Total No. of Results	Percent Rejected Data	No. of Rejected Results	Total No. of Results	Percent Rejected Data	No. of Rejected Results	Total No. of Results	Percent Rejected Data	No. of Rejected Results	Total No. of Results	Percent Rejected Data	No. of Rejected Results	Total No. of Results	Percent Rejected Data
03	1	624	0.160										5	351	1.425	12	492	2.439
06	1	676	0.148	36	625	5.760										11	1278	0.861
12										2	75	2.667	22	589	3.735	2	423	0.473
13	4	1549	0.258	21	348	6.034										5	539	0.928
16	0	1732	0.000							18	4739	0.380	4	453	0.883	1	758	0.132
17	2	541	0.370	6	756	0.794							1	148	0.676	11	1191	0.924
26	1	1903	0.053				0	33	0.000	6	506	1.186						
BG	5	877	0.570	15	1009	1.487				11	1591	0.691				38	981	3.874

NOTE: This table includes only analytical data generated for use in RI/FS decision making (unvalidated hydropunch screening samples were excluded).

- Each data package is validated using the EPA Region II checklist review procedure. A separate checklist is used for each sample delivery group (SDG) package and for each type of data (TCL organics, TAL inorganics, or miscellaneous parameters). Before beginning the review of a particular package, laboratory deliverables are first examined for completeness by comparison with field chain of custody (COC) records.

- The organic checklist is divided into sections for volatiles, semivolatiles, and pesticides/PCBs. Within each section, the reviewer evaluates adherence to sample holding times and preservation requirements; system monitoring compound and surrogate recoveries; matrix spike recoveries; method blank and field quality control blank contamination; instrument performance checks such as mass spectral tuning ratios and gas chromatographic (GC) performance evaluation mixture degradation; target compound results (Form I, chromatograms, mass spectral identification criteria, retention time matching against standards, and instrument quantitation list calculations); tentatively identified compound results; compound quantitation limits; initial calibration data (minimum response factors and relative standard deviation); continuing calibration data (minimum response factors and percent differences); internal standard area recoveries and retention time control; field duplicate precision; pesticide analytical sequence verification, and pesticide cleanup efficiency recoveries.

- The inorganic checklist is divided into sections for COC forms and laboratory cover page; comparison of sample results (Form Is) to raw data; evaluation of preparation logs and measurement readout records for each type of analysis; holding times and sample preservation; calibration (initial calibration verification and continuing calibration recoveries); laboratory initial calibration blank, continuing calibration blank, and preparation blank contamination; inductively coupled plasma (ICP) interference check sample recoveries; matrix spike recoveries; laboratory control sample recoveries; laboratory and field duplicate precision; laboratory control sample recoveries; ICP serial dilution accuracy; furnace atomic absorption post digestion spike recoveries, duplicate burn precision, and standard addition linearity; comparison of dissolved versus total analyses; field quality control blank contamination; verification of instrumental parameters (instrument detection limits, linear ranges, and ICP interelement correction factors); and percent solids of sediments.

- After completion of the data review and checklist, the data validator completes and signs an attached data assessment summary, which contains a summary of quality control deficiencies and the corresponding sample results affected. The completed validation report consists of qualified analytical results with attached qualifier code definitions, Form I results as reported by the laboratory, a Region II data validation checklist and data assessment summary, and photocopies of field COC forms, laboratory narrative, and deficient quality control results from the laboratory data package. After completion of the data review, all data validation reports are reviewed and approved by a senior validation chemist.

2.6 ECOLOGICAL RISK ASSESSMENT APPROACH

2.6.1 Background

Screening-level ecological risk assessments (ERAs) were performed for all sites investigated as part of recent RI activities on NWS Earle, as well as for all watersheds investigated in that study (B&R Environmental, 1996). Ecological risks at most RI sites and in most watersheds on the installation were determined to be low or negligible, and hence, no further study or remediation based on potential ecological risks appeared to be warranted. However, significant potential ecological risks from contaminants related to Site 3 (Mainside) and Sites 6 and 17 (Waterfront) were determined to be possible based on elevated concentrations of several contaminants in aquatic habitats near those sites and exceedences of ecological screening levels. As a result, further ecological study at those sites was recommended as part of additional RI sampling activities on the installation (B&R Environmental, 1996).

The focus of additional sampling at Sites 12, 13, 16, and 26 was limited to subsurface soil and groundwater, and therefore, additional ecological investigation is not appropriate at those sites. This section summarizes the methods that will be used to assess potential ecological risks at Sites 3, 6, and 17 as part of RI Addendum sampling activities, and the objectives of these investigations.

The methods used as part of the RI Addendum ERAs are described in detail in the 1996 RI report (B&R Environmental, 1996). Thus, a detailed discussion of the approach that was taken will not be included in this report. The approach that was followed is the one recommended by most recent EPA guidance for conducting ERAs (Wentsel et al., 1996; EPA, 1994, 1992). In general, the approach consists of four steps: problem formulation, ecological effects assessment, exposure assessment, and risk characterization. Since most of the text for these steps is explained in detail in the RI report and below, they will be combined into background, results, and summary and conclusion sections for each site. The approach used in this assessment is consistent with that used in the RI report. However, additional site-specific parameters and information were used in this assessment in a more focused effort to assess potential ecological risks at Sites 3, 6, and 17. In addition, the ERAs for Sites 3, 6, and 17 build on and incorporate the data generated during 1993 RI/FS investigations at Site 3 (Weston, 1993a) and 1993 SI investigations at Sites 6 and 17 (Weston, 1993b), as well as the screening-level ERAs conducted at these sites as part of recent RI activities (B&R Environmental, 1996). An overview of the site-specific approach and objectives of the RI Addendum ERAs, mainly the more focused aspects relative to the RI ERAs, is provided below.

2.6.2 Problem Formulation

The problem formulation phase of this assessment follows the problem formulation methodology discussed in the RI report (B&R Environmental, 1996), with two exceptions. First of all, the assessment and measurement endpoints were re-evaluated to ensure that the proper focus and objectives for each site were investigated. Assessment endpoints are ecological attributes that are defined as "explicit expressions of the environmental value that is to be protected" (EPA, 1992). The determination of appropriate assessment endpoints allows the risk assessor to address the issue of the ecological significance of a given site (EPA, 1996a). In the original RI, the assessment endpoint selected for all RI sites was the maintenance of receptor populations that inhabit NWS Earle.

The ecological risk assessment for Site 3 performed as part of the RI determined that potential ecological risks were confined to the wetlands southeast of the landfill. Given the relatively small size of Site 3 and the nearby impacted wetlands, receptor population-level effects are unlikely. Nonetheless, the sensitive nature of the wetlands and the semi-aquatic organisms that inhabit them requires that they be adequately protected. As a result, the protection of species inhabiting the wetlands was chosen as a more focused assessment endpoint for Site 3.

Sites 6 and 17 are located near each other at the waterfront area adjacent to an extensive tidal marsh, and as discussed in further detail below, were investigated together. Given the large size of the landfills and length of the landfill toes at the edge of the marsh, potential population effects on saltmarsh organisms is possible from landfill-related contaminant inputs. Hence, the maintenance of receptor populations in the marsh was chosen as the assessment endpoint for Sites 6 and 17.

It was not necessary to alter the initial measurement endpoints chosen as part of the RI, which were the contaminant concentrations likely to result in adverse effects on individuals. These endpoints still relate to, and serve as surrogates for, the more focused assessment endpoints chosen for Sites 3, 6, and 17.

The conceptual model was also refined to reflect the new focus of the assessment. The conceptual model is designed to identify potentially exposed receptor populations and applicable exposure routes based on the physical nature of the sites investigated and surrounding areas. Contaminant migration pathways were similar for Sites 3, 6, and 17. Also, the inclusion of only Sites 3, 6, and 17 in this assessment resulted in the presence of only aquatic and semi-aquatic exposure routes (i.e., no surface soil-related exposure routes). As a result of these similarities, the refined conceptual model for all three sites was combined for this assessment (Figure 2-4).

2.6.3 Ecological Effects Evaluation

Ecological screening levels, or ecotox thresholds (ETs; EPA, 1996b), were used in this assessment to compare to exposure point concentrations of contaminants in various media for Sites 3, 6, and 17. However, unlike the RI, site-specific ET values were calculated for this assessment, when possible. For surface water at the Waterfront (Sites 6 and 17), site-specific surface water ET values were calculated for several metals using site-specific water hardness data collected for this study. Although the marsh is considered a saltmarsh, salinity values were low enough to require freshwater ETs. Salinities for Site 6 and 17 averaged 6.2 and 2.4 percent, respectively. As defined in 40 CFR 131, saltwater criteria are applicable for water bodies only with salinities greater than 10 percent. Site-specific ET values for cadmium, copper, chromium, lead, and nickel in Site 6 and 17 surface water were calculated using the following formula, from EPA (1996b).

$\text{Criterion} = e^{(m[\ln(\text{hardness})]+b)} * \text{CF}$

where:

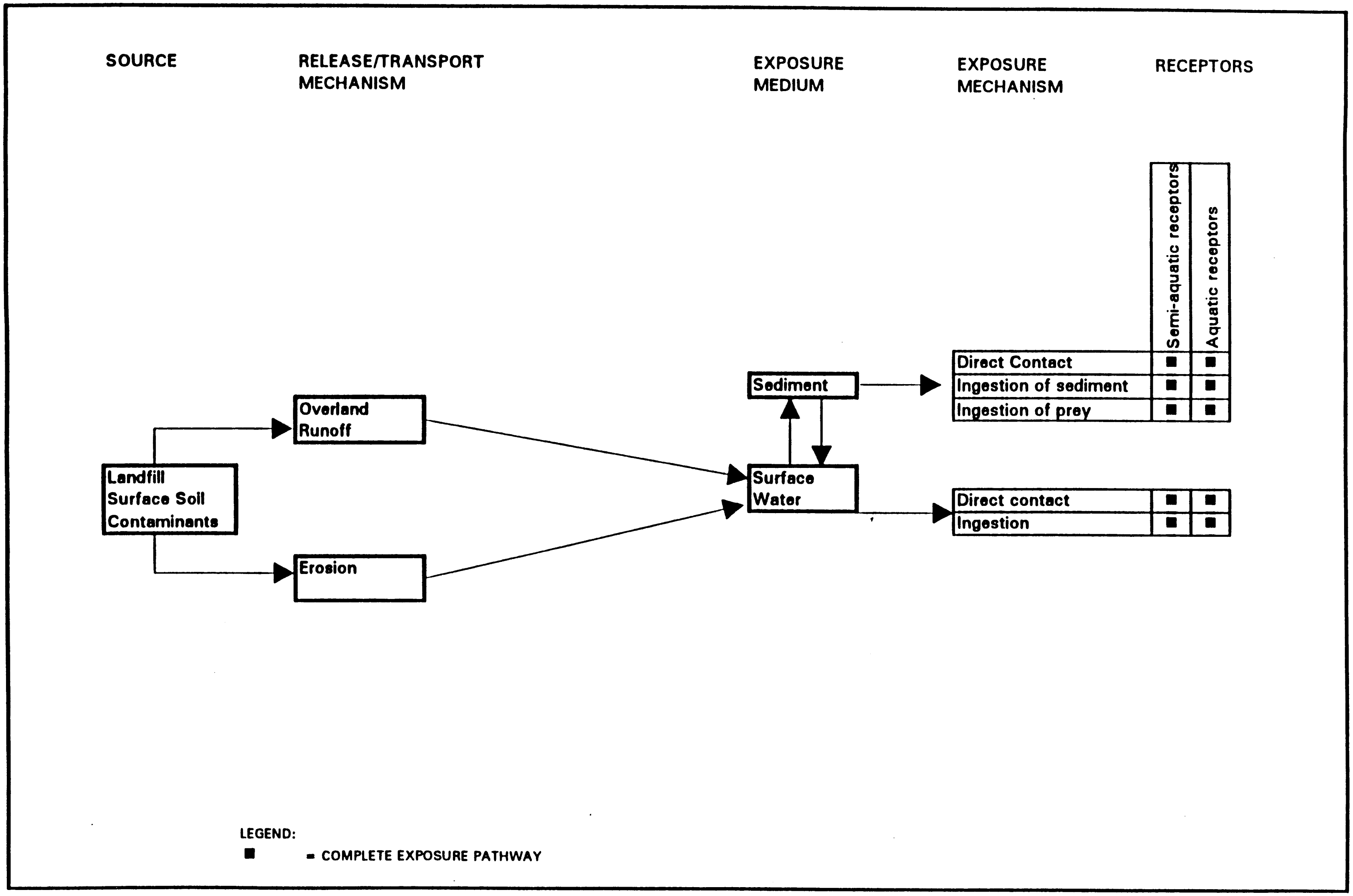
m = slope

b = intercept

ln (hardness) = natural log of the water hardness (mg $CaCO_3$/L)

CF = conversion factor, ratio of total recoverable to dissolved metal concentration

For Site 6, hardness averaged 813 mg/L. Therefore a value of 400 mg/L was used in the calculations, as recommended by EPA (1996b) when hardness exceeds 400 mg/L. The slightly brackish nature of the water in the marsh near Site 6 most likely accounts for the relatively high hardness values. For Site 17, the average hardness value was 261 mg/L. Surface water ET values for other metals and organics were obtained from the sources listed in the RI report (B&R Environmental, 1996). Surface water ET values used in this assessment are presented in Tables 2-24 and 2-25. Surface water samples for Site 3 were not collected due to the ephemeral nature of the water in the wetlands adjacent to the site.



	Semi-aquatic receptors	Aquatic receptors
Direct Contact	■	■
Ingestion of sediment	■	■
Ingestion of prey	■	■

	Semi-aquatic receptors	Aquatic receptors
Direct contact	■	■
Ingestion	■	■

Figure 2-4

CONCEPTUAL SITE MODEL
SITE 3 AND SITES 6 AND 17
NWS EARLE, COLTS NECK, NEW JERSEY

TABLE 2-24
SURFACE WATER ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Ecotox Threshold (ug/L)	Source
Aluminum	87	Ambient Water Quality Criterion (USEPA, 1991)
Antimony	160	USEPA Region IV screening value (USEPA, 1995)
Arsenic	190	Ambient Water Quality Criterion (USEPA, 1996b)
Barium	3.9	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Beryllium	5.1	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Cobalt	3	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Copper	37.11	Site-specific value using 400 mg/L site-specific hardness
Iron	1000	Ambient Water Quality Criterion (USEPA, 1996b)
Lead	14.7	Site-specific value using 400 mg/L site-specific hardness

TABLE 2-24
SURFACE WATER ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Contaminant of Concern	Ecotox Threshold (ug/L)	Source
Manganese	80	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Mercury	1.3	Ambient Water Quality Criterion for inorganic mercury (USEPA, 1996b)
Nickel	507.9	Site-specific value using 400 mg/L site-specific hardness
Selenium	5	Ambient Water Quality Criterion (USEPA, 1996b)
Silver	0.012	USEPA Region IV screening value (USEPA, 1995)
Thallium	4	USEPA Region IV screening value (USEPA, 1995)
Vanadium	19	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)

TABLE 2-25
SURFACE WATER ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Ecotox Threshold (ug/L)	Source
Aluminum	87	Ambient Water Quality Criterion (USEPA, 1991)
Barium	3.9	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Cobalt	3	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Copper	25.8	Site-specific value using 261 mg/L site-specific hardness
Iron	1000	Ambient Water Quality Criterion (USEPA, 1996b)
Lead	8.54	Site-specific value using 261 mg/L site-specific hardness
Manganese	80	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Nickel	507.9	Site-specific value using 261 mg/L site-specific hardness
Selenium	5	Ambient Water Quality Criterion (USEPA, 1991)
Thallium	4	USEPA Region IV screening value (USEPA, 1995)

TABLE 2-25
SURFACE WATER ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Contaminant of Concern	Ecotox Threshold (ug/L)	Source
Vanadium	19	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)
Zinc	235.6	Site-specific value using 261 mg/L site-specific hardness
Organic (ug/L)		
Bis(2-ethylhexyl)phthalate	32	Ambient Water Quality Criterion, Tier II (USEPA, 1996b)

Site-specific sediment quality criteria (ETs) were calculated for this study for non-polar organic contaminants using equilibrium partitioning (EqP), as recommended by EPA (1996b). EqP uses the octanol/water partitioning coefficient (K_{ow}) to determine the sediment partitioning coefficient of a contaminant (K_{oc}), using the following formula (Di Toro, 1985):

$\log_{10}K_{oc} = 0.00028 + 0.983 \log_{10}K_{ow}$

The K_{oc} value is then multiplied by the sorption capacity of the sediment using the site-specific fraction of organic carbon (f_{oc}). Finally, an appropriate water quality criterion, such as an AWQC, is multiplied by K_{oc} and f_{oc}, resulting in the following equation to generate site-specific sediment quality criteria (ETs):

$SQC = f_{oc} * K_{oc} *$

AWQCSediment ETs for non-polar organics were calculated in this manner for Sites 3, 6, and 17. Average organic carbon concentrations from RI Addendum sediment samples of 6.4%, 2.05%, and 3.91% were used for Sites 3, 6, and 17, respectively. ET values for metals and other organics were gathered from the sources identified in the RI report (B&R Environmental, 1996). For the most part, values were gathered from the Ontario Ministry of the Environment (OME, 1992) for Site 3 sediments, since these values were developed primarily for freshwater. Since the marsh at the Waterfront is an estuarine system, NOAA sediment values, Effects Range (ER) values, were primarily used at Sites 6 and 17, since they were developed mainly for estuarine sediments. Sediment ET values used in this assessment are presented in Tables 2-26 through 2-28.

2.6.4 Exposure Assessment

Data used to obtain exposure point contaminant concentrations were those generated during RI Addendum sampling activities at Sites 3, 6, and 17. In addition, data from 1993 SI (Weston, 1993b), 1993 RI/FS (Weston, 1993a), and 1995 RI sampling activities were used qualitatively (B&R Environmental), where applicable. Background data from RI Addendum sampling activities near the Waterfront were used for Sites 6 and 17. Background data from RI addendum sampling and 1995 RI sampling were also utilized qualitatively in this assessment. In addition, RI Addendum surface soil samples taken at the landfill toe at Site 3 were assessed qualitatively. For conservatism, when a positive detection was present for at least one sample of given type at each site, one-half the detection limit was used for non-detects when average concentrations were calculated.

2.6.5 Risk Characterization

Methods used for risk characterization in this assessment were those used in the RI (B&R Environmental, 1996). Comparisons of maximum and average exposure point concentrations to ecological screening

TABLE 2-26
SEDIMENT ECOTOX THRESHOLDS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Ecotox Threshold	Source
Inorganics (mg/kg)		
Aluminum	NA	
Arsenic	6	Lowest Effects Level from Ontario Ministry of the Environment (OME, 1992)
Barium	20	USEPA Region V sediment classification for non-polluted sediments (WADOE, 1991)
Beryllium	NA	
Cadmium	0.6	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Chromium	26	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Cobalt	NA	
Copper	16	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Lead	31	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Manganese	460	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)

TABLE 2-26
SEDIMENT ECOTOX THRESHOLDS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 3

Contaminant of Concern	Ecotox Threshold	Source
Nickel	16	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Silver	1	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Vanadium	NA	
Zinc	120	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Organics (ug/kg)		
Benzo(a)pyrene	677	Site-specific value derived from AWQC (USEPA, 1996b)
Benzo(a)anthracene	553	Site-specific value derived from Secondary Chronic Value (SCV) (ORNL, 1996)
Benzo(b)fluoranthene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)
Benzo(k)fluoranthene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)
Chrysene	384	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Fluoranthene	90,005	Site-specific value derived from AWQC (USEPA, 1996b)
Phenanthrene	9770	Site-specific value derived from AWQC (USEPA, 1996b)

TABLE 2-26
SEDIMENT ECOTOX THRESHOLDS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 3 OF 3

Contaminant of Concern	Ecotox Threshold	Source
Pyrene	665	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
4,4'-DDT	4024	Site-specific value derived from AWQC (USEPA, 1996b)

TABLE 2-27
SEDIMENT ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Ecotox Threshold	Source
Inorganics (mg/kg)		
Aluminum	NA	
Antimony	12	USEPA Region IV screening value (USEPA, 1995)
Arsenic	8.2	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Barium	20	USEPA Region V sediment classification for non-polluted sediments (WADOE, 1991)
Beryllium	NA	
Chromium	81	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Cobalt	NA	
Copper	34	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Lead	46.7	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Manganese	460	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)

TABLE 2-27
SEDIMENT ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 4

Contaminant of Concern	Ecotox Threshold	Source
Nickel	20.9	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Silver	1	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Thallium	NA	
Vanadium	NA	
Zinc	150	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Organics (ug/kg)		
Acenapthylene	4722	Site-specific value derived from AWQC (USEPA, 1996b)
Anthracene	43	Site-specific value derived from Lowest Chronic Value (LCV) (ORNL, 1996)
Benzo(a)pyrene	217	Site-specific value derived from AWQC (USEPA, 1996b)

TABLE 2-27
SEDIMENT ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 3 OF 4

Contaminant of Concern	Ecotox Threshold	Source
Benzo(a)anthracene	181	Site-specific value derived from Secondary Chronic Value (SCV) (ORNL, 1996)
Benzo(b)fluoranthene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)
Benzo(k)fluoranthene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)
Benzo(g,h,i)perylene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)
Bis(2-ethylhexyl)phthalate	1.06E+5	Site-specific value derived from AWQC (USEPA, 1996b)
Butylbenzylphthalate	11,000	USEPA Sediment Quality Benchmark from EqP (USEPA, 1996)
Chrysene	384	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Fluorene	1027	Site-specific value derived from AWQC (USEPA, 1996b)
Fluoranthene	28,806	Site-specific value derived from AWQC (USEPA, 1996b)
Indeno(1,2-cd)pyrene	665	USEPA Region IV value for high molecular weight PAHs (USEPA, 1995)

TABLE 2-27
SEDIMENT ECOTOX THRESHOLDS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 4 OF 4

Contaminant of Concern	Ecotox Threshold	Source
Phenanthrene	3127	Site-specific value derived from AWQC (USEPA, 1996b)
Pyrene	665	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
4,4'-DDD	241	Site-specific value derived from AWQC (USEPA, 1996b)
4,4'-DDE	1177	Site-specific value derived from AWQC (USEPA, 1996b)
Alpha-Chlordane	7628	Site-specific value derived from AWQC (USEPA, 1996b)
Gamma-Chlordane	4851	Site-specific value derived from AWQC (USEPA, 1996b)

TABLE 2-28
SEDIMENT ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Ecotox Threshold	Source
Inorganics (mg/kg)		
Aluminum	NA	
Antimony	12	USEPA Region IV screening value (USEPA, 1995)
Arsenic	8.2	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Barium	20	USEPA Region V sediment classification for non-polluted sediments (WADOE, 1991)
Beryllium	NA	
Cadmium	1.2	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Chromium	81	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Cobalt	NA	
Copper	34	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)

TABLE 2-28
SEDIMENT ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 4

Contaminant of Concern	**Ecotox Threshold**	**Source**
Lead	46.7	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Manganese	460	Lowest Effects Level (LEL) from Ontario Ministry of the Environment (OME, 1992)
Mercury	0.15	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Nickel	20.9	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Selenium	NA	
Silver	1	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Vanadium	NA	
Zinc	150	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Organics (ug/kg)		
Benzo(a)pyrene	414	Site-specific value derived from AWQC (USEPA, 1996b)
Benzo(a)anthracene	346	Site-specific value derived from Secondary Chronic Value (SCV) (ORNL, 1996)
Benzo(b)fluoranthene	665	Site-specific value derived from AWQC (USEPA, 1996b)
Benzo(k)fluoranthene	665	Site-specific value derived from AWQC (USEPA, 1996b)

TABLE 2-28
SEDIMENT ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 3 OF 4

Contaminant of Concern	Ecotox Threshold	Source
Benzo(g,h,i)perylene	665	Site-specific value derived from AWQC (USEPA, 1996b)
Bis(2-ethylhexyl)phthalate	2.03E+05	Site-specific value derived from AWQC (USEPA, 1996b)
Chrysene	384	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
Fluoranthene	55,000	Site-specific value derived from AWQC (USEPA, 1996b)
Indeno(1,2-cd)pyrene	665	Site-specific value derived from AWQC (USEPA, 1996b)
Phenanthrene	5970	Site-specific value derived from AWQC (USEPA, 1996b)
Pyrene	665	Effects Range-Low (ER-L) value from NOAA (Long et al., 1995)
4,4'-DDT	2459	Site-specific value derived from AWQC (USEPA, 1996b)
4,4'-DDD	461	Site-specific value derived from AWQC for DDT (USEPA, 1996)
4,4'-DDE	2246	Site-specific value derived from AWQC for DDT (USEPA, 1996)
Aroclor 1248	180	Site-specific value derived from Secondary Chronic Value (SCV) (ORNL, 1996)
Aroclor 1254	677	Site-specific value derived from Secondary Chronic Value (SCV) (ORNL, 1996)
Alpha-Chlordane	14,563	Site-specific value derived from AWQC (USEPA, 1996b)

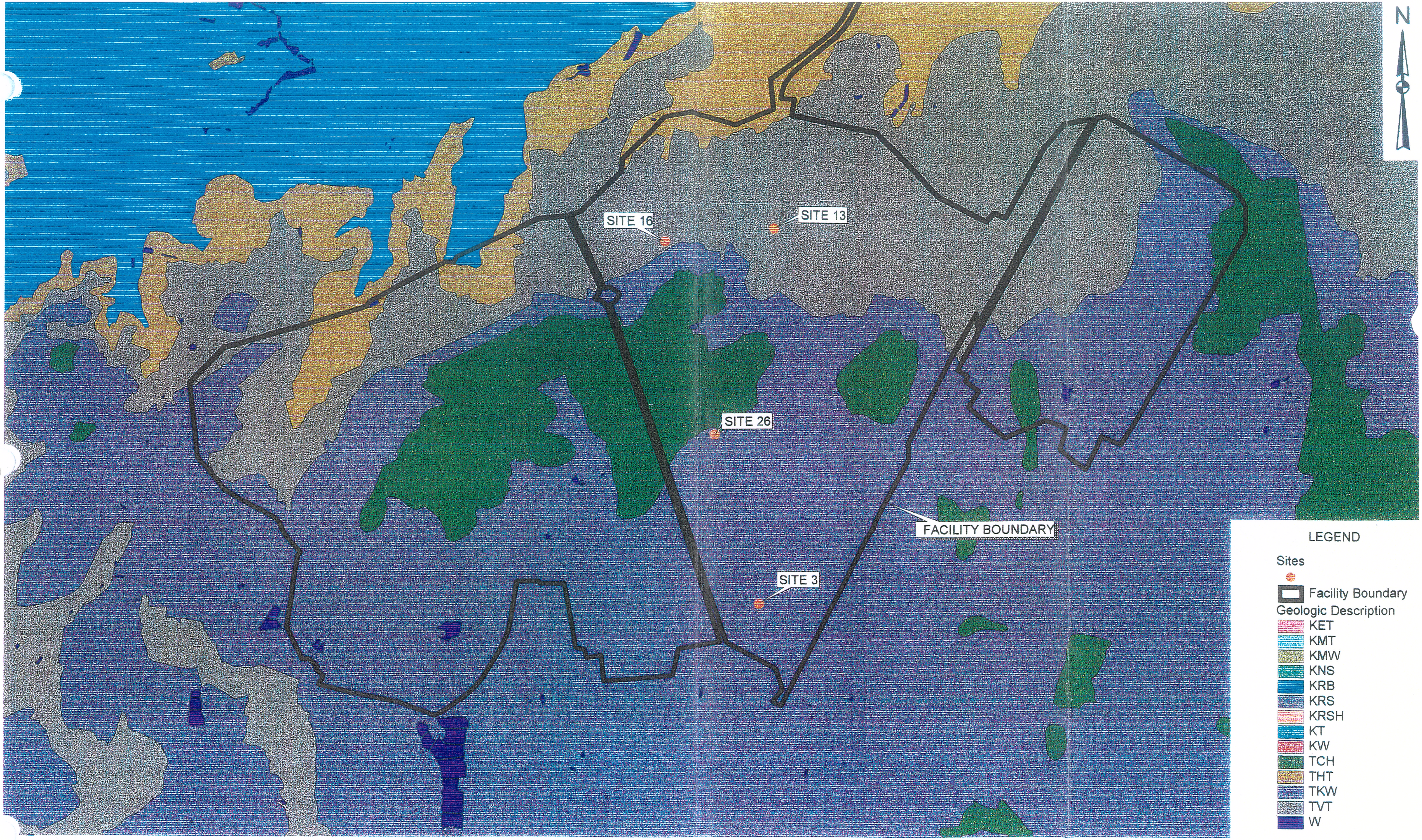
TABLE 2-28
SEDIMENT ECOTOX THRESHOLDS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 4 OF 4

Contaminant of Concern	Ecotox Threshold	Source
Endrin	309	Site-specific value derived from AWQC (USEPA, 1996b)
Gamma-Chlordane	2179	Site-specific value derived from AWQC (USEPA, 1996b)

levels (ETs), primarily site-specific screening levels, are presented in screening tables to select COCs. No average concentration screening table is presented for Site 3 sediment since only two samples were collected. Screening tables also contain background contaminant concentrations for comparative purposes. Sediment screening tables present other widely accepted ET values for comparative purposes when site-specific values were used. Waterfront screening tables present NOAA screening-levels for estuarine sediments (Long et al., 1995) and Site 3 tables present OME screening levels developed primarily for freshwater for comparative purposes against site-specific ET values (OME, 1992). As mentioned above, ETs from these two sources were also used quantitatively when no site-specific values could be calculated. NOAA values are described in detail in the RI report. OME values presented are Lowest Effect Levels (LELs) and Severe Effects Levels (SELs). The LEL and SEL can be considered the concentration in sediments at which ecotoxic effects become apparent and the concentration that could potentially eliminate most benthic species, respectively (OME, 1992). These values were developed by plotting the co-occurence of each contaminant in a sediment with a given benthic species to obtain a species screening level concentration (SSLC), which is the 90th percentile of the concentration distribution. A minimum of 10 SSLCs is required. The SSLCs for all species were then plotted for each contaminant. The fifth percentile of the SSLCs is the LEL and the 95th percentile is the SEL. Using this method, the OME guidelines are based on actual field observations that take into account ameliorating physical and chemical conditions in the field.

2.6.6 Uncertainties

A section describing generalized uncertainties involved in the RI ERAs that also pertain to this assessment is presented in the RI report (B&R Environmental, 1996). However, site-specific uncertainty sections are provided in the sections of this report describing Sites 3, 6, and 17.



GEOLOGIC MAP FOR THE MAINSIDE FACILITY

FIGURE 3-2

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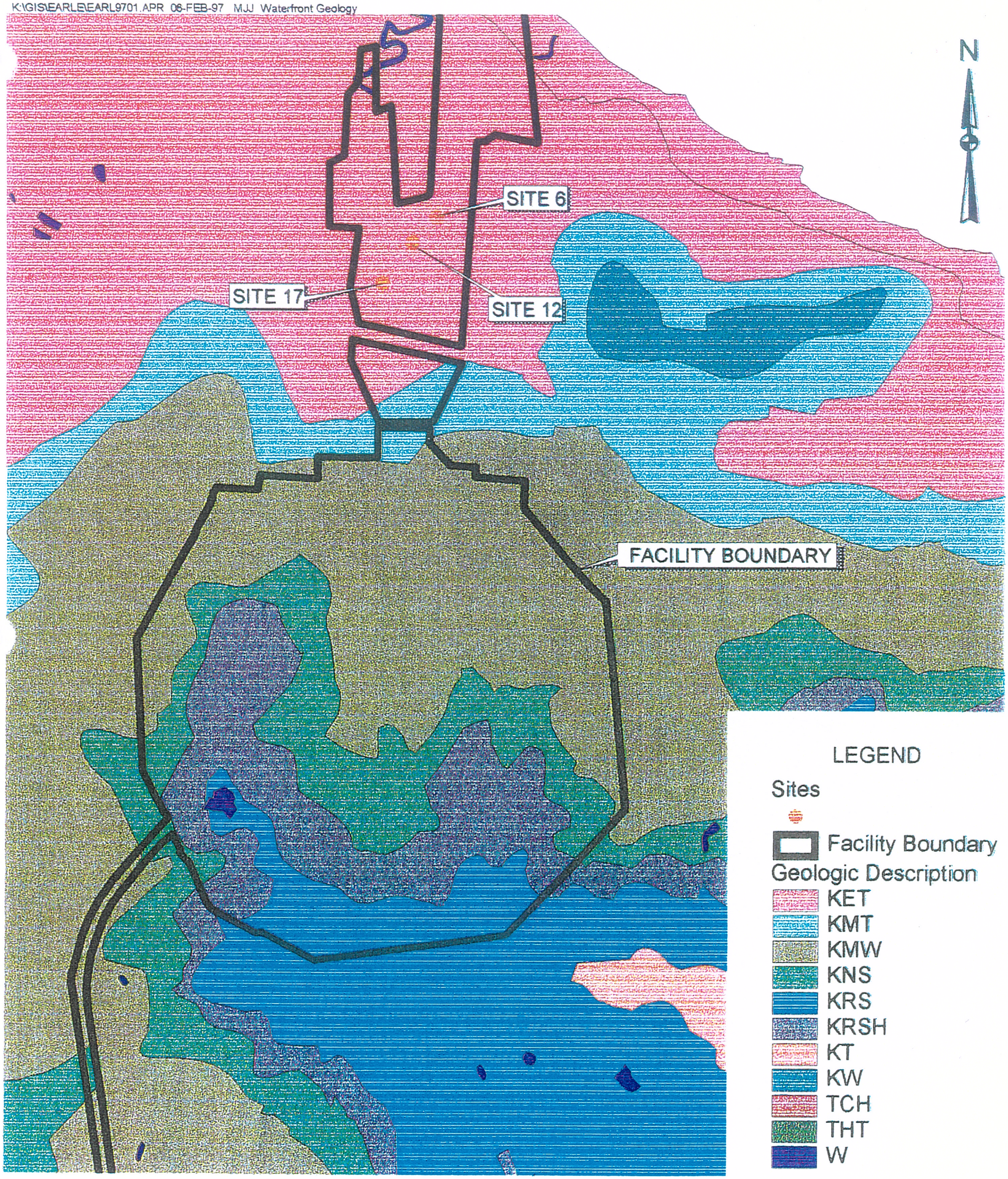

GEOLOGIC MAP FOR THE WATERFRONT AND CHAPEL HILL AREA

1500 0 1500 3000 Feet

FIGURE 3-3

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very fine- to fine-grained sand. These formations are mapped together because of their lithologic similarity. The formations range from 15 to 85 feet in thickness in Monmouth County.

The Upper Cretaceous Marshalltown Formation stratigraphically underlies the Wenonah Formation and consists of dark greenish-gray clay and glauconitic quartz sand. The Marshalltown Formation ranges from 30 to 50 feet in thickness in Monmouth County and crops out in the Waterfront and Chapel Hill areas.

The Upper Cretaceous Englishtown Formation stratigraphically underlies the Marshalltown Formation and consists of tan and gray, fine- to medium-grained quartz sand with local clay beds. The Englishtown Formation ranges from 35 to 150 feet in thickness in Monmouth County. The three Waterfront area sites (Sites 6, 12, and 17) are located in the outcrop area of the Englishtown Formation.

The Woodbury Clay stratigraphically underlies the Englishtown Formation and consists of gray clay and black, micaceous silt. The Woodbury Clay has an average thickness of 50 feet in Monmouth County. The Woodbury Clay does not crop out in the vicinity of NWS Earle.

The Upper Cretaceous Merchantville Formation stratigraphically underlies Woodbury Clay and consists of gray and black, glauconitic, micaceous clay with locally very fine-grained quartz and glauconite sand. The Merchantville Formation averages between 50 and 60 feet in thickness in Monmouth County. The Merchantville Formation does not crop out in the vicinity of NWS Earle.

The Upper Cretaceous Magothy Formation stratigraphically underlies the Merchantville Formation and consists of sheet deposits of coarse beach sand and other associated near-shore marine deposits. The Magothy Formation ranges from 25 to 175 feet in thickness in Monmouth County. The Magothy Formation does not crop out in the vicinity of NWS Earle.

The Upper Cretaceous Raritan Formation stratigraphically underlies the Magothy Formation and consists of alternating sequences of clay, silt, sand, and gravel that were primarily deposited in a fluvial-continental environment. The Raritan Formation ranges from 150 to more than 400 feet in thickness in Monmouth County. In downdip positions near the coast, the glauconite and shell beds of the Raritan Formation are indicative of a marine depositional environment. The Raritan Formation does not crop out in the vicinity of NWS Earle.

The Lower to Upper Cretaceous Potomac Group stratigraphically underlies the Raritan Formation and consists of alternating sequences of clay, silt, sand, and gravel that were deposited in a continental environment. The oldest sediments deposited on the pre-Cretaceous basement-bedrock complex are of the

Lower to Upper Cretaceous Potomac Group. The Potomac Group does not crop out in the vicinity of NWS Earle.

3.5 SOILS

The soils mapped at NWS Earle are described in the Soil Survey of Monmouth County, New Jersey (United States Department of Agriculture, Soil Conservation Service, 1990). The most prevalent soil series mapped in the Mainside and Waterfront areas are summarized in Table 3-3; site-specific soils are summarized in Table 3-4. Mainside soils formed in acid, loamy or sandy, Coastal Plain sediments, Waterfront soils formed in acid, clayey Coastal Plain sediments, and Chapel Hill soils formed in acid, loamy, glauconitic Coastal Plain sediments. Slopes range from zero to 25 percent and the soils are generally extremely acid to strongly acid.

Metals concentrations were determined for 80 samples collected between 1985 and 1987 at select background locations in New Jersey (see NJDEP Site Remedial Program and Division of Science and Research A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey. September 1993). Nine of the 80 samples were collected in soil series considered prevalent at NWS Earle: Manahawkin, Atsion, Freehold, Keyport, Lakewood, Sassafrass, Holmdel, and Adelphia Series. The series sampled, sample number and land use at each sample location are summarized for the above series in Table 3-5. Metal results are summarized in Table 3-6; the range of positive detects, frequency of positive results, and media value are also provided for each analyte.

3.6 HYDROGEOLOGY

The following section describes the regional hydrogeologic framework in the vicinity of NWS Earle and discusses the regulatory classification of the aquifers. Hydrogeologic parameters such as the depth to the water table and groundwater flow direction are highly variable and are dependent on local conditions such as topography, location relative to discharge points, and proximity to external stresses such as well pumpage. The site-specific hydrogeologic conditions are discussed in Sections 4 through 10.

Table 3-3
Prevalent Soils Series
NWS Earle, Colts Neck, New Jersey

Prevalent Soils in the Mainside Area			
Atsion Series	Evesboro Series	Humaquepts	Keyport Series
Klej Series	Lakehurst Series	Lakewood Series	Manahawkin Series
Marlton Series	Pemberton Series	Pits	Sassafras Series
Shrewsbury Series	Tinton Series	Udorthents	

Prevalent Soils in the Waterfront Area		
Elkton Series	Sulfaquents and Sulfihemists	Udorthents-Urban land complex

Prevalent Soils in the Chapel Hill Area			
Adelphia Series	Collington Series	Colts Neck Series	Freehold Series
Holmdel Series	Phalanx Series	Psamments	Tinton Series
Psamments			

Table 3-4
Site-Specific Soils
NWS Earle, Colts Neck, New Jersey

Site	Soil Name	Description	Permeability (in/in)	Soil Reaction (pH)
3	Lakehurst sand, 0 to 2 percent slopes	sand	6.0-20	3.6-5.0
6	Sulfaquents and Sulfihemists, frequently flooded	organic material	N/A	N/A
12	Udorthents-Urban land complex, 0 to 3 percent slopes	loamy material	N/A	N/A
13	Udorthents, smoothed	loamy material	N/A	N/A
16/F	Udorthents, smoothed	loamy material	N/A	N/A
17	Udorthents-Urban land complex, 0 to 3 percent slopes	loamy material	N/A	N/A
26	Lakehurst sand, 0 to 2 percent slopes	sand	6.0-20	3.6-5.0

N/A - Not Available

TABLE 3-5
SUMMARY INFORMATION ON BACKGROUND SOIL SAMPLES
NAVAL WEAPONS STATION EARLE, NEW JERSEY

Sample No.	County	Soil Series	Land Use
10	Ocean	Manahawkin	Rural
13	Burlington	Atsion	Rural
19	Monmouth	Freehold	Rural
20	Monmouth	Keyport	Rural
26	Hunterdon	Disturbed Soil	Urban
29	Ocean	Disturbed Soil	Urban
30	Camden	Lakewood Series	Rural
32	Atlantic	Disturbed Soil	Urban
34	Cape May	Sassafras	Rural
37	Middlesex	Sassafras	Rural
39	Passaic	Disturbed Soil	Suburban
40	Passaic	Disturbed Soil	Suburban
42	Hudson	Disturbed Soil	Urban
43	Essex	Disturbed Soil	Urban
44	Essex	Disturbed Soil	Urban

TABLE 3-6
TYPICAL STATE-WIDE BACKGROUND METAL CONCENTRATIONS
NAVAL WEAPONS STATION EARLE, NEW JERSEY

Analyte (mg/kg)	Sample No. 10	Sample No. 13	Sample No. 19	Sample No. 20	Sample No. 30	Samples No. 34 & 37		Sample No. 35	Sample No. 36	Range of Values/ No. of Positive Detects	Median Value
	Manahawkin Series [1]	Atsion Series	Freehold Series	Keyport Series	Lakewood Series	Sassafras Series		Holmdel Series	Adelphia Series		
Antimony	ND	ND	NA	NA	0.04	ND	0.02	ND	ND	0.02-0.04 / 2	0.03
Arsenic	4.78	0.23	17.1	2.85	0.14	0.06	8.41	4.56	10.7	0.06-17.1 / 9	4.78
Beryllium	1.63	0.02	0.76	1.07	ND	0.22	0.70	0.09	0.88	0.02-1.63 / 8	0.88
Cadmium	0.146	0.011	0.079	0.03	0.007	0.016	0.164	0.116	0.135	0.011-0.164 / 9	0.079
Chromium	9.7	3.7	20.7	18.9	1.0	4.2	14.3	10.4	14.0	1.0-20.9 / 9	10.4
Copper	10.4	1.31	5.57	5.25	0.78	1.77	41.7	6.05	7.27	0.78-41.7 / 9	5.57
Lead	46.0	7.4	44.3	18.5	5.0	8.0	58.9	25.9	15.1	8.0-58.9 / 9	25.9
Manganese	7	3	28	27	4	17	86	59	120	3-12- / 9	27
Mercury	0.11	ND	0.17	ND	ND	0.1	0.14	ND	ND	0.1-0.17 / 4	0.14
Nickel	6.6	ND	7.6	6.4	ND	2.1	8.5	3.2	8.3	2.1-8.5 / 7	6.6
Selenium	0.80	ND	0.10	0.11	ND	0.05	0.05	0.11	0.17	0.05-0.80 / 7	0.11
Silver	0.03	0.01	0.11	0.10	0.01	0.19	0.42	0.21	0.26	0.01-0.42 / 9	0.19
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	- / 0	-
Vanadium	5.3	0.9	23.5	23.6	1.0	0.7	19.4	1.3	14.0	0.7-23.6 / 9	5.3
Zinc	27.0	5.5	25.5	35.1	3.4	9.5	40.6	44.6	28.1	3.4-44.6 / 9	28.1
Site included in this report underlain by soil of the same series	(2)	(2)	(2)	(2)	(2)	(2)		(2)	(2)		

[1] Sample was collected from a cedar bog in the Pine Barrens.

[2] No site included in this report is underlain by a soil in this series.

3.6.1 Aquifer Classification

Groundwater classification areas were established in New Jersey under NJDEP Water Technical Programs Groundwater Quality Standards in New Jersey Administrative Code (N.J.A.C.) 7:9-6. The Mainside, Waterfront, and Chapel Hill areas are located in the Class II-A Groundwater Supporting Potable Water Supply area. Class II-A includes those areas where groundwater is an existing source of potable water with conventional water supply treatment or is a potential source of potable water. In the Mainside and Waterfront areas, in general, the deeper aquifers are used for public water supplies and the shallower aquifers are used for domestic supplies.

3.6.2 Hydrogeologic Units

The Coastal Plain sediments are the most important source of potable water in the Coastal Plain of New Jersey, with wells supplying greater than 75 percent of the potable water supply. Water-supply problems associated with the increased demand for groundwater in the Coastal Plain include decreased groundwater levels and the induced recharge of fresh, brackish, or saline water from surface water or adjacent aquifers. Recharge to the groundwater system is through the infiltration of precipitation, seepage from surface water bodies, and leakage through semiconfining beds. Groundwater discharge is induced by movement to overlying surface-water bodies, by evapotranspiration, and by withdrawal from wells. Generally, the regressive depositional units (the Cohansey Sand, the Kirkwood and Vincentown Formations, the Red Bank and Mount Laurel Sands, and the Wenonah and Englishtown Formations) form aquifers and the transgressive depositional units (the Manasquan Formation, the Hornerstown Sand, and the Navesink, Marshalltown, and Merchantville Formations) form confining or semiconfining beds.

The regional hydrogeologic classification system defined in the Hydrogeologic Framework of the New Jersey Coastal Plain, Regional Aquifer-System Analysis (O.S. Zapecza, 1984) has been followed for this report and is summarized in Table 3-1. The five principal Coastal Plain aquifers are the

- Kirkwood-Cohansey aquifer system
- Atlantic City 800-foot sand
- Wenonah-Mount Laurel aquifer system
- Englishtown aquifer
- Potomac-Raritan-Magothy aquifer system

Minor Coastal Plain aquifers include the

- Piney Point aquifer
- Vincentown aquifer
- Red Bank Sand aquifer

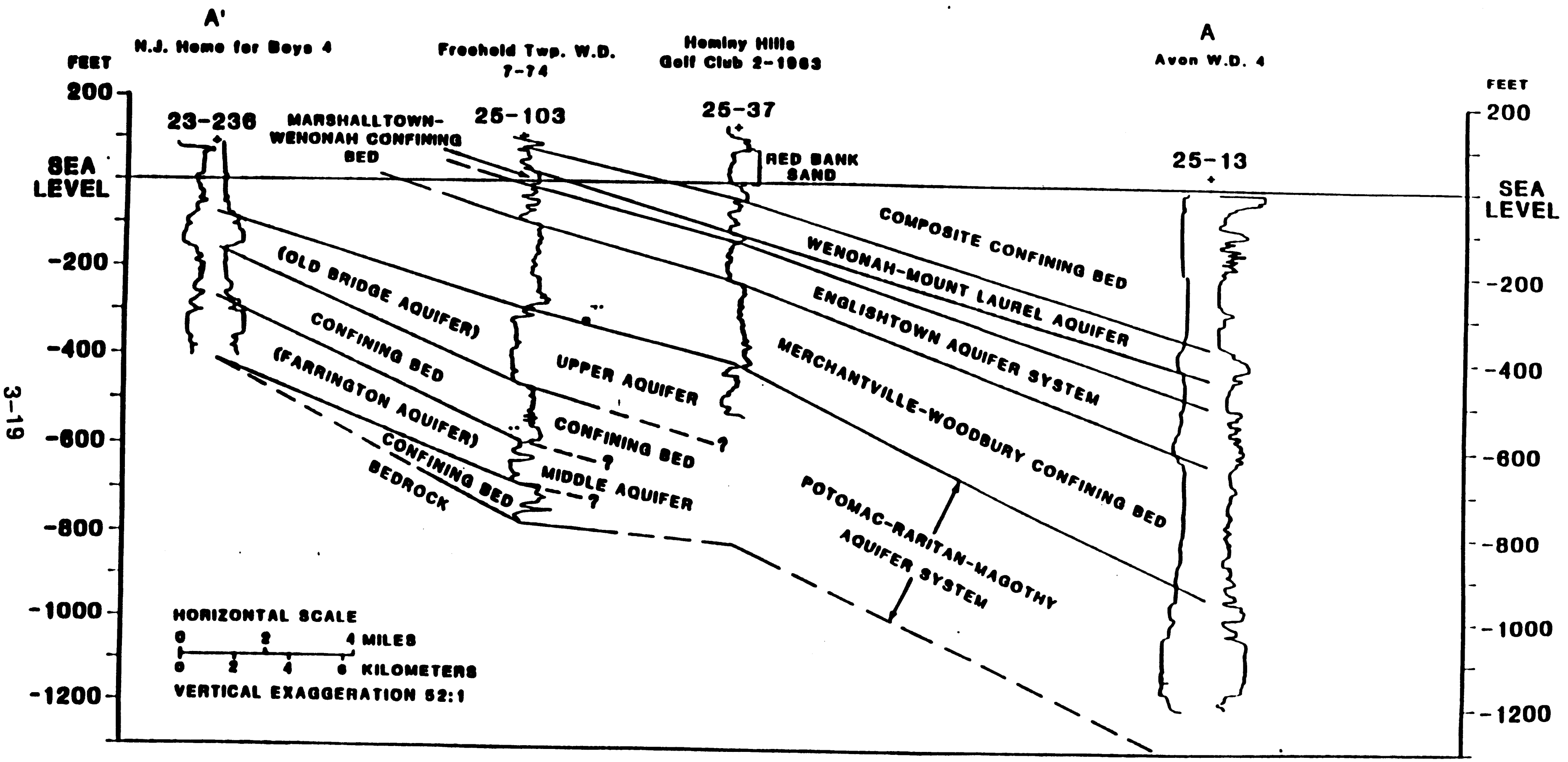
The five principal aquifers are capable of yielding large quantities of water for public supply use. The minor aquifers generally yield small to moderate quantities of water in or near their outcrop areas. All the Coastal Plain aquifers except the Kirkwood-Cohansey aquifer system are confined to semi-confined except where they crop out or are overlain by permeable surficial deposits. Increased groundwater withdrawals have produced large regional cones of depression in the major artesian aquifers.

Mainside is situated in the recharge area of the Kirkwood-Cohansey aquifer system and the Vincentown aquifer. Waterfront and Chapel Hill are situated in the recharge areas of the Wenonah-Mount Laurel aquifer system, the Englishtown aquifer, and the Red Bank Sand aquifer. Generalized hydrogeologic cross-sections for the Mainside and Waterfront-Chapel Hill areas are provided in Figures 3-4 and 3-5, respectively.

The Kirkwood-Cohansey aquifer system is a source of water in Monmouth County and is composed of the generally unconfined sediments of the Cohansey Sand and Kirkwood Formation. The Kirkwood-Cohansey aquifer system was reported in previous investigations as being used extensively for residential wells in the Mainside area. Along the coast, this aquifer system is underlain by thick diatomaceous clay beds of the Kirkwood Formation. Two of the Mainside sites (Sites 3 and 26) are located in the recharge area of the Kirkwood-Cohansey aquifer system.

The Atlantic City 800-foot sand (lower Kirkwood Formation) is a significant source of water in the Coastal Plain and is separated from other sands in the Kirkwood Formation by a confining unit. The Atlantic City 800-foot sand is not present in the NWS Earle area.

The Wenonah-Mount Laurel aquifer system is an important source of water in Monmouth County and is developed in the sands of the Wenonah Formation and Mount Laurel Sand. Although these formations are distinct lithological units, they are hydraulically connected. This aquifer system is underlain by semiconfining beds of the Wenonah and Marshalltown Formations. One of the Chapel Hill sites (Site 9) is located in the recharge area of the Wenonah-Mount Laurel aquifer system. This aquifer was reported in previous investigations as not being used as a source of potable water in the Waterfront-Chapel Hill areas.



SOURCE: U.S.G.S. OPEN-FILE REPORT 84-730. HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COSTAL PLAIN.

FIGURE 3-4

GENERALIZED HYDROGEOLOGIC CROSS-SECTION FOR THE MAINSIDE AREA
NWS EARLE, COLTS NECK, NEW JERSEY

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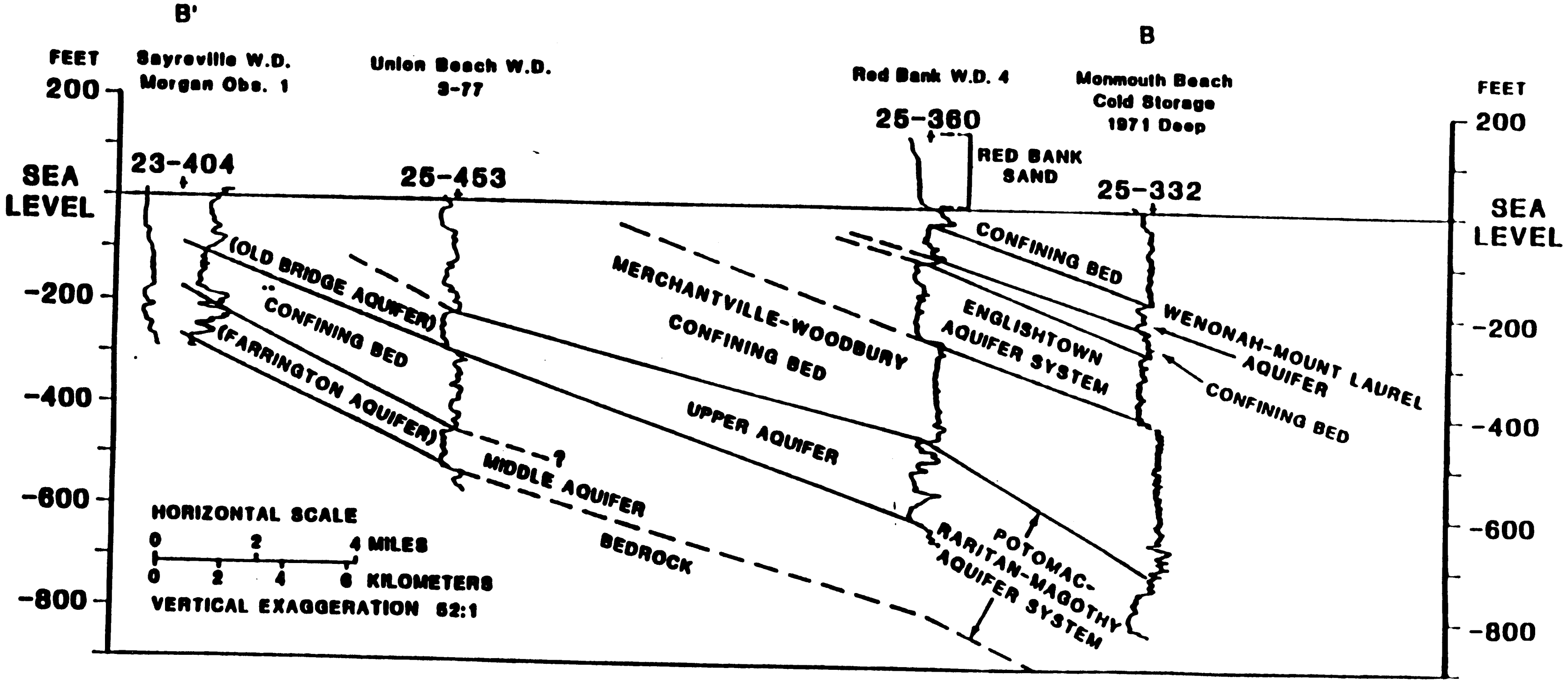

SOURCE: U.S.G.S. OPEN-FILE REPORT 84-730. HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COSTAL PLAIN.

FIGURE 3-5

GENERALIZED HYDROGEOLOGIC CROSS-SECTION FOR THE WATERFRONT AREA
NWS EARLE, COLTS NECK, NEW JERSEY

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The Englishtown aquifer is a significant source of water in Monmouth County and is developed in the sands of the Englishtown Formation. This aquifer is underlain by confining beds of the Woodbury Clay and Merchantville Formation. The three Waterfront sites (Sites 6, 12 and 17) are located in the recharge area of the Englishtown aquifer. This aquifer is probably not used as a source of potable water in the Waterfront-Chapel Hill areas because residences adjacent to these areas are supplied by municipal water systems.

The Potomac-Raritan-Magothy aquifer system underlies the entire New Jersey Coastal Plain and is the most heavily pumped aquifer in the Coastal Plain. This aquifer system is the primary source of groundwater supply in Monmouth County. The Potomac-Raritan-Magothy aquifer system is composed of three aquifers (an upper, a middle, and a lower aquifer) that are separated by confining beds. The upper aquifer is developed in the sands of the Magothy Formation and is underlain by confining beds of the Raritan Formation. The middle aquifer is developed in the sands of the Raritan Formation and is underlain by confining beds of the Potomac Group. The lower aquifer is developed in the sands of the Potomac Group and is underlain by crystalline rocks and metamorphic schists and gneiss of the pre-Cretaceous basement-bedrock complex. The recharge area of the Potomac-Raritan-Magothy aquifer system is located several miles north and west of the Mainside area. Two out-of-service 800-feet-deep water supply wells are located in Mainside; when operational, they produced from the middle and lower aquifers of the Potomac-Raritan-magothy aquifer system.

The Piney Point aquifer is developed in the sands of the Piney Point Formation and is underlain by confining beds of the Shark River and Manasquan Formations. The Piney Point aquifer is not present in the subsurface beneath NWS Earle.

The Vincentown aquifer is developed in the sands and calcarenites of the Vincentown Formation within its outcrop area and extends for approximately 8 to 10 miles downdip. The Vincentown aquifer was reported in previous investigations as being used extensively for residential wells in the Mainside area. This aquifer is underlain by confining beds of the Hornerstown and Tinton Sands. Two of the Mainside sites (Sites 13 and 16/F) are located in the recharge area of the Vincentown aquifer.

The Red Bank Sand aquifer is developed in the Red Bank Sand. This aquifer is underlain by confining beds of the Navesink Formation. One of the Waterfront sites (Site 7) is located in the recharge area of the Red Bank Sand aquifer. This aquifer is probably not used as a source of potable water in the Waterfront-Chapel Hill areas because residences adjacent to these areas are supplied by municipal water systems.

3.6.3 Hydraulic Conductivity

Twenty-eight monitoring wells, including four background wells, were installed as part of the original RI and five monitoring wells were installed as part of the Addendum RI. Table 3-7 summarizes the well numbers, formation mapped at the surface location, and the interpreted aquifer for the wells present at each of the sites included in the RI Addendum. Quantitative estimates of hydraulic conductivity have been calculated from rising-head slug tests performed on various monitoring wells located at NWS Earle, including nine of the 28 wells installed during the RI. The hydraulic conductivities from each test, which were calculated using either the Bower and Rice or Hvorslev methods, are listed in Table 3-8.

The interpreted aquifers are based on the geologic map and the site-specific lithologic descriptions. The range and average values of hydraulic conductivity for each aquifer are summarized in Table 3-9. In general, the average hydraulic conductivities calculated for the various aquifers are within one order of magnitude of each other.

3.7 WATER SUPPLY

All facilities located in the Waterfront area and the Mainside Administration area are connected to the public water supply (New Jersey American Water Company). Water for the public supply network comes from surface water intakes, reservoirs, and deep wells. No public water supply well or surface water intake is located on the NWS Earle facility.

A combination of private wells and public water supply from the New Jersey American Water Company serves businesses and residences in areas surrounding the Mainside and Waterfront facilities. A map obtained from the Monmouth County Health Department shows the location of public non-community (PNC) wells within 1 mile of the site (Figure 3-6). These wells typically serve commercial or industrial establishments where more than 25 people consume the water. It is assumed all PNC wells are currently in service.

One PNC-type well, located west of Highway 34, taps a deep (approximately 200 feet) aquifer source to feed a 300,000-gallon storage tank. Operations buildings draw water from the tank for general industrial use such as fire protection and for potable water uses. This well is located closest to background well BG MW-02, more than 1 mile from any area of concern. Periodic sampling results for a wide suite of drinking water parameters have shown compliances with drinking water standards.

TABLE 3-7
SUMMARY OF ESTIMATED HYDRAULIC CONDUCTIVITIES BY WELL
NWS EARLE, COLTS NECK, NEW JERSEY

Well Number	Formation Mapped at Surface	Interpreted Aquifer	Hydraulic Conductivity	
			K (cm/sec)	K (ft/day)
MW1-04	Vincentown Formation	Vincentown Formation	6.06 x 10^{-4}	1.72
MW1-05	Vincentown Formation	Vincentown Formation	1.29 x 10^{-3}	3.66
MW2-01	Vincentown Formation	Vincentown Formation	4.67 x 10^{-3}	13.24
MW2-05	Vincentown Formation	Vincentown Formation	4.62 x 10^{-4}	1.31
MW2-06	Vincentown Formation	Vincentown Formation	4.23 x 10^{-5}	0.12
MW2-07	Vincentown Formation	Vincentown Formation	1.73 x 10^{-4}	0.49
MW3-03(1)	Kirkwood Formation	Kirkwood Formation	7.16 x 10^{-4}	2.03
MW3-06(1)	Kirkwood Formation	Kirkwood Formation	5.50 x 10^{-4}	1.56
MW4-04	Cohansey Sand	Cohansey Sand	4.48 x 10^{-4}	1.27
MW5-02	Kirkwood Formation	Kirkwood/Vincentown Formations	3.18 x 10^{-4}	0.90
MW5-06	Kirkwood Formation	Kirkwood Formation	6.46 x 10^{-4}	1.83
MW5-07	Kirkwood Formation	Vincentown Formation	2.08 x 10^{-4}	0.59
MW7-02	Red Bank Sand	Red Bank Sand/Navesink Formation	9.74 x 10^{-4}	2.76
MW7-03	Red Bank Sand	Red Bank Sand	2.65 x 10^{-4}	0.75
MW10-04	Kirkwood Formation	Kirkwood/Vincentown Formations	2.54 x 10^{-4}	0.72
MW10-05	Kirkwood Formation	upper colluvium and Kirkwood/Vincentown Formations	6.99 x 10^{-4}	1.98
MW10-07	Kirkwood Formation	Kirkwood/Vincentown Formations	1.75 x 10^{-3}	4.96
MW11-02	Vincentown Formation	Vincentown Formation	3.56 x 10^{-4}	1.01
MW11-04	Vincentown Formation	upper colluvium and Vincentown Formation	8.64 x 10^{-4}	2.45
MW13-04(1)	Vincentown Formation	Vincentown Formation	2.64 x 10^{-5}	0.075

TABLE 3-7
SUMMARY OF ESTIMATED HYDRAULIC CONDUCTIVITIES BY WELL
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Well Number	Formation Mapped at Surface	Interpreted Aquifer	Hydraulic Conductivity	
			K (cm/sec)	K (ft/day)
MW16-01[(1)]	Vincentown Formation	Vincentown	3.48×10^{-4}	0.99
MW16-06[(1)]	Vincentown Formation	upper colluvium and Vincentown	1.39×10^{-3}	3.94
MW19-04	Kirkwood Formation	Kirkwood and Vincentown	6.91×10^{-4}	1.96
MW19-05	Kirkwood Formation	Kirkwood and Vincentown	1.06×10^{-3}	3.00
MW23-01	Kirkwood Formation	Kirkwood and Vincentown	2.79×10^{-3}	7.91
MW23-02	Kirkwood Formation	Kirkwood and Vincentown	2.04×10^{-3}	5.78
MW26-01[(1)]	Kirkwood Formation	Kirkwood Formation	3.85×10^{-4}	1.09
MW26-03[(1)]	Kirkwood Formation	Kirkwood Formation	1.92×10^{-3}	5.44
MW26-04[(1)]	Kirkwood Formation	Kirkwood Formation	7.09×10^{-4}	2.01

[(1)] Site included in addendum RI.

TABLE 3-8
SUMMARY OF ESTIMATED HYDRAULIC CONDUCTIVITIES BY WELL
NWS EARLE, COLTS NECK, NEW JERSEY

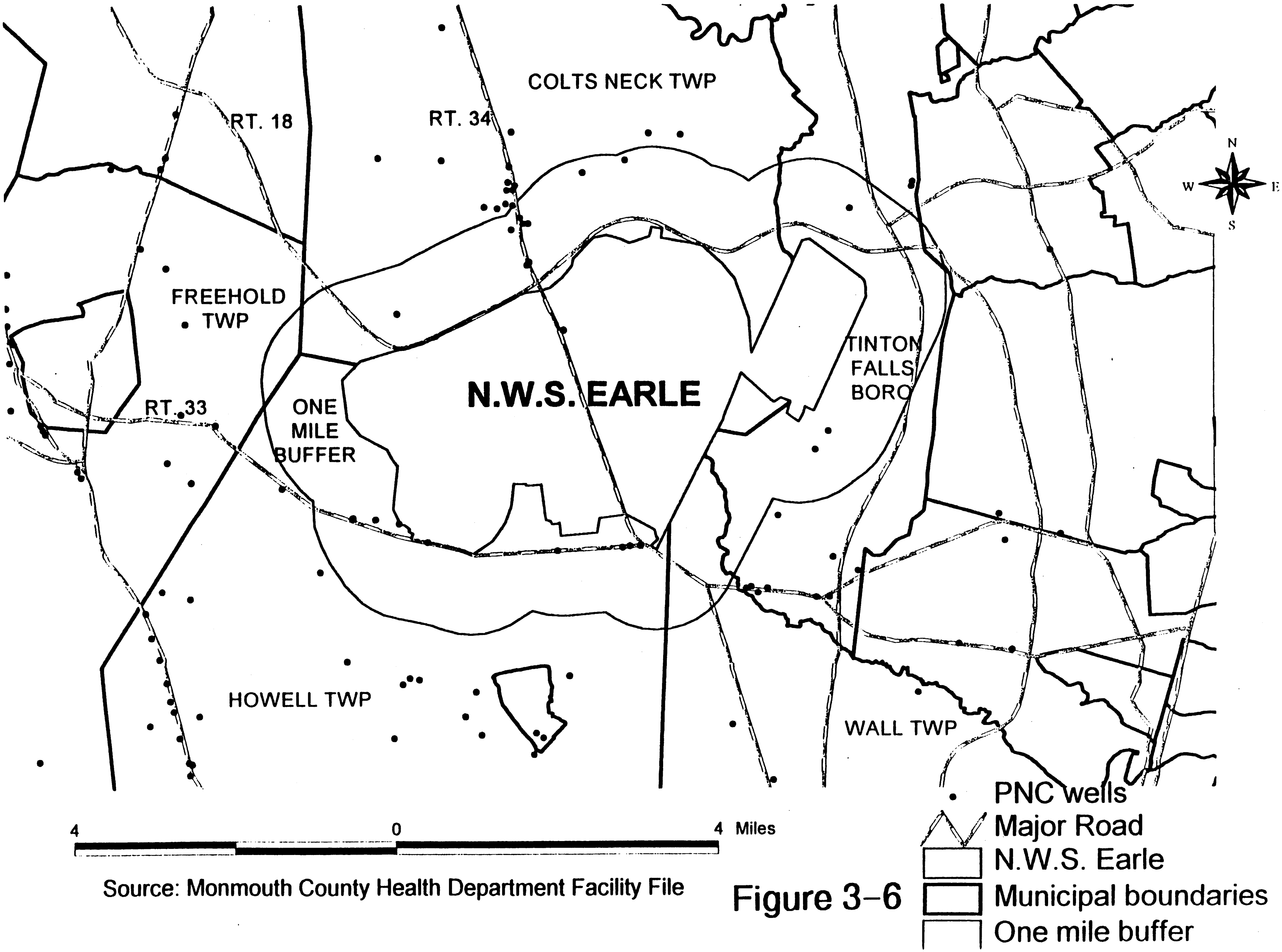
Well Number	Formation Mapped at Surface	Interpreted Aquifer	Hydraulic Conductivity	
			K (cm/sec)	K (ft/day)
MW16-01(1)	Vincentown Formation	Vincentown	3.48×10^{-4}	0.99
MW16-06(1)	Vincentown Formation	upper colluvium and Vincentown	1.39×10^{-3}	3.94
MW19-04	Kirkwood Formation	Kirkwood and Vincentown	6.91×10^{-4}	1.96
MW19-05	Kirkwood Formation	Kirkwood and Vincentown	1.06×10^{-3}	3.00
MW23-01	Kirkwood Formation	Kirkwood and Vincentown	2.79×10^{-3}	7.91
MW23-02	Kirkwood Formation	Kirkwood and Vincentown	2.04×10^{-3}	5.78
MW26-01(1)	Kirkwood Formation	Kirkwood Formation	3.85×10^{-4}	1.09
MW26-03(1)	Kirkwood Formation	Kirkwood Formation	1.92×10^{-3}	5.44
MW26-04(1)	Kirkwood Formation	Kirkwood Formation	7.09×10^{-4}	2.01

(1)Site included in addendum RI.

TABLE 3-9
SUMMARY OF HYDRAULIC CONDUCTIVITIES BY FORMATION
NWS EARLE, COLTS NECK, NEW JERSEY

Interpreted Aquifer	Frequency (Number of Wells)	Range of Hydraulic Conductivity	Average Hydraulic Conductivity
Upper colluvium and Kirkwood and Vincentown Formations	1	6.99×10^{-4} cm/sec	N/A
		2.76 ft/day	N/A
Upper colluvium and Vincentown Formation	2	8.64×10^{-4} to 1.39×10^{-3} cm/sec	8.21×10^{-4} cm/sec
		1.09 to 5.44 ft/day	2.33 ft/day
Cohansey Sand	1	4.48×10^{-4} cm/sec	N/A
		1.27 ft.day	N/A
Kirkwood Formation	6	3.85×10^{-4} to 1.92×10^{-3} cm/sec	8.21×10^{-4} cm/sec
		1.09 to 5.44 ft/day	2.33 ft/day
Kirkwood and Vincentown Formations	7	2.54×10^{-4} to 2.79×10^{-3} cm/sec	1.27×10^{-3} cm/sec
		0.72 to 7.91 ft/day	3.64 ft/day
Vincentown Formations	10	2.64×10^{-5} to 4.67×10^{-3} cm/sec	8.19×10^{-4} cm/sec
		0.75 to 13.24 ft/day	2.32 ft/day
Red Bank Sand	1	2.65×10^{-4} cm/sec	N/A
		0.75 ft/day	N/A
Red Bank Sand and Navesink Formation	1	9.74×10^{-4} cm/sec	N/A
		2.76 ft/day	N/A

Public Non Community Wells within 1 Mile of N.W.S. EARLE



Source: Monmouth County Health Department Facility File

Figure 3–6

3.7.1 Private Wells

An inventory map of domestic wells within 1 mile of the site was provided by Monmouth County Health Department (Figure 3-7). The domestic well map shows approximate locations (well driller estimates) of domestic wells. It is estimated that 90 percent or more of these wells are currently in use, including some at NWS Earle. However, results of RI activities to date indicate that no measurable concentration of any contaminant of concern exists in groundwater near the facility boundary or is moving off-post.

Quarters H, located at the western NWS Earle boundary at Tarawa Road, has one domestic well but is not expected to be occupied. The Quarters H well is not near any area of concern. A well located at the ordnance central operations building, located at the intersection of Guadalcanal and Lunga Roads, supplies potable water for drinking and sanitary use. Analytical results for a wide suite of drinking water parameters have shown compliance with drinking water standards. One more domestic well serves the Carpentry Shop, S-35 located on Tarawa Road, west of the intersection with Guadalcanal Road. The well at S-35 has been tested for a wide suite of drinking water parameters and shows compliance with drinking water standards.

3.7.2 Municipal Water System

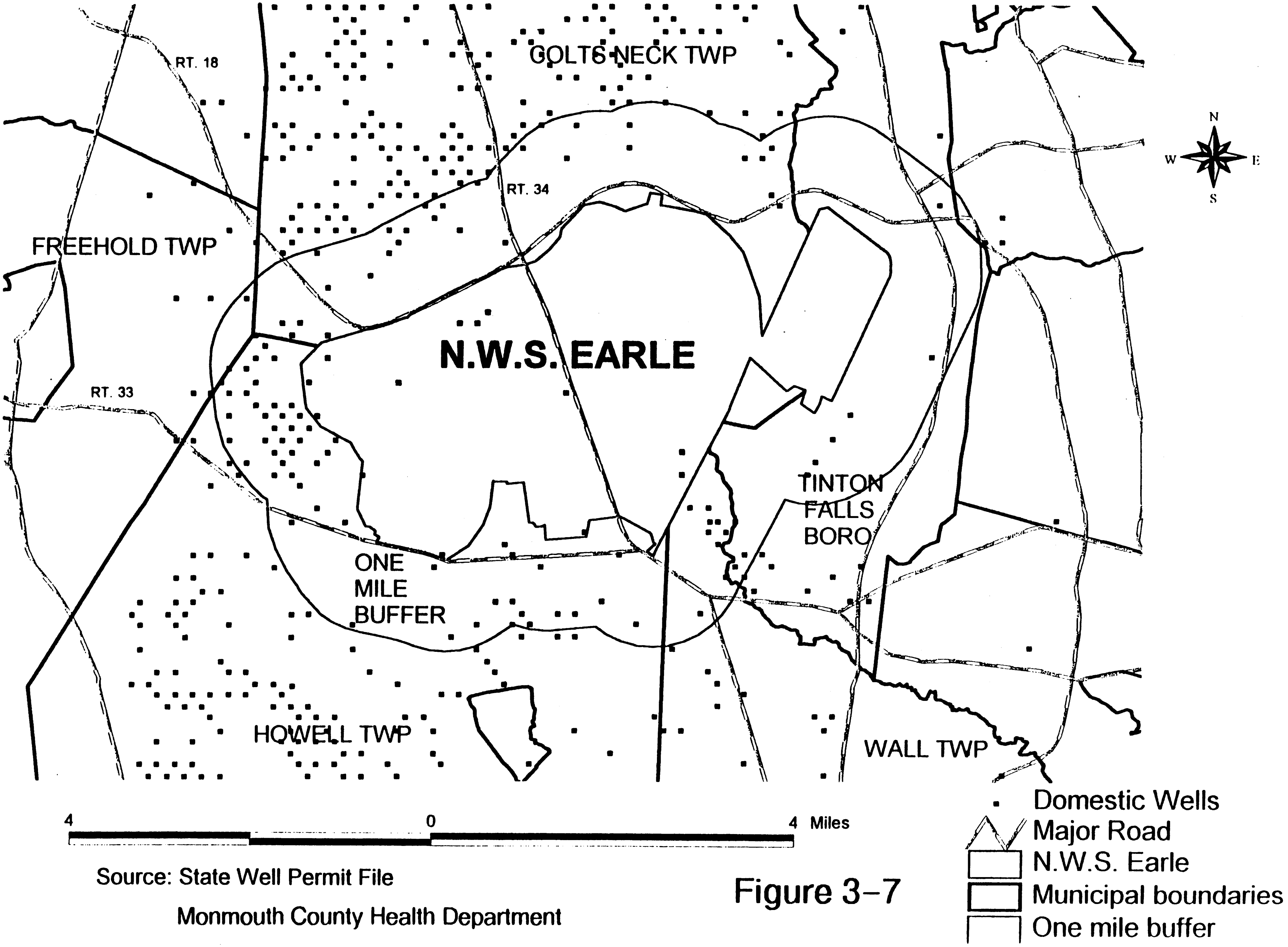
The New Jersey American Water Company (Eastern Division) is the only municipal water supplier operating in the vicinity of NWS Earle. Water resources include various deep wells, surface water intakes on the Jumping Brook, Shark, and Swimming Rivers, a temporary surface water intake on the Manasquan River, and two reservoirs, the Glendola and the Swimming River. Surface water originating at NWS Earle could migrate to any of these surface water intakes.

3.8 POPULATION AND LAND USE

3.8.1 Population

An estimated 2,500 people reside and/or work at NWS Earle. The total population of Monmouth County is approximately 550,000. Colts Neck Township, which is the location of the Mainside facility, has a total population of approximately 8,560 people. Middletown Township, which is the location of the Waterfront, has a total population of approximately 68,200 people (United States Department of Commerce, 1990).

Domestic Wells within 1 Mile of N.W.S. EARLE



Source: State Well Permit File

Monmouth County Health Department

Figure 3-7

3.8.2 Surrounding Land Use

The majority of the land at the Mainside area is undeveloped land associated with ordnance operations, production, and storage facilities; the undeveloped land is encumbered by explosive safety quantity distance (ESQD) arcs. Land use at the Mainside facility includes residences, office buildings, workshops and warehouses, recreational areas, open space, and undeveloped land. The area around the Mainside facility includes agricultural areas, vacant land, and low-density residential land.

Land use at the Waterfront facility includes residences, office buildings, recreational areas, open space, and undeveloped land. Approximately 20 percent of the Waterfront area is considered marshland. The area around the Waterfront includes commercial land and single-family residential land.

3.9 ECOLOGY

There is a rich diversity of ecological systems and habitats at NWS Earle. Much effort has been dedicated to identification of sensitive habitat systems, such as wetlands, and of the fauna/flora potentially affected by individual site-related exposures. Much attention has been given to ecological issues as evidenced by the significant effort given to Watershed surface water and sediment sampling and analysis performed as part of this RI. Section 30.1 presents the results of the Watershed studies.

Knieskern's beaked-rush (Rynchospora knieskernii), a sedge species on the federal endangered list, has been seen on the station, and some species on the New Jersey list such as the swamp pink (Helonias bullata) may be present. An osprey has visited Mainside and may nest in the Chapel Hill area. The Mingamahone Brook supports bog turtles downstream of Mainside and provides an appropriate habitat for them at the Mainside. The Waterfront area borders a tidal wetland, some of which has been filled in by the Navy and a neighboring (non-Navy) landfill. This marsh is a productive and environmentally useful resource that serves as a nursery for many marine and shore animals (Fred C. Hart Associates, Incorporated, 1983).

Resources and habitats of the drainage potentially impacted by sites investigated in the RI were summarized as follows (Source: NOAA in a letter from EPA Region II dated August 19, 1992, signed by Paul G. Ingrisano, project manager):

- Manasquan River - Mingamahone Brook and East Branch of Mingamahone Brook

  - American eel, alewife, white perch, and blueback herring are likely present in the upper reaches of the Manasquan River and may migrate to Mingamahone Brook.

  - Migration of fish may have been impacted by the construction of a reservoir located on a tributary that also takes water from the Manasquan River. Although suspected, impacts of the reservoir have not been studied.

- Navesink River

  - The Navesink River is a tidal embayment. NOAA trust species present in the Navesink River include striped bass, alewife, blueback herring, menhaden, bluefish, American eel, blue crab, and sea lamprey. Resource utilization is believed to be limited to foraging activity, with the exception of winter flounder and blue crab spawning.

- Swimming River - Pine Brook and Hockhockson Brook

  - Hockhockson and Pine Brooks originate within NWS Earle. Hockhockson Brook joins Pine Brook north of the facility. Pine Brook discharges to the Swimming River about 2 kilometers below the Swimming River Reservoir. Swimming River is tidally influenced below its confluence with Pine Brook and flows from there about 4 kilometers to the Navesink River.

  - Alewife and blueback herring are known to migrate in the Swimming River and have been sampled in Pine Brook. Their presence in Hockhockson Brook is expected.

- McClees Creek

  - McClees Creek flows about 5 kilometers to the Navesink River. The creek has not been studied but is free-flowing and could provide habitat for blueback herring, alewife, American eel, white perch, and blue crab.

Significant agricultural lands under consideration include cranberry bogs located at the headwaters of Yellow Brook and Marsh Bog Brook, potentially affected by Site 19.

Ecological receptors potentially affected by individual site activities are discussed in the site-specific subsections in Sections 4 through 10.

4.0 SITE 3: LANDFILL SOUTHWEST OF "F" GROUP

4.1 SITE BACKGROUND AND PHYSICAL SETTING

The Landfill Southwest of "F" Group is a 5-acre site used from 1960 to 1968 for the disposal of domestic and industrial wastes, the latter consisting of paints and paint thinners, solvents, varnishes, shellac, acids, alcohols, caustics, pesticide containers, rinse water, wood, and small amounts of asbestos. Records indicate that the industrial wastes comprise only a small portion of a total of approximately 4,800 tons of wastes. Figure 4-1 is a map of the site.

The site is accessible by a dirt road from the southeast and is characterized as an open area surrounded by woodlands. The landfill is primarily covered with a sandy soil and is not closed with an impermeable cap. The site is moderately vegetated with grasses and some scrub pines. There are several scarred areas with no vegetation in the northeastern portion of the site. The ground surface is relatively flat, and ground elevations are typically between 115 and 125 feet above MSL. Wetlands are located southeast of the site. Groundwater flow is generally to the southeast, based on measured groundwater levels.

4.2 PREVIOUS INVESTIGATIONS

4.2.1 IAS and SI

IAS

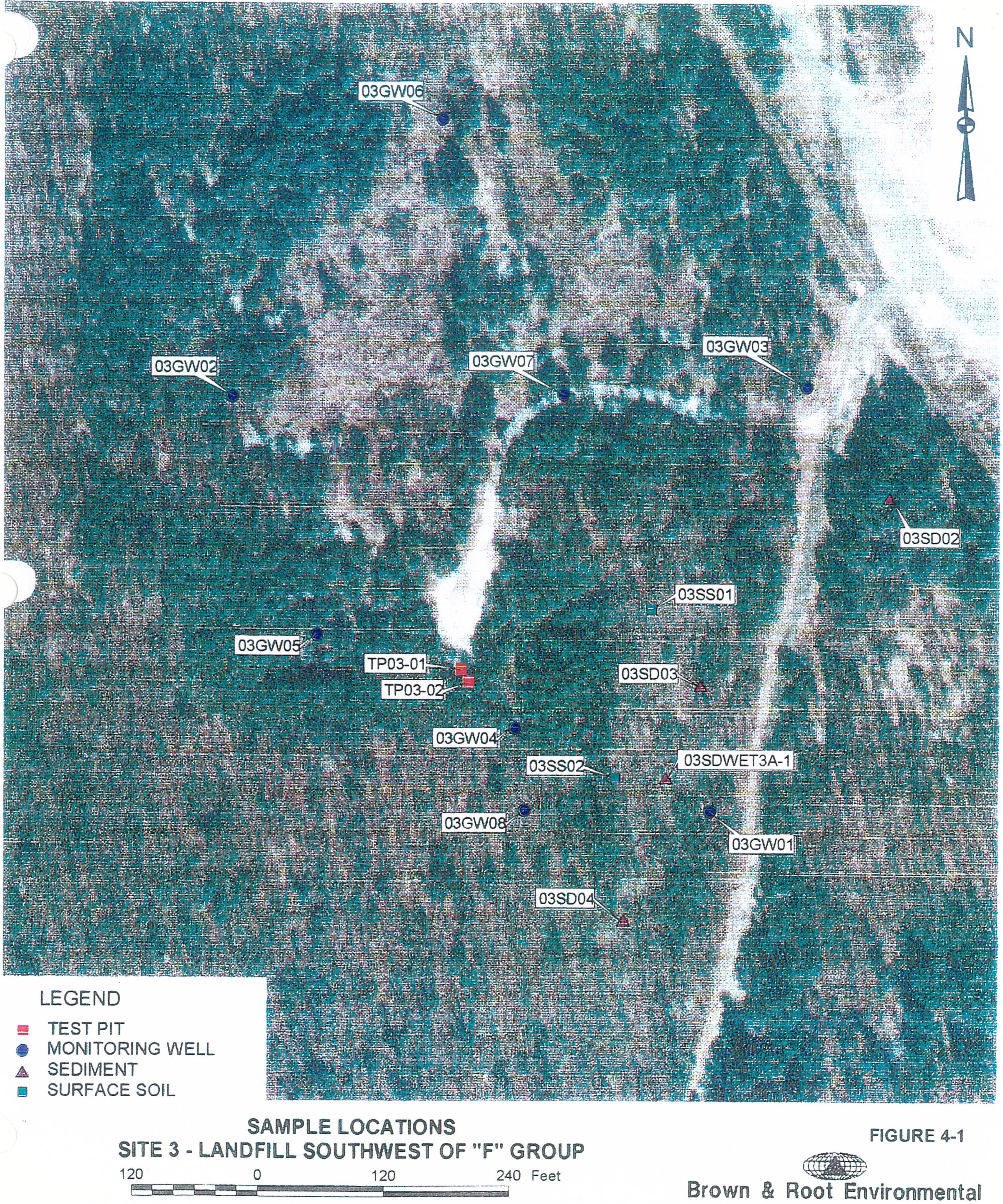
The 1983 IAS consisted of interviews and on-site observations. Based on the potential for groundwater impacts to the Kirkwood Aquifer, the site was recommended for a confirmation study.

SI

During the SI in 1986, three monitoring wells were installed. During the RI/FS in 1993, seven test pits were excavated and four additional monitoring wells were installed, one upgradient of the landfill and three downgradient of the landfill. The well depths ranged from 15 to 20 feet. Two soil samples collected from the test pits were analyzed for TCL organics and TAL inorganics. Groundwater from all seven wells was collected and analyzed for full TCL/TAL analytes. Later rounds of groundwater samples were analyzed for VOCs, drinking water metals, and inorganic landfill indicator parameters at a limited number of wells.

Based on visual inspection of test pit excavations, the landfill contains typical municipal waste. In groundwater samples, an elevated level of arsenic (0.37 ppm) was found in one downgradient well (MW3-01). Elevated levels of volatiles and semivolatiles were found in some wells (particularly monitoring well MW3-04). Wells MW3-04 and MW3-05 had low levels of several pesticide compounds. However, this concentration was not high enough to indicate that the landfill was generating a highly concentrated leachate.

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ SITE 3



SAMPLE LOCATIONS
SITE 3 - LANDFILL SOUTHWEST OF "F" GROUP

FIGURE 4-1

Brown & Root Environmental

4.2.2 1995 RI

Between May and October 1995, B&R Environmental conducted the following field investigation activities:

- Soil gas survey and analysis at 25 locations.
- Excavation of two test pits.
- Drilling and installation of one shallow permanent monitoring well.
- Sampling and analysis of groundwater from monitoring wells (03 GW 01, 03 GW 03, 03 GW 05, and 03 GW 06).
- Measurement of static-water levels in monitoring well.
- Sampling and analysis of one sediment sample in the wetlands southeast of the landfill (03 WET 3A-1).

B&R Environmental surveyed the horizontal locations and vertical elevations of soil gas grid corners, test pit locations, the newly installed monitoring well, selected existing wells, and the wetlands surface soil sample location. Sample locations are in Figure 4-1.

4.2.3 Summary of Conclusions

Monitoring well samples showed low levels of metals. Metals, semivolatiles, and pesticides were detected above screening levels in the drainage ditch in the wetland area (03 WET 3A-1).

4.2.4 Data Gaps (Objectives of RI Addendum Field Investigation)

Based on results of previous investigations and the 1995 RI, it was concluded that further sampling to delineate the extent of contamination in the wetlands adjacent to the site, particularly the drainage pathway southeast of the site, was required. In addition, surface soil samples from the southeastern face of the landfill were recommended to determine if the landfill was the source of the contamination seen in sample 03 WET 3A-1.

4.3 RI ADDENDUM FIELD INVESTIGATION

On October 29 and 30, 1996, B&R Environmental conducted the following field activities at Site 3:

- Sampling and analysis of surface soil (Section 4.3.1)
- Sampling and analysis of sediment (Section 4.3.2)

4.3.1 Surface Soil Sampling

Samples 03 SS 01 and 03 SS 02, as identified in the RI Addendum work plan, were collected by steel trowel and then placed directly into the sample container. These samples were collected at depths of 3 to 7 inches. 03 SS 01 was collected from the eastern perimeter of the landfill and 03 SS 02 was obtained from the southeastern face of the site (Figure 4-1). Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture analysis. B&R Environmental recorded pH, temperature, and conductivity in the field. These samples were obtained to determine if contaminants of concern detected in the 1995 RI sample from 03 WET 3A-1 were site related.

4.3.2 Sediment Sampling

Samples 03 SD 02 through 03 SD 04, as identified in the RI Addendum work plan, were collected by steel trowel and then placed directly into the sample container. These samples were collected at depths of 2 to 5 inches. These samples were collected from upstream, midstream, and downstream points along the drainage ditch in the wetlands adjacent to the southeastern portion of the site (Figure 4-1). Runoff from the site, particularly the area where the surface soil samples were collected, is expected to flow in the direction of the drainage ditch. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture analysis. B&R Environmental recorded pH, temperature and conductivity in the field. These samples were obtained to determine the extent of contamination in the wetlands.

4.4 SITE CHARACTERISTICS

4.4.1 Geology

Regional mapping places Site 3 within the outcrop area of the Kirkwood Formation. The Kirkwood Formation ranges between 60 and 100 feet in thickness. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Kirkwood and Vincentown Formations. Assuming a portion of the Kirkwood Formation was removed by erosion, it is possible that at least one of the soil borings penetrated the underlying Vincentown Formation. In general, the borings encountered white and yellowish-brown, very fine- to fine-grained sand with minor silt and clay layers, dark gray silt, and clay (probably representative of the Kirkwood Formation) and glauconitic, medium- to coarse-grained sand (probably representative of the Vincentown Formation). Mainside is located above the updip limit of the Piney Point, Shark River, and Manasquan Formations; therefore, the glauconitic sand is interpreted to be part of the Vincentown Formation.

Based upon the boring log descriptions, wells MW3-02 through MW3-07 penetrated the Kirkwood Formation and well MW3-01 penetrated the Kirkwood and Vincentown Formations.

4.4.2 Hydrogeology

Groundwater in the Kirkwood and Vincentown aquifer beneath the site occurs under unconfined conditions and the formations are interpreted to be hydraulically interconnected. The direction of shallow groundwater flow in the aquifer, as indicated by the August 1995 groundwater elevation measurements, is toward the southeast. Water levels in general could not be measured in October 1995 because all but one of the wells were dry. There is a significant seasonal variation in the elevation of the water table.

Based on boring log descriptions, well MW3-01 is screened across the contact between the Kirkwood and Vincentown Formations, and wells MW3-02 through MW3-07 are screened in the Kirkwood Formation. The hydraulic conductivities calculated for MW3-03 and MW3-06, both of which are screened in the Kirkwood Formation, are 7.16 x 10^{-4} cm/sec (2.03 ft/day) and 5.50 x 10^{-4} cm/sec (1.56 ft/day), respectively.

4.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates all sampling data for the 1995 RI and 1996 RI Addendum. Surface soils and sediment sample analysis results were compared to NWS Earle site-wide background samples as presented in Section 2.4.1. Groundwater at Site 3, found in the Kirkwood and Vincentown Formations, was compared to samples taken from the Cohansy Sand, Kirkwood and Vincentown Formation grouping of background groundwater samples taken at NWS Earle, as presented in Section 2.4.1.

4.5.1 Surface Soil

During the 1996 RI Addendum field activities, two surface soil samples (03 SS 01 and 03 SS 02) were collected from the southeastern face of the landfill to determine whether contaminants of concern detected in the wetlands are site related (Figure 4-1). Tables 4-1 and 4-2 present the occurrence and distribution of inorganic and organic chemicals detected in site-related surface soil samples and compare them to background. Table 4-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 4-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

4.5.1.1 Inorganics

Concentrations of metals in surface soils were similar to the range detected in background samples. Antimony was detected at low levels in 03 SS 01 (0.48 mg/kg) but was not detected in background samples.

4.5.1.2 Organics

PAHs, including benz(a)anthracene (44 ug/kg), benzo(a)pyrene (48 ug/kg), benzo(b)fluoranthene (80 ug/kg), chrysene (69.5 ug/kg), phenanthrene (97 ug/kg), and pyrene (105 ug/kg), were detected at location 03 SS 01. These compounds, with the exception of pyrene, were not detected in background samples. Pyrene was detected at levels approximately two times background. Phenol (50 ug/kg) was detected at 03 SS 01 but was not detected in background samples. Two pesticides, 4,4'-DDD (4.8 ug/kg) and heptachlor epoxide (1.35 ug/kg), were detected at 03 SS 01 but not in background samples. 4,4'-DDT was detected at 03 SS 01 (78 ug/kg) and 03 SS 02 (2.6 ug/kg). These levels were similar to the range exhibited in background samples. No organics other than 4,4'-DDT were detected at location 03 SS 02.

4.5.1.3 Miscellaneous Parameters

Samples were analyzed for percent solids and total organic carbon (TOC); results were within the range of background samples.

TABLE 4-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	4.6E+09	6153	2 / 2	319 - 339.5	329.25	NO	NO	339.50
ANTIMONY *	NOT DETECTED	-	-	-	1 / 2	0.48 - 0.48	0.34	YES	-	0.48
ARSENIC *	4 / 4	1.35 - 14.4	9.6E+02	13.43	1 / 2	1.3 - 1.3	0.83	NO	NO	1.30
BARIUM	4 / 4	1.85 - 31	3.6E+03	22.53	2 / 2	4 - 5.95	4.98	NO	NO	5.95
CADMIUM	1 / 4	0.3975 - 0.3975	6.7E-02	0.58	1 / 2	0.0905 - 0.0905	0.06	NO	NO	0.09
CALCIUM	4 / 4	40.1 - 519	2.3E+07	551.80	2 / 2	42 - 71	56.50	NO	NO	71.00
COBALT	2 / 4	0.75 - 5	1.0E+01	3.15	2 / 2	0.36 - 0.64	0.50	NO	NO	0.64
COPPER	4 / 4	0.97 - 8.4	4.5E+02	10.06	2 / 2	1.7 - 5.7	3.70	NO	NO	5.70
IRON	4 / 4	3745 - 62500	3.0E+12	52403	2 / 2	457 - 773.5	615.25	NO	NO	773.50
LEAD	4 / 4	1.8 - 39.4	2.1E+04	37.30	2 / 2	10.9 - 27.05	18.98	NO	NO	27.05
MANGANESE	4 / 4	3.45 - 214	4.3E+02	128.33	2 / 2	5.85 - 7.8	6.83	NO	NO	7.80
NICKEL	2 / 4	1.8 - 7.2	6.2E+01	5.18	2 / 2	0.39 - 1.25	0.82	NO	NO	1.25
POTASSIUM	4 / 4	95 - 792	5.9E+07	912.50	2 / 2	64.1 - 86.65	75.38	NO	NO	86.65
SILVER	2 / 4	0.37 - 0.67	2.3E-01	0.69	2 / 2	0.17 - 0.205	0.19	NO	NO	0.21
VANADIUM	4 / 4	11.05 - 64	5.0E+04	70.13	2 / 2	4.2 - 4.85	4.53	NO	NO	4.85
ZINC	3 / 4	0.665 - 27.6	6.1E+03	22.58	2 / 2	2.3 - 6.55	4.43	NO	NO	6.55

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400

TABLE 4-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOILS AT SITE 03
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	NOT DETECTED	-	-	1 / 2	4.8 - 4.8	4.8
4,4'-DDE *	2 / 4	16 - 330	277.86	1 / 2	21.5 - 21.5	21.5
4,4'-DDT *	2 / 4	43 - 420	355.71	2 / 2	2.6 - 78	78
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	1 / 2	1.35 - 1.35	1.35
BENZ(A)ANTHRACENE *	NOT DETECTED	-	-	1 / 2	44 - 44	44
BENZO(A)PYRENE *	NOT DETECTED	-	-	1 / 2	48 - 48	48
BENZO(B)FLUORANTHENE *	NOT DETECTED	-	-	1 / 2	80.5 - 80.5	80.5
CHRYSENE *	NOT DETECTED	-	-	1 / 2	69.5 - 69.5	69.5
FLUORANTHENE *	2 / 4	40 - 84	84	1 / 2	99.5 - 99.5	99.5
PHENANTHRENE *	NOT DETECTED	-	-	1 / 2	97 - 97	97
PHENOL *	NOT DETECTED	-	-	1 / 2	50 - 50	50
PYRENE *	1 / 4	46 - 46	46	1 / 2	105 - 105	105

* - Selected as a COPC

TABLE 4-3a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03GW01	03GW01	03GW01-F	03GW03	03GW03-F	03GW05	ARARS & TBCs		
LOCATION:	03GW01	03GW01	03GW01	03GW03	03GW03	03GW05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/24/95	07/25/95	07/24/95	07/24/95	07/24/95	07/20/95			
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	7930 E	n/a	5520 E	448 E	152	268 E J	-	-	200
antimony	2.7 U	n/a	6.1 E	2.7 U	10.6 E	2.7 U	6.00	3.00 a	20.0
arsenic	15.1 E	n/a	4.5	3.3 U	3.3 U	3.3 U	50.0	-	8.00
barium	689	n/a	34.0	16.5	16.0	41.7	2000	2000 a	2000
beryllium	0.11 U	n/a	0.20	0.11 U	0.11 U	0.11 U	4.00	4000 e	20.0
cadmium	11.7 E	n/a	12.3 E	2.3	2.2	6.5 E	5.00	5.00 e	4.00
calcium	3920	n/a	3730	4540	4440	6340	-	-	-
chromium, total	9.8	n/a	3.1	1.0 U	1.0 U	1.4	100 *	100 a	100
cobalt	4.4	n/a	3.6	0.60 U	0.60 U	8.4	-	-	-
copper	16.3	n/a	20.2	0.92	11.9	1.2	1300	-	1000
iron	26000 E	n/a	2670 E	988 E	433 E	930 E J	-	-	300
lead	5.1 J	n/a	3.1 J	1.5 UJ	1.5 UJ	1.5 U	15.0	-	10.0
magnesium	2560	n/a	1740	603	619	807	-	-	-
manganese	43.3	n/a	37.2	9.0	11.0	534 E J	-	-	50.0
mercury	0.12 J	n/a	0.13 J	0.11 J	0.10 J	0.0090	2.00	2.00 b	2.00
nickel	22.7	n/a	20.7	4.3	5.2	8.8	100	100 a	100
potassium	2270	n/a	1810	309	283	1000	-	-	-
sodium	7460	n/a	7950	3490	3480	4440	-	-	50000
thallium	3.6 U	n/a	3.6 U	3.6 U	3.6 U	3.6 U	2.00	0.400 a	10.0
vanadium	11.3	n/a	0.61 U	0.61 U	0.61 U	0.61 U	-	-	-
zinc	623 J	n/a	91.3 J	109 J	107 J	259	-	2000 a	5000
VOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
2-butanone	10.0 U	n/a	n/a	5.0 J	n/a	10.0 U	-	-	300
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	n/a	0.050 U	n/a	0.050 U	n/a	0.0016 R	0.200	0.200 a	0.200
gamma-chlordane	n/a	0.050 U	n/a	0.050 U	n/a	0.0081 J	2.00	2.00 a	0.500

TABLE 4-3a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 03
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03GW06	---	---	---	---	---	ARARS & TBCs		
LOCATION:	03GW06	---	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI								
SAMPLE DATE:	07/20/95								
INORGANICS	ug/L						ug/L	ug/L	ug/L
aluminum	498 E J						-	-	200
antimony	2.7 U						6.00	3.00 a	20 0
arsenic	3.3 U						50.0	-	8.00
barium	2.6						2000	2000 a	2000
beryllium	0.11 U						4.00	4000 e	20.0
cadmium	0.38 U						5.00	5.00 e	4.00
calcium	7260						-	-	-
chromium, total	1.3						100 *	100 a	100
cobalt	0.60 U						-	-	-
copper	0.79						1300	-	1000
iron	440 E J						-	-	300
lead	1.5 U						15.0	-	10.0
magnesium	3240						-	-	-
manganese	4.4						-	-	50.0
mercury	0.0080						2.00	2.00 b	2.00
nickel	1.1						100	100 a	100
potassium	497						-	-	-
sodium	4120						-	-	50000
thallium	4.0 E J						2.00	0.400 a	10.0
vanadium	0.69						-	-	-
zinc	1.6 U						-	2000 a	5000
VOLATILES	ug/L						ug/L	ug/L	ug/L
2-butanone	10.0 U						-	-	300
PESTICIDES	ug/L						ug/L	ug/L	ug/L
gamma-BHC (Lindane)	0.050 U						0.200	0.200 a	0.200
gamma-chlordane	0.050 U						2.00	2.00 a	0.500

TABLE 4-3a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- \- No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- \- No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 4-3b

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03SD02 10/30/96	03SD03 10/30/96	03SD04 10/30/96	03SDWET3A-1	- - -	- - -	- - -	SELECTED ARARS
LOCATION:	03SD02	03SD03	03SD04	03SDWET3A-1	- - -	- - -	- - -	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI	1995 RI				
SAMPLE DATE:	10/30/96	10/30/96	10/30/96	08/05/95				
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg				mg/kg
aluminum	1300	7800	615	9870				-
antimony	0.41 U	0.46 U	0.49 U	1.3				2.00 M
arsenic	1.1	11.0 E	0.92 U	6.2				8.20 L
barium	2.6	22.4	6.2	60.8 E				40.0 B
beryllium	0.068 U	0.47	0.080 U	0.26				-
cadmium	0.053 U	0.084	0.083	2.1 E				1.20 L
calcium	59.2	5260 R	242	2570				-
chromium, total	6.7 R	24.3	2.8 R	22.1 J				81.0 L
cobalt	0.62	0.86	0.43	2.3				50.0 T
copper	2.0	6.3 J	1.6	24.3				34.0 L
iron	1840	21200	613	15000				-
lead	6.5	14.7	7.4	89.1 E				47.0 L
magnesium	77.0 U	1400	91.7 U	545				-
manganese	6.5 J	59.5 J	5.2 J	42.3				460 O
mercury	0.12 U	0.14 U	0.14 U	0.26 E				0.150 L
nickel	0.76	4.2	0.67	9.5				21.0 L
potassium	166	2640	85.5	406				-
selenium	0.87 UJ	1.0 UJ	1.0 UJ	2.1 R				-
silver	0.20	0.14 U	0.16	0.44				1.00 M
sodium	157 U	226	187 U	85.3				-
vanadium	6.3	31.7	2.6	31.7				-
zinc	6.8	10.4	5.1	104 R				150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg				ug/kg
2-methylnaphthalene	400 UJ	450 UJ	470 UJ	140 J				330 F
acenaphthene	400 UJ	450 UJ	470 UJ	52.0 J				620 Q
acenaphthylene	400 UJ	450 UJ	470 UJ	130 E J				44.0 L
anthracene	400 UJ	450 UJ	470 UJ	140 J				330 F
benzo(a)anthracene	68.0 J	93.0 J	470 UJ	1300 E				330 F

TABLE 4-3b

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03SD02 10/30/96	03SD03 10/30/96	03SD04 10/30/96	03SDWET3A-1	---	---	---	SELECTED ARARS
LOCATION:	03SD02	03SD03	03SD04	03SDWET3A-1	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI	1995 RI				
SAMPLE DATE:	10/30/96	10/30/96	10/30/96	08/05/95				
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg				ug/kg
benzo(a)pyrene	81.0 J	97.0 J	470 UJ	1400 E				430 L
benzo(b)fluoranthene	110 J	120 J	470 UJ	2000 E				330 F
benzo(g,h,i)perylene	400 UJ	450 UJ	470 UJ	1000 E				330 F
benzo(k)fluoranthene	400 UJ	50.0 J	470 UJ	510 U				330 F
bis(2-ethylhexyl)phthalate	400 UJ	450 UJ	470 UJ	82.0 J				890000000 S
butylbenzylphthalate	400 UJ	450 UJ	470 UJ	64.0 J				11000 Q
carbazole	400 UJ	450 UJ	470 UJ	70.0 J				330 F
chrysene	130 J	140 J	470 UJ	1800 E				330 F
dibenz(a,h)anthracene	400 UJ	450 UJ	470 UJ	240 J				330 F
fluoranthene	160 J	190 J	470 UJ	2200				2900 Q
fluorene	400 UJ	450 UJ	470 UJ	260 J				540 P
indeno(1,2,3-cd)pyrene	400 UJ	450 UJ	470 UJ	880 E				330 F
naphthalene	400 UJ	450 UJ	470 UJ	130 J				480 P
phenanthrene	180 J	220 J	470 UJ	2400 E				850 Q
pyrene	190 J	230 J	470 UJ	3400 E				660 L
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg				ug/kg
4,4'-DDD	2.0 E R	4.5 U	4.7 U	5.1 U				1.60 L
4,4'-DDE	2.1 R	3.0 E R	4.7 U	16.0 E R				2.20 L
4,4'-DDT	4.0 U	3.0 E J	4.7 U	4.0 E J				1.60 L
alpha-BHC	2.0 U	2.3 U	2.4 U	0.082 JN				3.70 S
alpha-chlordane	2.0 U	2.3 U	2.4 U	2.1 J				7.00 O
endosulfan I	2.0 U	2.3 U	2.4 U	0.89 R				-
gamma-BHC (Lindane)	2.0 U	2.3 U	2.4 U	0.61 R				-
heptachlor	2.0 U	2.3 U	2.4 U	0.49 R				5.00 O
heptachlor epoxide	2.0 U	2.3 U	2.4 U	2.2 J				5.00 O

TABLE 4-3b
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).
UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.
No Value - Constituent was not analyzed for in this sample.
UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.
J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.
R - Positive result is considered rejected based on exceedance of data validation quality control criteria.
N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.
E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.
B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.
F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.
L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.
M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.
O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.
P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.
Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.
S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.
T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.
W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 4-3c

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		03SD02 10/30/96	03SD03 10/30/96	03SD04 10/30/96	---	---	---	---	ARARS & TBCs
LOCATION:		03SD02	03SD03	03SD04	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1996 RI	1996 RI	1996 RI					
SAMPLE DATE:		10/30/96	10/30/96	10/30/96					
MISCELLANEOUS									
% solids	%	82.9	73.4	69.6					- #
total organic carbon	mg/kg	160000	4860	27100					-

TABLE 4-3c
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 4-3d

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03SS01 10/29/96	03SS01-DUP	03SS02 10/29/96	- - -	- - -	- - -	ARARS & TBCs		
LOCATION:	03SS01	03SS01	03SS02	- - -	- - -	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1996 RI	1996 RI	1996 RI						
SAMPLE DATE:	10/29/96	10/29/96	10/29/96						
INORGANICS	mg/kg	mg/kg	mg/kg				mg/kg	mg/kg	mg/kg
aluminum	347	332	319				-	-	-
antimony	0.48	0.48	0.38 U				14.0	340	-
arsenic	1.4	1.2	0.72 U				20.0	20.0	-
barium	5.6	6.3	4.0				700	47000	-
cadmium	0.12	0.061	0.049 U				1.00	100	-
calcium	67.0	75.0	42.0				-	-	-
chromium, total	2.7 R	2.6 R	2.4 R				-	500	-
cobalt	0.42	0.30	0.64				-	-	-
copper	5.2 J	6.2 J	1.7				600	600	-
iron	762	785	457				-	-	-
lead	25.2	28.9	10.9				400	600	-
manganese	5.7 J	6.0 J	7.8 J				-	-	-
nickel	1.2	1.3	0.39				250	2400	-
potassium	81.1	92.2	64.1				-	-	-
silver	0.19	0.22	0.17				110	4100	-
vanadium	4.8	4.9	4.2				370	7100	-
zinc	6.0	7.1	2.3				1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg				ug/kg	ug/kg	ug/kg
benzo(a)anthracene	46.0 J	42.0 J	370 UJ				900	4000	500000
benzo(a)pyrene	51.0 J	45.0 J	370 UJ				660	660	100000
benzo(b)fluoranthene	85.0 J	76.0 J	370 UJ				900	4000	50000
chrysene	68.0 J	71.0 J	370 UJ				9000	40000	500000
fluoranthene	100 J	99.0 J	370 UJ				2300000	10000000	100000
phenanthrene	96.0 J	98.0 J	370 UJ				-	-	-
phenol	50.0 J	380 UJ	370 UJ				10000000	10000000	50000
pyrene	100 J	110 J	370 UJ				1700000	10000000	100000

TABLE 4-3d

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	03SS01 10/29/96	03SS01-DUP	03SS02 10/29/96	- - -	- - -	- - -	ARARS & TBCs		
LOCATION:	03SS01	03SS01	03SS02	- - -	- - -	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1996 RI	1996 RI	1996 RI						
SAMPLE DATE:	10/29/96	10/29/96	10/29/96						
PESTICIDES	ug/kg	ug/kg	ug/kg				ug/kg	ug/kg	ug/kg
4,4'-DDD	4.4	5.2 J	3.7 U				3000	12000	50000
4,4'-DDE	21.0	22.0	3.7 U				2000	9000	50000
4,4'-DDT	72.0	84.0	2.6 J				2000	9000	500000
dieldrin	3.9 U	3.3 R	3.7 U				42.0	180	50000
endrin	3.9 U	2.3 R	3.7 U				17000	310000	50000
heptachlor epoxide	1.1 J	1.6 J	1.9 U				-	-	-

TABLE 4-3d
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

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Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

02/04/97

DRAFT

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TABLE 4-3e

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 03

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		03SS01 10/29/96	03SS01-DUP	03SS02 10/29/96	- - -	- - -	ARARS & TBCs		
LOCATION:		03SS01	03SS01	03SS02	- - -	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1996 RI	1996 RI	1996 RI					
SAMPLE DATE:		10/29/96	10/29/96	10/29/96					
MISCELLANEOUS									
% solids	%	84.6	85.7	89.3			- #	- #	- #
total organic carbon	mg/kg	21700	16700	3860			-	-	-

TABLE 4-3e
COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

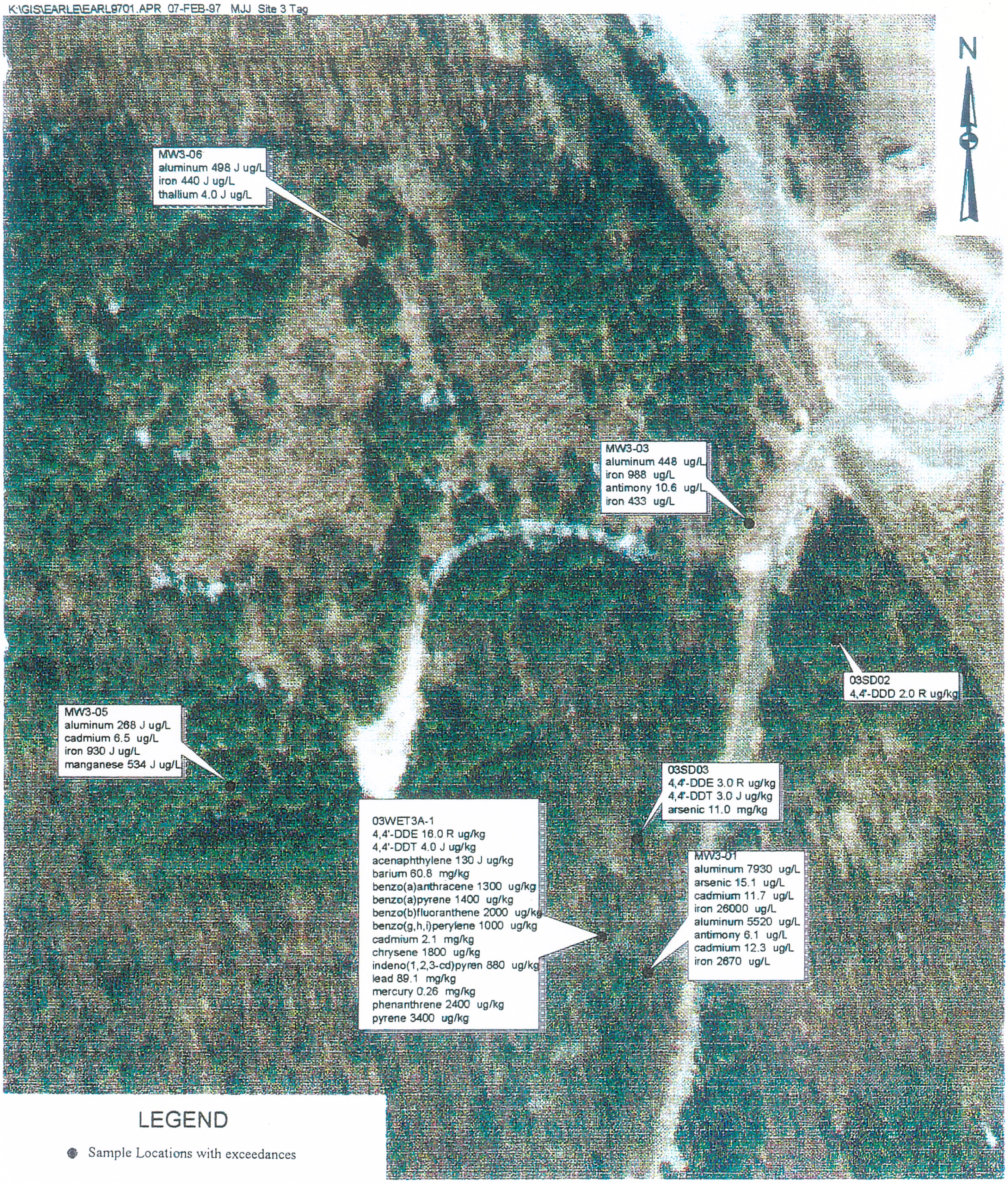
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\GIS\EARLE\EARL9701.APR 07-FEB-97 MJJ Site 3 Tag



CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 3 - LANDFILL SOUTHWEST OF "F" GROUP

120 0 120 240 Feet

FIGURE 4-2

Brown & Root Environmental

4.5.2 Sediment

During the 1995 RI, one sediment sample (03 SD WET3A-1) was collected from the drainage swale to determine potential impacts on the wetlands. In order to further define the extent of contamination in the wetlands, three additional sediment samples were obtained from the drainage swale during the 1996 RI Addendum field activities. These samples were located at points upstream on the landfill (03 SD 02), midstream on the swale, but upstream of sample location 03 SD WET3A-1 (03 SD 03), and downstream of the landfill (03 SD 04). Figure 4-1 shows the sample locations. Tables 4-4 and 4-5 present the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compare them to background. Table 4-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 4-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

4.5.2.1 Inorganics

Concentrations of metals in surface soils were similar to the range detected in background samples. Antimony was detected at low levels in 03SDWET3A-1 (1.3 mg/kg) but was not detected in background samples.

4.5.2.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, and pyrene were detected in 03SDWET3A-1 at concentrations two to three times higher than background concentrations. 4,4'-DDT was detected in sediment samples from 3 to 4 ug/kg; however, background concentrations as high as 19 ug/kg were detected. Alpha-BHC and heptachlor epoxide were detected in sample 03SDWET3A-1 at 0.082 ug/kg and 2.2 ug/kg, respectively.

4.5.2.3 Miscellaneous Parameters

Sediment samples collected in 1996 were analyzed for percent solids and TOC; results were within the range of background samples, with the exception of 03 SD 02 (160,000 mg/kg TOC).

TABLE 4-4

OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 3

NWS EARLE, COLTS NECK, NEW JERSEY

(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5460	4 / 4	615 - 9870	4896	NO	NO	9870
ANTIMONY *	NOT DETECTED	-	-	-	1 / 4	1.3 - 1.3	0.50	YES	-	1.13
ARSENIC *	5 / 6	2.4 - 9.9	2.9E+02	11.23	3 / 4	1.1 - 11	4.69	NO	NO	11.00
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	4 / 4	2.6 - 60.8	23.00	YES	NO	60.80
BERYLLIUM	4 / 6	0.34 - 0.57	3.3E-01	0.72	2 / 4	0.26 - 0.47	0.20	NO	NO	0.47
CADMIUM	2 / 6	0.44 - 0.46	1.1E+00	0.93	3 / 4	0.083 - 2.1	0.57	NO	NO	1.77
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	3 / 3	59.2 - 2570	957.07	YES	NO	2570
CHROMIUM	6 / 6	4.3 - 56	2.6E+03	40.42	2 / 2	22.1 - 24.3	23.20	NO	NO	24.30
COBALT	4 / 6	0.51 - 2.1	6.4E+00	2.85	4 / 4	0.43 - 2.3	1.05	NO	NO	2.30
COPPER	6 / 6	1 - 13	1.9E+01	9.08	4 / 4	1.6 - 24.3	8.55	NO	NO	24.30
IRON	6 / 6	228 - 21400	7.2E+09	23589	4 / 4	613 - 21200	9663	NO	NO	21200
LEAD	6 / 6	4 - 34.3	4.8E+01	21.07	4 / 4	6.5 - 89.1	29.43	YES	NO	76.44
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	809.90	2 / 4	545 - 1400	507.34	NO	NO	1400
MANGANESE	6 / 6	3.9 - 63.1	8.9E+01	36.22	4 / 4	5.2 - 59.5	28.38	NO	NO	59.50
MERCURY *	1 / 6	0.068 - 0.068	8.5E-03	0.09	1 / 4	0.26 - 0.26	0.12	YES	YES	0.23
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	4 / 4	0.67 - 9.5	3.78	NO	NO	9.50
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892	4 / 4	85.5 - 2640	824.38	NO	NO	2258
SILVER	2 / 6	0.1125 - 0.15	2.8E+00	1.13	3 / 4	0.16 - 0.44	0.22	NO	NO	0.44
SODIUM	4 / 6	26.6 - 2280	2.9E+03	876.80	2 / 4	85.3 - 226	120.83	NO	NO	203.65
VANADIUM	6 / 6	5.9 - 42.7	2.1E+03	39.42	4 / 4	2.6 - 31.7	18.08	NO	NO	31.70
ZINC	6 / 6	12.5 - 34.7	1.5E+03	41.23	3 / 3	5.1 - 10.4	7.43	NO	NO	10.40

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 4-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 03
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT *	1 / 6	19 19	10.64	2 / 4	3 - 4	4
ALPHA-BHC *	NOT DETECTED	-	-	1 / 4	0.082 - 0.082	0.082
ALPHA-CHLORDANE *	NOT DETECTED	-	-	1 / 4	2.1 - 2.1	2.1
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	1 / 4	2.2 - 2.2	2.2
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	1 / 4	140 - 140	140
ACENAPHTHENE *	NOT DETECTED	-	-	1 / 4	52 - 52	52
ACENAPHTHYLENE *	NOT DETECTED	-	-	1 / 4	130 - 130	130
ANTHRACENE *	NOT DETECTED	-	-	1 / 4	140 - 140	140
BENZO(A)ANTHRACENE *	3 / 6	85 - 560	560	3 / 4	68 - 1300	1117
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	3 / 4	81 - 1400	1200
BENZO(B)FLUORANTHENE *	3 / 6	150 490	346.54	3 / 4	110 - 2000	1704
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380	1 / 4	1000 - 1000	874.24
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470	1 / 4	50 - 50	50
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	1 / 4	82 - 82	82
BUTYLBENZYLPHTHALATE *	NOT DETECTED	-	-	1 / 4	64 - 64	64
CARBAZOLE *	NOT DETECTED	-	-	1 / 4	70 - 70	70
CHRYSENE *	3 / 6	130 - 940	577.87	3 / 4	130 - 1800	1538
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	1 / 4	240 - 240	240
FLUORANTHENE *	3 / 6	240 - 1800	1024	3 / 4	160 - 2200	1876
FLUORENE *	1 / 6	190 190	190	1 / 4	260 - 260	260
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310	1 / 4	880 - 880	773.69
NAPHTHALENE *	NOT DETECTED	-	-	1 / 4	130 - 130	130
PHENANTHRENE *	3 / 6	110 - 1900	1052	3 / 4	180 - 2400	2047
PYRENE *	3 / 6	200 - 1900	1077	3 / 4	190 - 3400	2886

* - Selected as a COPC

** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

4.5.3 Groundwater

Four site-related groundwater samples (03GW01, 03GW03, 03GW05, and 03GW06) were collected (Figure 4-1). These samples were obtained from monitoring wells MW3-01, MW3-03, MW3-05, and MW3-06, respectively. Tables 4-6 and 4-7 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples and compare them to background. Table 4-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 4-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

4.5.3.1 Inorganics

With the exception of beryllium, the site-related samples also showed the presence of all the metals found in background, in addition to arsenic and thallium. The highest concentrations of metals in Site 3 groundwater samples were detected in the sample collected at 03GW01. This well and one other (03GW 03) required sample filtering in the field. The filtered sample from the downgradient location, 03GW01, exhibited fairly high aluminum levels (5,520 ug/L) and also displayed concentrations greater than background ranges for antimony and cadmium. Other metals, such as iron, zinc, and barium, were present at considerably lower levels in the filtered sample. Sample 03GW05, collected from a well cross-gradient from the landfill, displayed an elevated level of manganese, and sample 03GW06 (an upgradient location) exhibited thallium at a low level.

4.5.3.2 Organics

Due to dry conditions in the summer of 1995, four monitoring wells (MW3-02, MW3-04, MW2-07, and MW3-08) were found to be dry. One of these wells, MW3-04, was found to have high levels of VOCs during a previous sampling event in March 1991. MW3-04 has been dry in all subsequent sampling events. VOCs detected above the NJDEP GWQS in MW3-04 were acetone (970 ug/L) and xylene (470 ug/L).

2-Butanone (5 ug/L) and gamma-chlordane (0.0081 ug/L) were each detected in one groundwater sample collected at Site 3. Neither of these compounds were detected in background groundwater samples.

4.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 3 is described in this subsection. The various chemicals detected during the 1995 RI and 1996 RI Addendum field activities and their transport potential in the environment are discussed in Section 4.6.1. Persistence of detected chemicals in the environment is discussed in Section 4.6.2. Section 4.6.3 presents a brief discussion of contaminant trends.

TABLE 4-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	9.6E+06	5098	4 / 4	268 - 7930	2286	NO	NO	6715
ARSENIC *	1 / 11	5.8 - 5.8	6.6E+00	4.05	1 / 4	15.1 - 15.1	5.01	YES	NO	15.10
BARIUM	11 / 11	2.6 - 518	5.8E+02	229.60	4 / 4	2.6 - 689	187.45	NO	NO	581.36
CADMIUM *	5 / 11	0.6 - 1.9	2.3E+00	1.21	3 / 4	2.3 - 11.7	5.17	YES	YES	11.70
CALCIUM	11 / 11	506 - 17200	1.7E+04	8307	4 / 4	3920 - 7260	5515	NO	NO	7260
CHROMIUM *	NOT DETECTED	-	-	-	3 / 4	1.3 - 9.8	3.25	YES	-	8.41
COBALT	6 / 11	0.7 - 10.1	9.6E+00	4.06	2 / 4	4.4 - 8.4	3.35	NO	NO	8.40
COPPER	9 / 11	0.79 - 13.5	1.4E+01	6.53	4 / 4	0.79 - 16.3	4.80	NO	NO	13.82
IRON	11 / 11	153 - 7690	8.5E+03	4197	4 / 4	440 - 26000	7090	YES	NO	21927
LEAD	3 / 11	2.1 - 3	3.1E+00	2.44	1 / 4	5.1 - 5.1	1.84	NO	NO	5.10
MAGNESIUM	11 / 11	273 - 27400	2.3E+04	8450	4 / 4	603 - 3240	1803	NO	NO	3240
MANGANESE	11 / 11	3.3 - 65	1.2E+03	46.18	4 / 4	4.4 - 534	147.68	YES	NO	451.42
MERCURY	11 / 11	0.005 - 0.12	2.0E-01	0.12	4 / 4	0.008 - 0.12	0.06	NO	NO	0.12
NICKEL	10 / 11	0.81 - 25.5	2.6E+01	11.98	4 / 4	1.1 - 22.7	9.23	NO	NO	22.70
POTASSIUM	11 / 11	350 - 3245	2.5E+06	2811	4 / 4	309 - 2270	1019	NO	NO	2270
SODIUM	11 / 11	1850 - 11650	1.3E+04	8449	4 / 4	3490 - 7460	4878	NO	NO	7460
THALLIUM	3 / 11	4 - 5.1	1.1E+01	5.15	1 / 4	4 - 4	2.35	NO	NO	4.00
VANADIUM	10 / 11	0.69 - 42.25	4.0E+01	16.48	2 / 4	0.69 - 11.3	3.15	NO	NO	9.55
ZINC	6 / 9	3.7 - 348	4.4E+02	178.61	3 / 4	109 - 623	247.95	YES	NO	623.00

* - Selected as a COPC

** - Upper Tolerance Limit

TABLE 4-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 03
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-BUTANONE *	NOT DETECTED	-	-	1 / 4	5 - 5	5
GAMMA-CHLORDANE *	NOT DETECTED	-	-	1 / 4	0.0081 - 0.0081	0.0081

* - Selected as a COPC

** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

4.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 3 indicate that a wide variety of semivolatile and pesticide compounds at low levels, in addition to several inorganics, is present in surface soil, groundwater, and sediment. One volatile compound, 2-butanone, was present in groundwater. No surface water samples were collected at the site. The physical transport data for the detected contaminants are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

One organic groundwater contaminant, 2-butanone, is considered volatile and mobile in the environment (either through soil gas migration or groundwater transport). This compound may have originated at source locations within or near the landfill, which may or may not have been depleted of this contaminant. This compound is also considered a common laboratory contaminant; however, the application of data validation protocols indicates this compound is not a laboratory artifact.

The majority of the detected surface soil and sediment contaminants are PAHs and phthalate esters, which are characteristically immobile except when present at high concentrations.

Elevated levels of certain metals in groundwater may or may not indicate the potential for groundwater transport for one or more of these metals, depending on the proportion of dissolved versus suspended concentrations that are present. Suspended solids in the unfiltered groundwater samples are suggested by the occurrence of much lower levels in corresponding filtered samples from the same location. Metals in suspension are expected to have a greatly diminished potential for in-situ transport compared to metals in solution, given that geologic conditions conducive to solution channeling or fracture-based flow do not exist. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, at monitoring wells MW3-01 and MW3-03, low-turbidity samples could not be collected. Samples obtained from these two wells were filtered in the field.

4.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Chemical transformation of a chemical to degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The product chemical(s) may or may not be significantly different toxicologically or from a physical transport perspective. If the transformational process is known or suspected, by-product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

4.6.3 Observed Chemical Contaminant Trends

Despite their relatively high water solubilities, volatile organics were not detected at significant levels in groundwater. 2-Butanone and the pesticide gamma-chlordane were each detected in only one groundwater sample and were below quantitation limits. Without the benefit of an identified source of the release, accurate discussions about chemical migration potential cannot be made. A single sample location with a concentration below quantitation limits does not conclusively indicate that groundwater has been impacted or that further downgradient transport of the detected compounds is expected.

The presence of suspended solids in sample 03 GW 01 is suggested by elevated turbidity readings and elevated levels of metals such as aluminum, whose common species are relatively insoluble. In the case of 03 GW 01, concentrations of iron and zinc were high in the unfiltered sample; filtered sample results were lower. However, levels of aluminum were still moderately high in the filtered sample, which may be due to a very low pH (less than 4.0). Although unfiltered sample results were used in all calculations for the groundwater risk assessment, in accordance with the recommended conservative approach to this evaluation, the filtered sample results for iron and zinc are more representative of dissolved-phase contamination.

The source of the contamination in the sediment is likely the result of runoff and erosional dispersion. Sample 03 SS 01, collected from the eastern face of the landfill, contained elevated levels of PAHs. Runoff from this location is expected to migrate to the drainage swale, which has shown elevated levels of PAHs in the midstream segment (sample locations 03 WET3A-1 and 03 SD 03). It is unknown whether the surface water (not present during sampling) has the same constituents as the sediment; however, PAHs and phthalate esters are relatively immobile in the environment.

4.6.4 Conclusions

Chemical constituents detected in the surface soil and sediments at Site 3 have low potential for impact to groundwater. Runoff and erosional dispersion may allow limited migration of contaminated sediments. Detected chemicals in the groundwater do not conclusively demonstrate groundwater impact or identify a particular source location. Filtered samples collected from MW3-01 indicated several metals present in suspension rather than in the dissolved phase, which would diminish the potential for long-range transport of these metals in groundwater. However, the filtered sample collected from downgradient well MW3-01 also exhibited cadmium and aluminum at levels greater than background, which suggests their presence in solution. Filtered results for arsenic were approximately one-third of the concentration of the unfiltered results and are considered more representative of dissolved-phase concentrations. Risk calculations based on unfiltered arsenic results are considered conservative and slightly over estimated.

4.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 3. The risk assessment was performed using the approach outlined in Section 2.4. Tables 4-8 through 4-10 provide the selected COPCs and representative concentrations of inorganics and organics in site related surface soil, sediment, and groundwater, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included. The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

4.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, industrial, and recreational receptors).

TABLE 4-8
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE SOIL - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	0.48
ARSENIC	1.3
4,4'-DDD *	4.8
4,4'-DDE *	21.5
4,4'-DDT *	78
HEPTACHLOR EPOXIDE *	1.35
BENZ(A)ANTHRACENE *	44
BENZO(A)PYRENE *	48
BENZO(B)FLUORANTHENE *	80.5
CHRYSENE *	69.5
FLUORANTHENE *	99.5
PHENANTHRENE *	97.0
PHENOL *	50.0
PYRENE *	105.0

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 4-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	1.13
ARSENIC	11
MERCURY	0.23
4,4'-DDT*	4
ALPHA-BHC*	0.082
ALPHA-CHLORDANE*	2.1
HEPTACHLOR EPOXIDE*	2.2
2-METHYLNAPHTHALENE*	140
ACENAPHTHENE*	52
ACENAPHTHYLENE*	130
ANTHRACENE*	140
BENZO(A)ANTHRACENE*	1117.00
BENZO(A)PYRENE*	1200.38
BENZO(B)FLUORANTHENE*	1704.00
BENZO(G,H,I)PERYLENE*	874.24
BENZO(K)FLUORANTHENE*	50
BIS(2-ETHYLHEXYL)PHTHALATE*	82
BUTYLBENZYLPHTHALATE*	64
CARBAZOLE*	70
CHRYSENE*	1538.00
DIBENZ(A,H)ANTHRACENE*	240
FLUORANTHENE*	1876.00
FLUORENE*	260
INDENO(1,2,3-CD)PYRENE*	773.69
NAPHTHALENE*	130
PHENANTHRENE*	2047.00
PYRENE*	2886.00

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 4-10
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
GROUNDWATER - SITE 3 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ARSENIC	15.1
CADMIUM	11.7
CHROMIUM	8.41
2-BUTANONE	5
GAMMA-CHLORDANE	0.0081

4.7.1.1 Current Industrial Employee

Surface Soil Exposure

RME

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 3 are 8.5E-07 (ingestion) and 3.4E-06 (dermal contact). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 3 is less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 3 in Tables 4-11 and 4-12, respectively.

CTE

No CTE analysis is required for surface soil exposure.

4.7.1.2 Future Industrial Employee

Groundwater Exposure

RME

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 3 is 7.9E-05 (ingestion) and 1.6E-07 (dermal contact). The total groundwater cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway).

TABLE 4-11

RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 03

SURFACE SOIL

NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	4.0E-10	N/A	N/A
4,4'-DDE	2.6E-09	N/A	N/A
4,4'-DDT	9.3E-09	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-08	N/A	N/A
BENZO(A)PYRENE	1.2E-07	N/A	N/A
BENZO(B)FLUORANTHENE	2.1E-08	N/A	N/A
CHRYSENE	1.8E-10	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
HEPTACHLOR EPOXIDE	4.3E-09	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	6.8E-07	3.4E-06	N/A
TOTAL RISK	8.5E-07	3.4E-06	N/A

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-12
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 03
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	1.5E-04	N/A	N/A
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
FLUORANTHENE	2.4E-06	N/A	N/A
HEPTACHLOR EPOXIDE	1.0E-04	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	8.2E-08	N/A	N/A
PYRENE	3.4E-06	N/A	N/A
ANTIMONY	1.7E-03	N/A	N/A
ARSENIC	4.2E-03	2.1E-02	N/A

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 3 is less than 1.0 for the ingestion exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 3 in Tables 4-13 and 4-14, respectively.

CTE

No CTE analysis is required for groundwater exposure.

4.7.1.3 Future Residential Receptor

Surface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 3 are 4.3E-06 (ingestion) and 7.9E-06 (dermal contact). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 81 percent of the cancer risk for this pathway; dermal contact, 100 percent of the cancer risk for this pathway) and benzo(a)pyrene (ingestion, 13 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 3 is less than 1.0 for the ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 3 in Tables 4-15 and 4-16, respectively.

CTE

No CTE analysis is required for surface soil exposure.

TABLE 4-13
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
2-BUTANONE	N/A	N/A
GAMMA-CHLORDANE	3.7E-08	N/A
ARSENIC	7.9E-05	1.6E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
TOTAL RISK	7.9E-05	1.6E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-14
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
2-BUTANONE	8.2E-05	N/A
GAMMA-CHLORDANE	1.3E-03	N/A
ARSENIC	4.9E-01	1.1E-03
CADMIUM	2.3E-01	4.7E-04
CHROMIUM	8.2E-05	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-15
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 03
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	1.9E-09	N/A	N/A
4,4'-DDE	1.1E-08	N/A	N/A
4,4'-DDT	4.2E-08	N/A	N/A
BENZO(A)ANTHRACENE	5.3E-08	N/A	N/A
BENZO(A)PYRENE	5.5E-07	N/A	N/A
BENZO(B)FLUORANTHENE	9.2E-08	N/A	N/A
CHRYSENE	7.9E-10	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
HEPTACHLOR EPOXIDE	1.9E-08	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	3.5E-06	7.9E-06	N/A
TOTAL RISK	4.3E-06	7.9E-06	N/A

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-16
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 03
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	2.0E-03	N/A	N/A
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
FLUORANTHENE	3.2E-05	N/A	N/A
HEPTACHLOR EPOXIDE	1.3E-03	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	4.5E-05	N/A	N/A
PYRENE	1.1E-06	N/A	N/A
ANTIMONY	1.5E-02	7.4E-04	N/A
ARSENIC	5.5E-02	8.5E-02	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Groundwater Exposure

RME

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 3 is 3.4E-04 (ingestion), 4.1E-06 (dermal contact), and 8.6E-09 (inhalation of VOCs during showering).

The total groundwater cancer risk is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 3 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: skin (3.2 - arsenic) and kidney (1.5 - cadmium). The estimated noncarcinogenic HI for the dermal contact and inhalation exposure pathways were less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 3 in Tables 4-17 and 4-18, respectively.

CTE

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 3 is 1.5E-04 (ingestion), 1.3E-06 (dermal contact), and 2.5E-09 (inhalation of VOCs during showering).

The total groundwater cancer risk is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

TABLE 4-17
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION -LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIM	INHALATION OF VOAS IN GW - ADULT
2-BUTANONE	N/A	N/A	N/A
GAMMA-CHLORDANE	1.6E-07	N/A	8.6E-09
ARSENIC	3.4E-04	4.1E-06	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
TOTAL RISK	3.4E-04	4.1E-06	8.6E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	SKIN	KIDNEY	RESPIRATORY SYSTEM	LIVER	CENTRAL NERVOUS SYSTEM	REPRODUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
2-BUTANONE	5.3E-04			5.3E-04		5.3E-04	5.3E-04	N/A	3.3E-04
GAMMA-CHLORDANE	8.6E-03				8.6E-03	8.6E-03	8.6E-03	N/A	N/A
ARSENIC	3.2E+00	3.2E+00						4.1E-02	N/A
CADMIUM	1.5E+00		1.5E+00					1.9E-02	N/A
CHROMIUM	5.4E-04		5.4E-04					N/A	N/A
	HI FOR TARGET ORGAN	3.2E+00	1.5E+00	5.3E-04	8.6E-03	9.2E-03	9.2E-03		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 3 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (1.5 - arsenic). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 3 in Tables 4-19 and 4-20, respectively.

4.7.1.4 Future Recreational Receptor

Sediment

RME

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 3 are 3.9E-07 (ingestion) and 8.2E-07 (dermal contact). This sediment cancer risk is below the 10^{-4} to 10^{-6} target acceptable risk range.

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 3 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 3 in Tables 4-21 and 4-22, respectively.

CTE

No CTE analysis is required for sediment and surface water exposure.

TABLE 4-19
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION -LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
2-BUTANONE	N/A	N/A	N/A
GAMMA-CHLORDANE	7.1E-08	N/A	2.5E-09
ARSENIC	1.5E-04	1.3E-06	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
TOTAL RISK	1.5E-04	1.3E-06	2.5E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-20
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 3
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	SKIN	KIDNEY	RESPIRATORY SYSTEM	LIVER	CENTRAL NERVOU SYSTEM	REPRODUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
2-BUTANONE	2.5E-04			2.5E-04		2.5E-04	2.5E-04	N/A	9.7E-05
GAMMA-CHLORDANE	4.0E-03				4.0E-03	4.0E-03	4.0E-03	N/A	N/A
ARSENIC	1.5E+00	1.5E+00						8.2E-02	N/A
CADMIUM	7.0E-01		7.0E-01					3.8E-02	N/A
CHROMIUM	2.5E-04		2.5E-04					N/A	N/A
	HI FOR TARGET ORGAN	1.5E+00	7.0E-01	2.5E-04	4.0E-03	4.3E-03	4.3E-03		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-21
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 3
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDT	1.8E-11	N/A
ALPHA-BHC	6.8E-12	N/A
ALPHA CHLORDANE	3.6E-11	N/A
HEPTACHLOR EPOXIDE	2.6E-10	N/A
2-METHYLNAPHTHALENE	N/A	N/A
ACENAPHTHENE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-08	N/A
BENZO(A)PYRENE	1.2E-07	N/A
BENZO(B)FLUORANTHENE	1.6E-08	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	4.8E-11	N/A
BIS(2-ETHYLHEXYL)PHTHALA	1.5E-11	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A
CARBAZOLE	1.8E-11	N/A
CHRYSENE	1.5E-10	N/A
DIBENZ(A,H)ANTHRACENE	2.3E-08	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
INDENO(1,2,3-CD)PYRENE	7.4E-09	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	2.2E-07	8.2E-07
MERCURY	N/A	N/A
TOTAL RISK	3.9E-07	8.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 4-22
ME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDT	1.2E-06	N/A
ALPHA-BHC	N/A	N/A
ALPHA CHLORDANE	5.4E-06	N/A
HEPTACHLOR EPOXIDE	2.6E-05	N/A
2-METHYLNAPHTHALENE	N/A	NA
ACENAPHTHENE	1.3E-07	N/A
ACENAPHTHYLENE	N/A	NA
ANTHRACENE	7.2E-08	N/A
BENZO(A)ANTHRACENE	N/A	NA
BENZO(A)PYRENE	N/A	NA
BENZO(B)FLUORANTHENE	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	NA
BENZO(K)FLUORANTHENE	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALA	6.3E-07	N/A
BUTYLBENZYLPHTHALATE	4.9E-08	N/A
CARBAZOLE	N/A	N/A
CHRYSENE	N/A	N/A
DIBENZ(A,H)ANTHRACENE	7.2E-06	N/A
FLUORANTHENE	1.0E-06	N/A
FLUORENE	N/A	N/A
INDENO(1,2,3-CD)PYRENE	5.0E-07	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	1.5E-05	N/A
PYRENE	1.4E-05	N/A
ANTIMONY	4.3E-04	N/A
ARSENIC	5.6E-03	2.1E-02
MERCURY	1.2E-04	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

4.7.2 Conclusions

Sediment, groundwater, and surface water were sampled at Site 3. The potential receptors considered for this site were future industrial, residential, and recreational receptors.

The RME cancer risks associated with future residential and future industrial (groundwater) exposure scenarios were at the upper end of the target risk range. In addition, CTE cancer risks also for the future residential receptor were also at the upper end of the target risk range. Arsenic (via ingestion of and dermal contact with groundwater) is the principal COPC that contributed to the cancer risks for these exposure scenarios.

RME estimates for noncarcinogenic HIs associated with future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenarios. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

RME risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 3 in Table 4-23 for subsurface soil and groundwater. Table 4-24 presents the relevant CTE risk estimates associated with potential receptors for groundwater, sediment and surface water.

The estimated RME cancer risk for the future industrial employee and the future residential receptor is at the upper end of the target risk range, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor is also at the upper end of the target risk range, based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

Arsenic is the compound of concern in groundwater at Site 3 causing the majority of the calculated excess human health risk (above the EPA guideline acceptable range). Arsenic was detected in one out of four site-related samples at a concentration of 15 ug/l and in one out of 11 background samples at a concentration of 5.8 ug/l. Therefore, arsenic is concluded to be elevated above background (based on one detection in site-related samples at a higher concentration than the one detection in background samples). However, considering site-specific uncertainties, such as the finding that arsenic concentrations in filtered groundwater samples were approximately one-third the concentrations found in unfiltered samples (see Section 4.6.4), risk calculations, which are based on the (higher) unfiltered results, should be considered conservative and slightly over estimated.

TABLE 4-23
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	8.5E-07	N/A	4.3E-06	N/A	6.2E-03	N/A	7.4E-02	N/A	N/A
	Dermal Contact	3.4E-06	N/A	7.9E-06	N/A	2.1E-02	N/A	8.6E-02	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	3.9E-07	N/A	N/A	N/A	N/A	6.2E-03
	Dermal Contact	N/A	N/A	N/A	8.2E-07	N/A	N/A	N/A	N/A	2.1E-02
Groundwater	Ingestion	N/A	7.9E-05	3.4E-04	N/A	N/A	7.3E-01	3.2E+00@	N/A	N/A
	Dermal Contact	N/A	1.6E-07	4.1E-06	N/A	N/A	1.6E-03	6.0E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	8.6E-09	N/A	N/A	N/A	N/A	3.3E-04	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	TOTAL	4.3E-06	7.9E-05	3.5E-04	1.2E-06	2.7E-02	7.3E-01	3.4E+00	9.8E-05	2.7E-02

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 4-24
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Dermal Contact	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/R	1.5E-04	N/A	N/A	N/R	1.5E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	1.3E-06	N/A	N/A	N/R	1.2E-01	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	2.5E-09	N/A	N/A	N/A	N/A	9.7E-05	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	-	1.5E-04	-	-	-	1.6E+00	9.7E-05	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R = Central Tendency calculation not required.
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

4.8 ECOLOGICAL RISK ASSESSMENT

4.8.1 Background

Site 3 is a 5-acre landfill that was used from 1960 to 1968 for the disposal of domestic and industrial wastes, including various liquid wastes, wood, and small amounts of asbestos. Industrial wastes are believed to constitute only a small portion of the approximately 4,800 tons of wastes that were disposed at the site. The site is covered with grasses, brush, and some small trees, although many bare areas with exposed and scattered debris are also present.

Most of the site is surrounded by upland forested areas that are dominated by pitch pine, scarlet oak, and white oak. Some shrubs (*Vaccinium* sp.) and woody vines (*Smilax* sp.) are present in the wooded areas. The southeastern edge of the landfill slopes downward into a relatively small (less than 2 acres) forested wetland. The wetland is dominated by red maple and blackgum. A small drainage depression runs through a culvert under the access road east of the site and terminates in the wetland from the northeast. Water in the drainage depression is ephemeral and generally flows only after periods of moderate or heavy rainfall. Surface water in the wetland is also ephemeral and dependent on rainfall. As a result, no permanent aquatic community is present in the wetland. Water also enters the wetland via runoff from the eastern portion of the landfill. The surface water body closest to Site 3 is the East Branch of Mingamahone Brook, located approximately 800 feet to the west, although it is not connected hydrologically to the Site 3 wetland.

The landfill provides marginal upland habitat, but the wooded areas surrounding the landfill and the wetland provide excellent upland and semi-aquatic habitat, respectively. Most mammals found on the installation, such as white-tailed deer, red fox, gray fox, and several species of small mammals are expected to use the upland areas, as are avian species found on NWS Earle that are attracted to wooded areas. However, as in the ERA conducted for the RI report (B&R Environmental, 1996), the wetland and related potential ecological risk to wetland receptors is the focus of this assessment. Although a permanent aquatic community is not present in the wetland, terrestrial and semi-aquatic organisms, such as amphibians, are expected to utilize the area. A limited aquatic invertebrate community is most likely present during the wetter months of the year. No sensitive habitats, other than the wetland, and no threatened or endangered species are known to occur on or around Site 3.

No sediment samples were collected prior to 1995 at Site 3. One sediment sample was collected during 1995 RI sampling activities at the site to investigate potential contaminant inputs from the landfill to the wetland. Several metals and PAHs were detected in the 1995 RI sediment sample collected in the wetland. Barium, cadmium, lead, and mercury slightly exceeded conservative thresholds used in the initial screening-level ERA for Site 3 conducted as part of the RI (B&R Environmental, 1996). Less conservative thresholds were available for cadmium, lead, and mercury, and concentrations of these metals did not exceed those thresholds. The most conservative sediment screening thresholds (e.g., ER-L values from NOAA) were initially used in the calculation of hazard quotients in the 1996 RI ecological risk assessment. Hazard quotients were also calculated using less conservative thresholds (e.g., ER-M values from NOAA) to reduce the uncertainty involved in using the most conservative screening thresholds available and generate a "risk range" when the maximum detected concentration exceeded the most conservative threshold. Since the range between the ER-L and ER-M is defined as the concentration range in which adverse effects may "rarely to occasionally" occur, ascribing risk to a maximum concentration that exceeds the ER-L but is less than the ER-M may be misleading.

Aluminum was detected above background in the sediment sample, but no suitable screening value was available. Concentrations of several PAHs exceeded ecological screening values in the ERA. Benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, and indeno(1,2,3-cd)pyrene exceeded the most conservative thresholds used but did not exceed less conservative values. Phenanthrene and pyrene exceeded the most conservative thresholds available as well as less conservative values.

Although the wetland is relatively small, and hence, population effects from potential contaminant inputs are unlikely, the wetland is considered a sensitive habitat and most likely contains sensitive organisms. Therefore, potential ecological risks from PAHs to aquatic and semi-aquatic receptors that inhabit the wetland were considered possible. Data from the one sediment sample taken during the RI and the test pit soil samples collected on the eastern portion of the landfill as part of 1993 RI/FS (Weston, 1993a) and 1995 RI sampling activities were not sufficient to ascertain whether elevated concentrations of contaminants, primarily PAHs, in Site 3 sediments were attributable to runoff from Site 3. Since contaminants detected in the sediment sample were either not detected or were present only in relatively low concentrations in groundwater, it was assumed that runoff was the most likely potential contaminant migration pathway from Site 3. In particular, no PAHs were detected in groundwater samples.

For these reasons, additional sediment samples in the wetland and surface soil samples on the eastern toe of the landfill were proposed in the RI report to more fully determine the nature and extent of contaminants, mainly PAHs, in the wetland and determine whether surface soils on the landfill are contributing those contaminants to the wetland. As previously mentioned (Section 4.3.2), as part of RI Addendum sampling, two sediment samples (03SD03 and 03SD04) were collected slightly downgradient of where runoff from the landfill enters the wetland area (Figure 4-1). Also, one sediment sample (03SD02) was taken upgradient in the small drainage depression that enters the wetland from the northeast to determine if contaminants in the wetland may be due to upstream sources (although no other

RI sites or major apparent contaminant sources are located near Site 3). Two surface soil samples were taken on the southeastern edge of the landfill where runoff exits the site to help ascertain whether runoff/erosion from site surface soils is contributing contaminants to the wetland (Figure 4-1). Surface water samples in the wetland or drainage depression were not collected since surface water in the area is ephemeral and contaminants would be expected to deposit in sediments.

4.8.2 Results and Discussion

Of the inorganics detected in sediment samples collected in the wetland southeast of the landfill, only arsenic and barium exceeded sediment thresholds (Table 4-25). These exceedances were quite low; arsenic had an HQ of 1.8 and barium had an HQ of 1.1. Also, arsenic was detected only in one sample and the detected concentration was considerably less than the SEL for this inorganic (a less conservative threshold). The inorganics aluminum, beryllium, cobalt, and vanadium were retained as COCs since no suitable sediment thresholds values were available from any source.

The maximum detected concentration of cobalt (0.86 mg/kg) in Site 3 sediments (essentially moist soils) was comparable to the concentration in the upgradient sample and was well within the range of background soil concentrations (0.3 to 70 mg/kg) found in the eastern United States (Shacklette and Boerngen, 1984) and the facility-wide sediment background concentration from the 1995 RI (2.1 mg/kg). The maximum detected concentrations of aluminum, beryllium, and vanadium in Site 3 sediments were higher than in the upgradient sample. However, beryllium was detected only in one sample and, although it was not detected in the upgradient sample, the detected concentration (0.47 mg/kg) was less than the background concentration from 1995 RI sampling (0.57 mg/kg). It is also within the range of background concentrations in eastern United States soils (1 to 7 mg/kg) (Shacklette and Boerngen, 1984). Beryllium was not detected in surface soil samples collected on the landfill near the wetland (Table 4-3d).

The other detected concentrations of aluminum and vanadium in sediments were lower than in the upgradient sample. The maximum detected concentrations of aluminum and vanadium in landfill surface soils were an order of magnitude lower than the concentrations of those inorganics detected in background surface soil samples collected as part of 1995 RI sampling activities. The concentrations of aluminum in RI Addendum sediment samples were also less than the values detected in the 1995 RI Site 3 sediment sample (Table 4-3b). Aluminum is a ubiquitous metal and is one of the most common elements in the earth's crust (Goyer, 1986), and vanadium is not generally considered to be toxic in the environment (Mailman, 1980). In addition, the maximum detected concentrations of aluminum (7,800 mg/kg) and vanadium (31.7 mg/kg) in Site 3 sediments are within or comparable to common eastern

TABLE 4-25
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 3
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections[1]	Upgradient Concentration[2]	Maximum Concentration	Representative Sediment Thresholds[3]	Lowest Effect Level	Severe Effect Level	Hazard Quotient	Retained as COC?
Inorganics (mg/kg)									
Aluminum	2/2	615-7,800	1,300	7,800	NA	NA	NA		Yes
Arsenic	1/2	11	1.1	11	6	6	33	1.8	Yes
Barium	2/2	6.2-22.4	2.6	22.4	20	NA	NA	1.1	Yes
Beryllium	1/2	0.47	ND	0.47	NA	NA	NA		Yes
Cadmium	2/2	0.083-0.084	ND	0.084	0.6	0.6	10	0.1	No
Chromium	1/2	24.3	ND	24.3	26	26	110	0.9	No
Cobalt	2/2	0.43-0.86	0.62	0.86	NA	NA	NA		Yes
Copper	2/2	1.6-6.3	2	6.3	16	16	110	0.4	No
Lead	2/2	7.4-14.7	6.5	14.7	31	31	250	0.5	No
Manganese	2/2	5.2-59.5	6.5	59.5	460	460	1100	0.1	No
Nickel	2/2	0.67-4.2	0.76	4.2	16	16	75	0.3	No
Silver	1/2	0.16	0.2	0.16	1	NA	NA	0.2	No
Vanadium	2/2	2.6-31.7	6.3	31.7	NA	NA	NA		Yes
Zinc	2/2	5.1-10.4	6.8	10.4	120	120	820	0.0	No
Organics (µg/kg)									
4,4'-DDT	1/2	3	ND	3	4,020	7	12000	0.0	No
Benzo(a)pyrene	1/2	97	81	97	677	NA	NA	0.1	No
Benzo(a)anthracene	1/2	93	68	93	553	NA	NA	0.2	No
Benzo(b)fluoranthene	1/2	120	110	120	665	NA	NA	0.2	No
Benzo(k)fluoranthene	1/2	50	ND	50	665	NA	NA	0.0	No
Chrysene	1/2	140	130	140	384	NA	NA	0.4	No
Fluoranthene	1/2	190	160	190	90,005	NA	NA	0.0	No
Phenanthrene	1/2	220	180	220	9770	NA	NA	0.0	No
Pyrene	1/2	230	190	230	665	NA	NA	0.3	No

[1] Data from samples 03SD03 and 03SD04 from RI Addendum (1996) sampling. Results from location WET3A (1995 RI) not included.

[2] Sample 03SD02

[3] See Table 2-26

ND = Not Detected

United States soil background concentrations (aluminum = 10,000 to 20,000 mg/kg; vanadium = 20 to 30 mg/kg) (Shacklette and Boerngen, 1984). Background sediment concentrations of aluminum and vanadium from the 1995 RI sampling were 3,940 mg/kg and 42.7 mg/kg, respectively.

Of the organics detected in wetland sediment samples (PAHs and 4,4'-DDT), none exceeded threshold values (Table 4-25). Organics were detected only in one sample. Phenanthrene and pyrene, detected in elevated concentrations in the 1995 RI wetland sediment sample, were only detected in low concentrations in one 1996 RI Addendum sample. Also, PAH compounds were detected only in low concentrations (all equal to or less than 0.1 mg/kg) in surface soil samples collected on the landfill near the wetland. Low levels of some pesticides were detected in landfill surface soil samples (Table 4-3d), but they were not detected in the wetland sediments, with the exception of one low detection of 4,4'-DDT (3 µg/kg).

4.8.3 Summary and Conclusions

Site 3 is a former landfill that received a variety of wastes in the 1960s. The former landfill area is covered with brush and small trees, although many bare areas with exposed debris are present. A small forested wetland is located directly southeast of the former landfill, and runoff from most of the landfill flows toward the wetland.

Some metals and several PAHs were detected in wetland sediments during 1995 RI sampling activities. Most of these contaminants exceeded screening values used in the 1995 RI ecological risk assessment and were, therefore, retained as COCs. Nonetheless, only one sediment sample was collected in 1995. The COCs were either not detected or were detected at relatively low concentrations in groundwater, suggesting that contaminants may be migrating from the former landfill to the wetland via overland runoff/erosion. However, no surface soil samples had been taken to ascertain whether contaminants were present in landfill surface soils near the wetland. Hence, two additional sediment samples were collected in the wetland near the area where runoff from the landfill enters the wetland, and one sediment sample was collected upgradient in a drainage ditch that enters the wetland from the north to determine if contaminants may be entering the wetland from other sources. Two surface soil samples were also collected at the landfill toe nearest the wetland to determine if runoff/erosion of contaminants was potentially occurring.

Only two contaminants in sediments (arsenic and barium) collected in 1996, exceeded thresholds, and the exceedances were minor. Some inorganics were retained as COCs since no suitable thresholds were available and the maximum detected concentrations were slightly higher than in the upgradient sample, but the concentrations all fall within the ranges of background soil concentrations in the eastern United

States. Several PAHs and 4,4'-DDT were detected in one wetland sediment sample but did not exceed screening values. In landfill surface soil samples collected at the landfill toe, concentrations of contaminants that were sediment COCs were relatively low. Concentrations of these COCs were also relatively low in 1995 RI groundwater samples.

The sample from the 1995 RI (03SDWET-3A-1) showed higher levels of several inorganics and PAHs than samples collected both upstream and downstream of that point during the 1996 RI Addendum field activities. This indicates that this location may be representative of a "hot spot" with contaminants that may not be site-related.

The assessment endpoint chosen for Site 3 was the protection of individuals inhabiting the wetland area. For the reasons discussed above, impacts to the wetland appear to be minor and potential ecological risks to wetland receptors appear to be insignificant. Therefore, no remedial action based on potential risks to ecological receptors or additional ecological study is recommended at Site 3.

4.8.4 Site-Specific Uncertainties

Several inorganics were detected in Site 3 sediments for which no suitable ET values were available. Most of these metals were present in concentrations comparable to those in the upgradient sample. However, aluminum and vanadium were present in maximum concentrations in excess of those in the upgradient sample, although the other detected concentrations of those metals were less than those in the upgradient sample. For the most part, aluminum and vanadium were not significantly elevated in 1996 surface soil samples collected on the landfill toe or 1995 groundwater samples. Aluminum was elevated in one downgradient groundwater sample, but concentrations in samples closer to the landfill were not elevated. Therefore, the presence of the one elevated hit of aluminum in landfill sediments is unclear, but it appears to be due to natural conditions. Nonetheless, this detection of aluminum and the lack of adequate sediment toxicity data for aluminum and vanadium introduces uncertainty into the results.

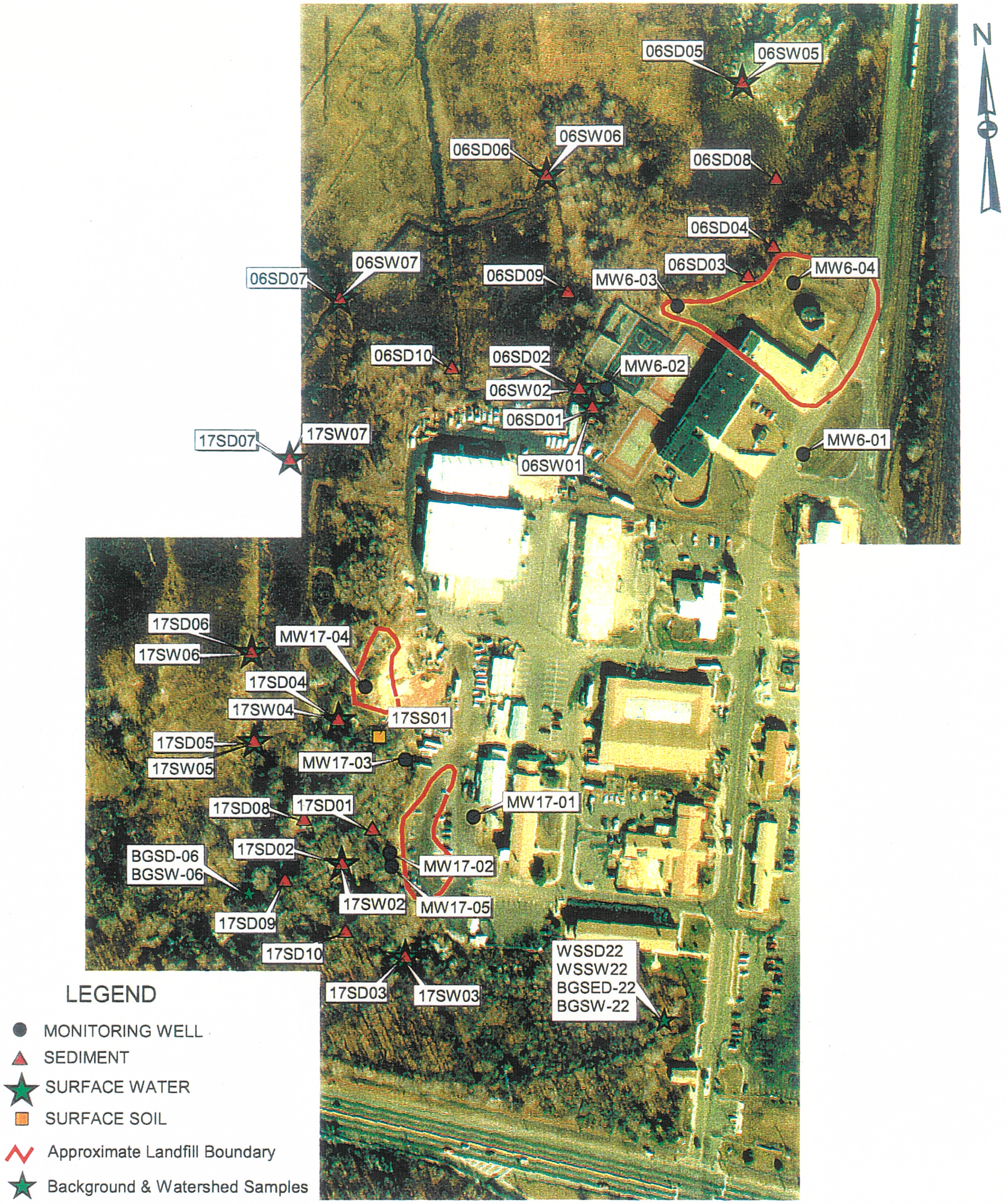
4.9 EVALUATION SUMMARY

Based on the 1995 RI results, metals in groundwater which exceeded regulatory guidelines include aluminum, antimony, arsenic, cadmium, and iron. Results of the human health risk assessment indicate that ingestion of groundwater could result in increased carcinogenic and non-carcinogenic risks above regulatory limits. The human health risk assessment results, however, should be considered conservative and may be overestimated based on arsenic in groundwater.

Contamination in the drainage ditch may be the result of runoff from the landfill as evidenced by the presence of similar PAHs and phthalate esters in surface soil collected from the landfill and in the ditch sediments. These compounds, however, are relatively immobile at the concentrations present and have not impacted the adjacent marsh area. Results of the ecological risk assessment indicate insignificant potential risks to ecological receptors from Site 3-related contaminants.

EPA guidance "Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance)," Directive No. 9355.0-62FS from the EPA Federal Facilities Restoration and Reuse Office may be applicable when considering disposition of the site.

P:\GIS\EARLE\APR\EARL9708.APR 11-September-97 MJJ Site 6/17 Layout



SAMPLE LOCATIONS
SITE 6 and 17

250 0 250 500 Feet

FIGURE 5-1

Brown & Root Environmental

5.2.2 1995 RI

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 6:

- Sampling and analysis of surface water (Samples 06 SW 01 and 06 SW 02).
- Sampling and analysis of sediment (Samples 06 SD 01 through 06 SD 04).
- Sampling and analysis of groundwater from the four existing monitoring wells (Samples 06 GW 01 through 06 GW 04).
- Measurement of static-water levels in the four monitoring wells.

A survey was conducted to establish the horizontal locations and vertical elevations of the sediment sample locations, the surface water sample locations, and selected existing monitoring wells.

5.2.3 Summary of Conclusions

Groundwater showed elevated levels of cadmium, iron, and manganese and low levels of pesticides. Sediment samples showed elevated levels of metals, pesticides, and semivolatile compounds, and surface water indicated the presence of metals.

5.2.4 Data Gaps (Objectives of RI Addendum Field Investigation)

Based on previous investigations, including the 1995 RI, it was determined that further data were required to assess the ecological impacts on the adjacent wetlands.

5.3 RI ADDENDUM FIELD INVESTIGATION

On October 29, 1996 and November 1, 1996, B&R Environmental conducted the following field activities at Site 6:

- Sampling and analysis of surface water (Section 5.3.1)
- Sampling and analysis of sediment (Section 5.3.2)

A survey was also conducted to establish horizontal locations and vertical elevations of the sampling locations.

5.3.1 Surface Water Sampling

The RI Addendum work plan proposed the collection of six surface water samples from the marsh area adjacent to the northeastern side of the landfill. Due to low-flow conditions (despite heavier than average rainfall over the period before sampling in 1996) at three of the locations, only three surface water samples (06 SW 05 through 06 SW 07) were collected (Figure 5-1). These samples were collected to obtain additional data to delineate the extent of surface water contamination in the wetlands. Samples were submitted to IEA Laboratories and analyzed for TAL metals, TCL pesticides/PCBs, suspended solids, alkalinity, hardness, BOD, COD, and TDS. B&R Environmental collected the samples by placing the sample container directly into the water. Field measurements obtained included pH, specific conductivity, salinity, and flow data (depth and width).

5.3.2 Sediment Sampling

The six sediment samples (06 SD 05 through 06 SD 10) proposed in the work plan were collected at Site 6 from the wetlands adjacent to the northeastern side of the landfill (Figure 5-1). These locations were selected to further define the extent of sediment contamination in the wetlands. Samples were collected by steel trowel and transferred directly into the sample container. Samples were obtained from beneath the organic material layer at depths of 10 to 18 inches. Samples were submitted to IEA Laboratories and analyzed for TAL metals, TCL pesticides/PCBs, TOC, grain size, and percent moisture. Field measurements included pH, conductivity, and temperature.

5.4 SITE CHARACTERISTICS

5.4.1 Geology

Regional mapping places Site 6 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness and the soil borings are no more than 23 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Englishtown Formation. In general, the borings encountered fill material, yellowish-brown clay, yellowish-brown, olive, and gray sand and silty sand, and gray silt.

Based upon the boring log descriptions, the wells penetrated fill material and the Englishtown Formation.

5.4.2 Hydrogeology

Groundwater in the fill material and Englishtown aquifer beneath the site occurs under unconfined conditions and the fill material and formation are interpreted to be hydraulically interconnected. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October 1995 groundwater elevation measurements, is toward the north and northwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based upon the boring log descriptions, the wells are screened across the contact between the fill material and the Englishtown Formation.

5.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates all sampling data for the 1995 RI and 1996 RI Addendum. Surface water and sediment sample analysis results were compared to NWS Earle site-wide background samples as presented in Section 2.4.1. Groundwater at Site 6, found in the fill and Englishtown Formation, was compared to samples taken from the the fill and Englishtown Formation grouping of background groundwater samples taken at NWS Earle, as presented in Section 2.4.1.

5.5.1 Sediment

Four site-related sediment samples (06 SD 01 through 06 SD 04) were collected at Site 6 during the 1995 RI and six additional sediment samples (06 SD 05 through 06 SD 10) were collected during the 1996 RI Addendum field activities (Figure 5-1). Tables 5-1 and 5-2 present the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compare them to background. The background samples for sediment are BGSD01, BGSD02, and BGSD04 through BGSD07. Table 5-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 5-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

5.5.1.1 Inorganics

Higher concentrations of metals, in comparison to background, were seen in site-related samples, particularly at sample locations 06 SD 01 and 06 SD 04 and, to a lesser extent, at sample locations 06 SD 02 and 06 SD 07. Samples showed aluminum (up to 14,500 mg/kg at 06 SD 07), arsenic (up to 36.3 mg/kg at 06 SD 04), barium (up to 138 mg/kg at 06 SD 02), cadmium (up to 1.8 mg/kg at 06 SD 04), cobalt (up to 8.2 mg/kg at 06 SD 01), copper (up to 228 mg/kg at 06 SD 06 SD 04), iron (up to 52,200 mg/kg at 06 SD 01), lead (up to 445 mg/kg at 06 SD 04), magnesium (up to 2,460 mg/kg at 06 SD 01), manganese (up to 451 mg/kg at 06 SD 04), mercury (up to 0.63 mg/kg at 06 SD 04), nickel (up to 43.8 mg/kg at 06 SD 04), selenium (up to 3.4 mg/kg at 06 SD 04), vanadium (up to 104 mg/kg at 06 SD 07), and zinc (up to 1,720 mg/kg at 06 SD 04). Antimony and thallium were detected at two locations at levels up to 12.4 mg/kg and 2.1 mg/kg, respectively. These two compounds were not detected in background samples.

TABLE 5-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5459.67	10 / 10	2050 - 14500	5491.00	YES	NO	7578.17
ANTIMONY *	NOT DETECTED	-	-	-	2 / 10	0.51 - 12.4	2.42	YES	-	4.63
ARSENIC *	5 / 6	2.4 - 9.9	2.9E+02	11.23	10 / 10	1.9 - 36.3	13.93	YES	NO	21.60
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	10 / 10	5 - 138	42.69	YES	NO	72.47
BERYLLIUM	4 / 6	0.34 0.57	3.3E-01	0.72	9 / 10	0.11 - 1.2	0.42	NO	YES	0.64
CADMIUM	2 6	0.44 - 0.46	1.1E+00	0.93	2 / 10	1.5 - 1.8	0.41	NO	NO	0.80
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	10 / 10	92.4 - 8820	1890.64	YES	NO	3522.28
CHROMIUM	6 / 6	4.3 - 56	2.6E+03	40.42	7 / 7	14.4 - 77.2	34.64	NO	NO	50.89
COBALT	4 / 6	0.51 2.1	6.4E+00	2.85	9 / 10	0.33 - 8.2	2.62	NO	NO	4.38
COPPER *	6 / 6	1 - 13	1.9E+01	9.08	10 / 10	0.75 - 228	39.85	YES	YES	82.70
IRON	6 / 6	228 - 21400	7.2E+09	23589	10 / 10	1790 - 52200	21524	NO	NO	32677
LEAD *	6 / 6	4 - 34.3	4.8E+01	21.07	10 / 10	3.8 - 445	80.28	YES	YES	163.62
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	809.90	9 / 10	401 - 2460	1165.04	YES	NO	2460.00
MANGANESE	6 / 6	3.9 - 63.1	8.9E+01	36.22	10 / 10	4.1 - 451	72.84	YES	NO	152.91
MERCURY *	1 / 6	0.068 0.068	8.5E-03	0.09	4 / 10	0.027 - 0.63	0.15	YES	YES	0.27
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	10 / 10	0.93 - 43.8	9.09	YES	NO	17.03
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892.03	10 / 10	172 - 2630	1093.70	NO	NO	2411.68
SELENIUM	0 / 6	-	1.9E+00	-	4 / 10	1.2 - 3.4	1.22	YES	NO	1.88
SILVER	2 / 6	0.1125 0.15	2.8E+00	1.13	2 10	0.12 - 0.26	0.35	NO	NO	0.26
SODIUM	4 / 6	26.6 - 2280	2.9E+03	876.80	9 / 10	28.6 - 6960	1105.26	YES	NO	2320.44
THALLIUM *	NOT DETECTED	-	-	-	2 / 10	0.92 - 2.1	0.67	YES	-	0.98
VANADIUM	6 / 6	5.9 - 42.7	2.1E+03	39.42	10 / 10	3.9 - 104	37.67	NO	NO	104.00
ZINC	6 / 6	12.5 - 34.7	1.5E+03	41.23	10 / 10	4.5 - 1720	244.76	YES	NO	556.85

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 5-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND** FREQUENCY OF DETECTION	BACKGROUND** RANGE OF POSITIVE DETECTION	BACKGROUND** REPRESENTATIVE CONCENTRATION	SITE-RELATED FREQUENCY OF DETECTION	SITE-RELATED RANGE OF POSITIVE DETECTION	SITE-RELATED REPRESENTATIVE CONCENTRATION
4,4'-DDD *	2 / 6	4.9 - 21	11.98	4 / 9	2.4 - 230	80.01
4,4'-DDE *	1 / 6	1.7 - 1.7	1.7	5 / 10	3.6 - 66	24.62
4,4'-DDT *	1 / 6	19 - 19	10.64	4 / 10	9.3 - 110	47.12
ALPHA-CHLORDANE *	NOT DETECTED	-	-	3 / 9	9.8 - 48	19.64
DIELDRIN *	NOT DETECTED	-	-	2 / 10	0.31 - 1.6	1.6
ENDOSULFAN II *	NOT DETECTED	-	-	3 / 10	2.6 - 24	8.82
ENDRIN *	NOT DETECTED	-	-	1 / 10	1.6 - 1.6	1.6
ENDRIN KETONE *	1 / 5	1.6 - 1.6	1.6	1 / 10	7.3 - 7.3	7.3
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.095	4 / 10	0.34 - 56	19.82
HEPTACHLOR *	NOT DETECTED	-	-	2 / 10	0.16 - 0.35	0.35
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	4 / 10	0.2 - 2.3	2.30
ACENAPHTHYLENE *	NOT DETECTED	-	-	2 / 10	56 - 160	160.00
ANTHRACENE *	NOT DETECTED	-	-	3 / 10	88 - 260	260.00
BENZ(A)ANTHRACENE *	3 / 6	85 - 560	560	5 / 10	75 - 1700	676.58
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	6 / 10	100 - 2400	852.30
BENZO(B)FLUORANTHENE *	3 / 6	150 - 490	346.54	5 / 10	190 - 4800	1587.69
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380	4 / 10	150 - 2600	912.89
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470	5 / 10	66 - 1100	451.37
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 10	96 - 880	521.76
BUTYLBENZYLPHTHALATE *	NOT DETECTED	-	-	1 / 10	300 - 300	300.00
CARBAZOLE *	NOT DETECTED	-	-	1 / 10	140 - 140	140
CHRYSENE *	3 / 6	130 - 940	577.87	5 / 10	130 - 2400	884.84
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	2 / 10	150 - 720	385.24
DIBENZOFURAN *	NOT DETECTED	-	-	1 / 10	78 - 78	78
FLUORANTHENE *	3 / 6	240 - 1800	1024.31	5 / 10	110 - 1600	819.64
FLUORENE *	1 / 6	190 - 190	190	2 / 10	65 - 83	83
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310	5 / 10	69 - 2300	800.89
NAPHTHALENE *	NOT DETECTED	-	-	1 / 10	90 - 90	90.00
PHENANTHRENE *	3 / 6	110 - 1900	1052.11	4 / 10	210 - 740	421.54
PYRENE *	3 / 6	200 - 1900	1076.74	5 / 10	130 - 2000	884.61
4-METHYL-2-PENTANONE *	NOT DETECTED	-	-	1 / 4	2 - 2	2
TOLUENE *	1 / 3	480 - 480	480	1 / 4	31 - 31	31
XYLENE (TOTAL) *	NOT DETECTED	-	-	1 / 4	3 - 3	3

* - Selected as a COPC
** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 5-3a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06GW01	06GW02	06GW03	06GW04	---	---	ARARS & TBCs		
LOCATION:	06GW01	06GW02	06GW03	06GW04	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
SAMPLE DATE:	07/28/95	08/02/95	08/03/95	08/03/95					
INORGANICS	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
aluminum	1320 E	420 E	190	145			-	-	200
arsenic	5.1	3.3 U	8.8 E	26.8 E			50.0	-	8.00
barium	30.4	64.9	48.2	45.0			2000	2000 a	2000
beryllium	0.11 U	0.21	0.11 U	0.11 U			4.00	4000 e	20.0
cadmium	7.0 E	1.2	2.2	5.2 E			5.00	5.00 e	4.00
calcium	22000	5670	8290	89800			-	-	-
chromium, total	1.0 U	1.0 U	1.0 U	1.2			100 *	100 a	100
cobalt	7.6	4.0	0.81	0.60 U			-	-	-
iron	95200 E	13400 E	24800 E	66700 E			-	-	300
magnesium	17300	5220	3120	53000			-	-	-
manganese	1820 E	280 E	61.3 E	855 E			-	-	50.0
nickel	3.7	5.0	0.76	1.0			100	100 a	100
potassium	3620	2250	2440	9270			-	-	-
sodium	83100 E	34800	25000	20800			-	-	50000
zinc	18.9	25.8 R	7.1	3.3			-	2000 a	5000
PESTICIDES	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
endosulfan I	0.050 U	0.050 U	0.050 U	0.0021 J			-	-	0.400
gamma-BHC (Lindane)	0.0008 J	0.050 U	0.050 U	0.050 U			0.200	0.200 a	0.200

TABLE 5-3a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 5-3b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06GW01	06GW02	06GW03	06GW04	- - -	ARARS & TBCs		
LOCATION:	06GW01	06GW02	06GW03	06GW04	- - -	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	07/28/95	08/02/95	08/03/95	08/03/95				
MISCELLANEOUS								
ammonia nitrogen mg/L	3.0 E	0.20 J	1.0 U	6.0 E		-	30.0	0.500
biochemical oxygen demand mg/L	12.0	2.0	2.0	12.0		-	-	-
chemical oxygen demand mg/L	48.0	10.0	12.0	64.0		-	-	-
chloride mg/L	210	80.0	49.0	45.0		-	-	250
nitrate nitrogen mg/L	0.50 U	0.12 J	0.50 U	0.50 U		10.0	10.0	-
sulfate mg/L	21.0	25.0	39.0	3.0		500	-	250
total organic carbon mg/L	13.0	3.0	3.0	21.0		-	-	-
total phosphorus as PO4 mg/L	0.20 J	0.20 U	0.20 U	0.20		-	-	-
turbidity ntu	288	5.8	26.0	460		-	-	-

TABLE 5-3b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 5-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01 06/15/95	06SD02 06/15/95	06SD03 06/15/95	06SD04 06/15/95	06SD05 11/01/96	06SD06 11/01/96	06SD07 11/01/96	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	06SD05	06SD06	06SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	06/15/95	06/15/95	06/15/95	06/15/95	11/01/96	11/01/96	11/01/96	
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	7610 J	6370	3980	3660 J	2050	5450	14500 J	-
antimony	9.3 UJ	5.2 U	5.5 U	12.4 E J	0.43 U	0.44 U	0.74 UJ	2.00 M
arsenic	21.4 E J	3.0	33.1 E	36.3 E J	1.9	5.0	22.5 E J	8.20 L
barium	94.5 E J	138 E J	13.7	114 E J	5.0	14.6	14.3 J	40.0 B
beryllium	1.0 J	0.57	0.21	0.30 UJ	0.11	0.20	1.2 J	-
cadmium	1.5 E J	0.61 U	0.65 U	1.8 E J	0.056 U	0.057 U	0.10 UJ	1.20 L
calcium	4880 J	1170	1080	8820 J	289	202	1540 J	-
chromium, total	44.5 J	18.0	22.5	77.2 J	4.1 R	14.9 R	42.6 J	81.0 L
cobalt	8.2 J	4.3	1.2 U	7.7 J	0.33	1.5	1.8 J	50.0 T
copper	111 E J	20.9	13.1	228 E J	0.75	7.5 J	6.3 J	34.0 L
iron	52200 J	13800	15300	46000 J	5580	7970	47800 J	-
lead	221 E J	41.0 J	28.7 J	445 E J	3.8	9.6	16.9 J	47.0 L
magnesium	2460 J	1180	401	2330 J	416	1180	2240 J	-
manganese	134 J	27.1 J	32.3 J	451 J	4.1 J	32.3 J	14.8 J	460 O
mercury	0.38 E J	0.027	0.060	0.63 E J	0.13 U	0.13 U	0.22 UJ	0.150 L
nickel	21.7 E J	8.1	2.3	43.8 E J	0.93	4.0	5.1 J	21.0 L
potassium	956 J	1770	542	1530 J	426	970	1310 J	-
selenium	3.2 J	1.3 J	1.2 J	3.4 J	0.91 U	0.93 U	1.6 UJ	-
silver	1.8 UJ	1.0 U	1.1 U	1.7 UJ	0.13 U	0.13 U	0.22 UJ	1.00 M
sodium	335 J	191	28.6	420 J	1280	994	6960 J	-
thallium	2.1 J	0.73 U	0.78 U	1.3 UJ	0.92 J	0.80 U	1.3 UJ	-
vanadium	48.7 J	18.2	43.3	87.8 J	12.3	11.1	104 J	-
zinc	486 E J	87.4 J	61.1 J	1720 E J	8.2	23.2	18.6 J	150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
acenaphthylene	740 UJ	410 U	430 U	160 E J	420 U	420 U	720 UJ	44.0 L
anthracene	740 UJ	88.0 J	430 U	260 J	420 U	420 U	720 UJ	330 F
benzo(a)anthracene	170 J	580 E	75.0 J	1700 E J	420 U	420 U	720 UJ	330 F
benzo(a)pyrene	160 J	460 E	110 J	2400 E J	100 J	420 U	720 UJ	430 L

TABLE 5-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01 06/15/95	06SD02 06/15/95	06SD03 06/15/95	06SD04 06/15/95	06SD05 11/01/96	06SD06 11/01/96	06SD07 11/01/96	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	06SD05	06SD06	06SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	06/15/95	06/15/95	06/15/95	06/15/95	11/01/96	11/01/96	11/01/96	
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	340 E J	700 E	190 J	4800 E J	420 U	420 U	720 UJ	330 F
benzo(g,h,i)perylene	170 J	440 E	430 U	2600 E J	420 U	420 U	720 UJ	330 F
benzo(k)fluoranthene	89.0 J	170 J	66.0 J	1100 E J	420 U	420 U	720 UJ	330 F
bis(2-ethylhexyl)phthalate	740 U	880	430 U	1700 U	420 U	420 U	720 UJ	890000000 S
butylbenzylphthalate	740 UJ	410 U	430 U	690 UJ	420 U	420 U	720 UJ	11000 Q
carbazole	740 UJ	410 U	430 U	140 J	420 U	420 U	720 UJ	330 F
chrysene	240 J	570 E	130 J	2400 E J	420 U	420 U	720 UJ	330 F
dibenz(a,h)anthracene	740 UJ	150 J	430 U	720 E J	420 U	420 U	720 UJ	330 F
dibenzofuran	740 UJ	410 U	430 U	78.0 J	420 U	420 U	720 UJ	2000 P
fluoranthene	380 J	1200	110 J	1600 J	420 U	420 U	720 UJ	2900 Q
fluorene	740 UJ	83.0 J	430 U	690 UJ	420 U	420 U	720 UJ	540 P
indeno(1,2,3-cd)pyrene	130 J	290	69.0 J	2300 E J	420 U	420 U	720 UJ	330 F
naphthalene	740 UJ	410 U	430 U	90.0 J	420 U	420 U	720 UJ	480 P
phenanthrene	210 J	490	430 U	740 J	420 U	420 U	720 UJ	850 Q
pyrene	380 J	1000 E	130 J	2000 E J	420 U	420 U	720 UJ	660 L
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4-methyl-2-pentanone	2.0 J	12.0 U	13.0 U	21.0 UJ	n/a	n/a	n/a	-
toluene	31.0 J	12.0 U	13.0 U	21.0 UJ	n/a	n/a	n/a	670 P
xylene (total)	3.0 J	12.0 U	13.0 U	21.0 UJ	n/a	n/a	n/a	25.0 P
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4,4'-DDD	230 E J	43.0 E	2.4 E JN	5.4 E R	4.2 U	4.2 U	7.2 UJ	1.60 L
4,4'-DDE	66.0 E J	10.0 E	5.2 E	30.0 E J	4.2 U	4.2 U	7.2 UJ	2.20 L
4,4'-DDT	89.0 E JN	9.3 E J	14.0 E	110 E J	4.2 U	4.2 U	7.2 UJ	1.60 L
aldrin	38.0 UJ	0.077 R	2.2 U	0.35 R	2.1 U	2.2 U	3.7 UJ	-
alpha-chlordane	48.0 E J	22.0 E	0.39 R	3.5 UJ	2.1 U	2.2 U	3.7 UJ	7.00 O
dieldrin	7.3 UJ	4.0 U	0.31 J	1.6 J	4.2 U	4.2 U	7.2 UJ	52.0 Q
endosulfan II	24.0 E J	2.6 J	4.3 U	5.6 E JN	4.2 U	4.2 U	7.2 UJ	5.40 P
endrin	7.3 UJ	4.0 U	1.6 JN	6.9 UJ	4.2 U	4.2 U	7.2 UJ	20.0 Q

TABLE 5-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01 06/15/95	06SD02 06/15/95	06SD03 06/15/95	06SD04 06/15/95	06SD05 11/01/96	06SD06 11/01/96	06SD07 11/01/96	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	06SD05	06SD06	06SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	06/15/95	06/15/95	06/15/95	06/15/95	11/01/96	11/01/96	11/01/96	
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
endrin ketone	73.0 UJ	4.0 U	4.3 U	7.3 J	4.2 U	4.2 U	7.2 UJ	20.0 Q
gamma-chlordane	56.0 E J	23.0 E	0.34 JN	3.5 UJ	2.1 U	2.2 U	3.7 UJ	7.00 O
heptachlor	0.35 J	0.16 J	2.2 U	3.5 UJ	2.1 U	2.2 U	3.7 UJ	5.00 O
heptachlor epoxide	2.3 J	0.24 J	0.20 J	1.0 J	2.1 U	2.2 U	3.7 UJ	5.00 O

TABLE 5-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD08 10/29/96		06SD09 10/29/96		06SD10 10/29/96		---	---	---	---	SELECTED ARARS	
LOCATION:	06SD08		06SD09		06SD10		---	---	---	---	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1996 RI		1996 RI		1996 RI							
SAMPLE DATE:	10/29/96		10/29/96		10/29/96							
INORGANICS	mg/kg		mg/kg		mg/kg						mg/kg	
aluminum	2170		4490		4630						-	
antimony	0.44	U	0.43	U	0.51						2.00	M
arsenic	2.2		7.0		6.9						8.20	L
barium	8.1		12.5		12.2						40.0	B
beryllium	0.11		0.26		0.40						-	
cadmium	0.057	U	0.055	U	0.061	U					1.20	L
calcium	92.4		583		250						-	
chromium, total	3.7	R	23.3		14.4						81.0	L
cobalt	0.48		0.40		0.86						50.0	T
copper	1.1		2.7		7.1	J					34.0	L
iron	1790		14500		10300						-	
lead	4.2		7.5		25.1						47.0	L
magnesium	82.7	U	416		986						-	
manganese	12.4	J	10.0	J	10.4	J					460	O
mercury	0.13	U	0.12	U	0.14	U					0.150	L
nickel	1.0		1.2		2.8						21.0	L
potassium	172		631		2630						-	
selenium	0.93	UJ	0.90	UJ	1.0	UJ					-	
silver	0.13	U	0.12		0.26						1.00	M
sodium	168	U	185		575						-	
thallium	0.80	UJ	0.78	UJ	0.86	UJ					-	
vanadium	3.9		33.4		14.0						-	
zinc	4.5		12.4		26.2						150	L
SEMIVOLATILES	ug/kg		ug/kg		ug/kg						ug/kg	
acenaphthylene	430	UJ	410	UJ	56.0	E J					44.0	L
anthracene	430	UJ	410	UJ	89.0	J					330	F
benzo(a)anthracene	430	UJ	410	UJ	280	J					330	F
benzo(a)pyrene	430	UJ	410	UJ	280	J					430	L

TABLE 5-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD08 10/29/96	06SD09 10/29/96	06SD10 10/29/96	---	---	---	---	SELECTED ARARS
LOCATION:	06SD08	06SD09	06SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI					
SAMPLE DATE:	10/29/96	10/29/96	10/29/96					
SEMIVOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
benzo(b)fluoranthene	430 UJ	410 UJ	370 E J					330 F
benzo(g,h,i)perylene	430 UJ	410 UJ	150 J					330 F
benzo(k)fluoranthene	430 UJ	410 UJ	150 J					330 F
bis(2-ethylhexyl)phthalate	430 UJ	410 UJ	96.0 J					890000000 S
butylbenzylphthalate	300 J	410 UJ	460 UJ					11000 Q
carbazole	430 UJ	410 UJ	460 UJ					330 F
chrysene	430 UJ	410 UJ	350 E J					330 F
dibenz(a,h)anthracene	430 UJ	410 UJ	460 UJ					330 F
dibenzofuran	430 UJ	410 UJ	460 UJ					2000 P
fluoranthene	430 UJ	410 UJ	780					2900 Q
fluorene	430 UJ	410 UJ	65.0 J					540 P
indeno(1,2,3-cd)pyrene	430 UJ	410 UJ	150 J					330 F
naphthalene	430 UJ	410 UJ	460 UJ					480 P
phenanthrene	430 UJ	410 UJ	340 J					850 Q
pyrene	430 UJ	410 UJ	760 E					660 L
VOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
4-methyl-2-pentanone	n/a	n/a	n/a					-
toluene	n/a	n/a	n/a					670 P
xylene (total)	n/a	n/a	n/a					25.0 P
PESTICIDES	ug/kg	ug/kg	ug/kg					ug/kg
4,4'-DDD	4.3 U	4.1 U	15.0 E J					1.60 L
4,4'-DDE	4.3 U	4.1 U	3.6 E J					2.20 L
4,4'-DDT	4.3 U	4.1 U	4.6 U					1.60 L
aldrin	2.2 U	2.1 U	2.4 U					-
alpha-chlordane	2.2 U	2.1 U	9.8 E					7.00 O
dieldrin	4.3 U	4.1 U	4.6 U					52.0 Q
endosulfan II	4.3 U	4.1 U	4.6 U					5.40 P
endrin	4.3 U	4.1 U	4.6 U					20.0 Q

TABLE 5-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD08 10/29/96	06SD09 10/29/96	06SD10 10/29/96	---	---	---	---	SELECTED ARARS
LOCATION:	06SD08	06SD09	06SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI					
SAMPLE DATE:	10/29/96	10/29/96	10/29/96					
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**					**ug/kg**
endrin ketone	4.3 U	4.1 U	4.6 U					20.0 Q
gamma-chlordane	2.2 U	2.1 U	8.1 E					7.00 O
heptachlor	2.2 U	2.1 U	2.4 U					5.00 O
heptachlor epoxide	2.2 U	2.1 U	2.4 U					5.00 O

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 5-3d

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		06SD01 06/15/95	06SD02 06/15/95	06SD03 06/15/95	06SD04 06/15/95	06SD05 11/01/96	06SD06 11/01/96	06SD07 11/01/96	ARARS & TBCs
LOCATION:		06SD01	06SD02	06SD03	06SD04	06SD05	06SD06	06SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:		06/15/95	06/15/95	06/15/95	06/15/95	11/01/96	11/01/96	11/01/96	
MISCELLANEOUS									
% solids	%	n/a	n/a	n/a	n/a	78.9	77.7	46.2	-
moisture	%	54.8	18.3	23.1	52.3	n/a	n/a	n/a	-
pH		6.6 J	4.6	5.1	6.7 J	n/a	n/a	n/a	-
total organic carbon	mg/kg	33000 J	2000	8200	80000 J	8130	4600	78700 J	-

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TABLE 5-3d

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		06SD08 10/29/96	06SD09 10/29/96	06SD10 10/29/96	---	---	---	---	ARARS & TBCs
LOCATION:		06SD08	06SD09	06SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1996 RI	1996 RI	1996 RI					
SAMPLE DATE:		10/29/96	10/29/96	10/29/96					
MISCELLANEOUS									
% solids	%	77.2	79.6	71.8					-
moisture	%	n/a	n/a	n/a					-
pH		n/a	n/a	n/a					-
total organic carbon	mg/kg	4200	4830	22400					-

TABLE 5-3d
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 5-3e

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SW01 06/15/95	06SW02 06/15/95	06SW05 11/01/96	06SW06 11/01/96	ARARS & TBCs				
LOCATION:	06SW01	06SW02	06SW05	06SW06	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1996 RI	1996 RI					
SAMPLE DATE:	06/15/95	06/15/95	11/01/96	11/01/96					
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	500	305 J	434	15100	-	-	-	-	-
antimony	17.4 U	2.5 U	1.7 U	3.3	-	14.0	4300	-	12.2
arsenic	6.2 E	4.4 E	7.1 E	42.4 E	189	0.0180	0.140	-	0.0170
barium	468 J	45.1	30.7	65.0	-	-	-	-	2000
beryllium	0.14 U	0.14	1.0	2.4	-	-	-	-	-
cadmium	2.7 E J	0.17 U	0.22 U	0.22 U	1.10 +	-	-	-	-
calcium	20000	20300	159000	48900	-	-	-	-	-
chromium, total	8.5 U	1.1	0.40 UR	6.2 R	209 +	-	-	-	160
cobalt	2.7 U	1.8	0.79	6.6	-	-	-	-	-
copper	13.8 E	15.8 E	7.6	102 E	11.0 +	-	-	-	-
iron	13600	11400	3410	349000	-	-	-	-	-
lead	5.0 E	4.1 E	2.9	506 E J	3.20 +	-	-	-	5.00
magnesium	5390	5360	447000	138000	-	-	-	-	-
manganese	338	337	257	170	-	-	-	-	-
mercury	0.043 E	0.055 E	0.20 U	0.29 E	0.0120	0.140	0.150	-	-
nickel	6.5 U	4.3	1.8	27.2	160 +	610	4600	-	516
potassium	3610	3250	207000 J	64700 J	-	-	-	-	-
selenium	3.9 J	4.4 J	8.5 E	3.6 U	5.00	-	-	-	10.0
silver	1.5 U	0.63 U	0.50 U	0.74	1.90	-	-	-	164
sodium	53900	54700	3480000	1190000	-	-	-	-	-
thallium	5.1 E	3.0 U	10.7 E J	7.7 E J	-	1.70	6.30	-	1.70
vanadium	4.9 U	1.2	3.9	40.5	-	-	-	-	-
zinc	323 E J	55.4 J	16.4 R	217 E R	101 +	-	-	-	-
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
delta-BHC	n/a	n/a	0.050 U	0.020 R	-	-	-	-	-

TABLE 5-3e

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SW07 11/01/96	---	---	---	ARARS & TBCs				
LOCATION:	06SW07	---	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1996 RI								
SAMPLE DATE:	11/01/96								
INORGANICS	ug/L				ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	213				-	-	-	-	-
antimony	1.7 U				-	14.0	4300	-	12.2
arsenic	3.2 U				189	0.0180	0.140	-	0.0170
barium	30.1				-	-	-	-	2000
beryllium	0.45				-	-	-	-	-
cadmium	0.22 U				1.10 +	-	-	-	-
calcium	27500				-	-	-	-	-
chromium, total	0.40 UR				209 +	-	-	-	160
cobalt	2.0				-	-	-	-	-
copper	6.6				11.0 +	-	-	-	-
iron	2060				-	-	-	-	-
lead	1.2				3.20 +	-	-	-	5.00
magnesium	53300				-	-	-	-	-
manganese	205				-	-	-	-	-
mercury	0.20 U				0.0120	0.140	0.150	-	-
nickel	5.7				160 +	610	4600	-	516
potassium	24200 J				-	-	-	-	-
selenium	3.6 U				5.00	-	-	-	10.0
silver	0.50 U				1.90	-	-	-	164
sodium	438000				-	-	-	-	-
thallium	10.3 E J				-	1.70	6.30	-	1.70
vanadium	0.92				-	-	-	-	-
zinc	22.8 R				101 +	-	-	-	-
PESTICIDES	ug/L				ug/L	ug/L	ug/L	ug/L	ug/L
delta-BHC	0.050 UR				-	-	-	-	-

TABLE 5-3e
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

\- - No standard is available for this chemical in this classification.

\+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 5-3f
COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		06SW01 06/15/95	06SW02 06/15/95	06SW05 11/01/96	ARARS & TBCs				
LOCATION:		06SW01	06SW02	06SW05	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI	1995 RI	1996 RI					
SAMPLE DATE:		06/15/95	06/15/95	11/01/96					
MISCELLANEOUS									
alkalinity as CaCO3	mg/L	n/a	n/a	217	-	-	-	-	-
ammonia nitrogen	mg/L	0.40 E J	0.40 E J	n/a	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	4.0	4.0	15.0	-	-	-	-	-
chemical oxygen demand	mg/L	23.0	19.0	407 J	-	-	-	-	-
chloride	mg/L	100	101	n/a	-	-	-	230	230
nitrate nitrogen	mg/L	1.1	0.50	n/a	-	10.0	-	-	10.0
total dissolved solids	mg/L	n/a	n/a	13000	-	-	-	-	-
total hardness	mg/L	65.0	65.0	1610	-	-	-	-	-
total organic carbon	mg/L	6.0	6.0	n/a	-	-	-	-	-
total phosphorus as PO4	mg/L	0.80	0.70 R	n/a	-	-	-	-	-
total suspended solids	mg/L	n/a	n/a	59.0	-	-	-	-	-
turbidity	ntu	57.0	48.0	n/a	-	-	-	-	-

TABLE 5-3f

COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 06

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		06SW06 11/01/96	06SW07 11/01/96	- - -	ARARS & TBCs				
LOCATION:		06SW06	06SW07	- - -	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1996 RI	1996 RI						
SAMPLE DATE:		11/01/96	11/01/96						
MISCELLANEOUS									
alkalinity as CaCO3	mg/L	13.6	38.2		-	-	-	-	-
ammonia nitrogen	mg/L	n/a	n/a		-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	19.0	3.2		-	-	-	-	-
chemical oxygen demand	mg/L	579 J	30.3 J		-	-	-	-	-
chloride	mg/L	n/a	n/a		-	-	-	230	230
nitrate nitrogen	mg/L	n/a	n/a		-	10.0	-	-	10.0
total dissolved solids	mg/L	4300	1800		-	-	-	-	-
total hardness	mg/L	586	245		-	-	-	-	-
total organic carbon	mg/L	n/a	n/a		-	-	-	-	-
total phosphorus as PO4	mg/L	n/a	n/a		-	-	-	-	-
total suspended solids	mg/L	1100	24.0		-	-	-	-	-
turbidity	ntu	n/a	n/a		-	-	-	-	-

TABLE 5-3f
COMPARISON OF SURFACE WATER EXPLOSIVES AND MISC. DATA TO ARARS AND TBCS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

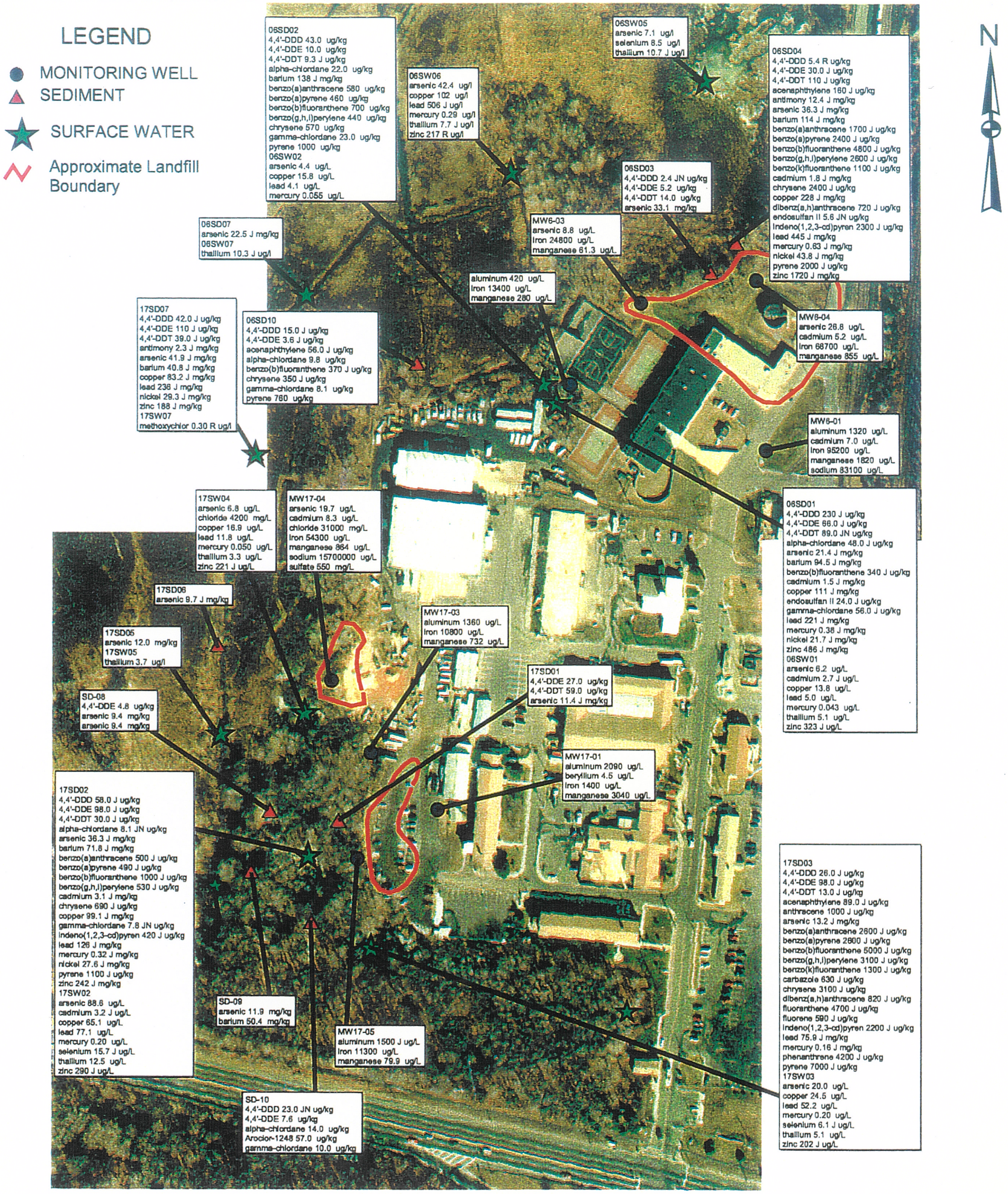
Footnotes to sample results:

U	- Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).
UJ	- Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.
No Value	- Constituent was not analyzed for in this sample.
UR	- Nondetected result is considered rejected based on exceedance of data validation quality control criteria.
J	- Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.
R	- Positive result is considered rejected based on exceedance of data validation quality control criteria.
N	- Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.
E	- Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

-	- No standard is available for this chemical in this classification.
+	- Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L
&	- Value represents the more stringent of criteria for freshwaters classified as FW2-NT, FW2-TP, and FW2-TM

P:\GIS\EARLE\APR\EARL9708.APR 11-September-97 MJJ Site 6/17 Tags Layout



CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 6 and 17

250 0 250 500 Feet

FIGURE 5-2

Brown & Root Environmental

5.5.1.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, and pyrene were detected in background sediment samples at levels ranging from 110 ug/kg to 1,900 ug/kg. The maximum concentrations of individual PAHs detected in the site-related sediments occurred in sample 06 SD 04 and ranged from one to 10 times higher than the concentrations in background sediment. Background samples revealed the pesticide DDT and its analogs at the following concentrations: 4,4'-DDT (19 ug/kg), 4,4'-DDE (1.7 ug/kg), and 4,4'-DDD (21 ug/kg). These pesticides were detected in the site-related sediment samples at Site 6, with 4,4'-DDT ranging from 9.3 ug/kg to 110 ug/kg, 4,4'-DDE ranging from 3.6 ug/kg to 66 ug/kg, and 4,4'-DDD ranging from 2.4 ug/kg to 230 ug/kg. Several additional pesticides were detected in site-related sediment samples that were not present in background sediments or were present at much lower levels. The highest levels of pesticides were at sample locations 06 SD 01, 06 SD 02, and 06 SD 04. Trace levels of xylene (3 ug/kg) and 4-methyl-2-pentanone (2 ug/kg) were each detected in one site-related sediment sample, 06 SD 01, but were not found in background sediments. Bis(2-ethylhexyl) phthalate was present in two site-related sediment samples at concentrations up to 880 ug/kg. Butylbenzyl phthalate was detected in one sample, 06 SD 08, at 300 ug/kg but was not detected in background samples. Toluene was detected in one site-related sediment sample at a level (31 ug/kg) considerably lower than the concentration detected in a background sediment sample (480 ug/kg).

5.5.1.3 Miscellaneous Parameters

The Site 6 sediment analyses consisted of pH and TOC. TOC levels in sediment did not exceed background.

5.5.2 Groundwater

Four site-related groundwater samples (06 GW 01 through 06 GW 04) were collected from monitoring wells MW6-01 through MW6-04, respectively, at Site 6 (Figure 5-1). Tables 5-4 and 5-5 present the occurrence and distribution of inorganic and organic chemicals detected in site related groundwater samples and compare them to background. Table 5-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 5-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

5.5.2.1 Inorganics

Concentrations of most metals in Site 6 groundwater were similar to the ranges detected in background samples. The following metals exhibited concentrations greater than background: cadmium (1.2 ug/L to 7.0 ug/L) and iron (13,400 ug/L to 95,200 ug/L) in samples 06 GW 01, 06 GW 02, 06 GW 03, and 06 GW 04 and manganese (1820/ug/L) in sample 06 GW 01.

TABLE 5-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	1320 - 2090	1.6E+11	3386.67	4 / 4	145 - 1320	518.75	NO	NO	1320.00
ARSENIC *	1 / 3	5.1 - 5.1	1.7E+02	5.60	3 / 4	5.1 - 26.8	10.59	YES	NO	26.80
BARIUM	3 / 3	30.4 - 78.1	2.5E+06	105.47	4 / 4	30.4 - 64.9	47.13	NO	NO	64.90
BERYLLIUM	2 / 3	0.23 - 4.5	7.7E+01	3.19	1 / 4	0.21 - 0.21	0.09	NO	NO	0.21
CADMIUM	3 / 3	0.43 - 7	2.2E+01	5.29	4 / 4	1.2 - 7	3.90	NO	NO	7.00
CALCIUM	3 / 3	11000 - 24100	9.4E+14	38067	4 / 4	5670 - 89800	31440	NO	NO	89800
CHROMIUM *	NOT DETECTED	-	-	-	1 / 4	1.2 - 1.2	0.66	YES	-	1.20
COBALT	3 / 3	3.2 - 24.7	4.2E+04	23.67	3 / 4	0.81 - 7.6	3.18	NO	NO	7.60
IRON	3 / 3	1400 - 95200	2.4E+16	66847	4 / 4	13400 - 95200	50025	NO	NO	95200
MAGNESIUM	3 / 3	8610 - 17300	2.5E+14	26940	4 / 4	3120 - 53000	19660	NO	NO	53000
MANGANESE	3 / 3	720 - 3040	7.3E+11	3720	4 / 4	61.3 - 1820	754.08	NO	NO	1820.00
NICKEL	3 / 3	3.7 - 43.2	2.7E+05	38.33	4 / 4	0.76 - 5	2.61	NO	NO	5.00
POTASSIUM	3 / 3	3000 - 3620	1.1E+12	6780	4 / 4	2250 - 9270	4395	NO	NO	9270
SODIUM	3 / 3	15800 - 92500	1.9E+17	127600	4 / 4	20800 - 83100	40925	NO	NO	83100
ZINC	2 / 2	18.9 - 30.9	7.3E+11	49.80	3 / 4	3.3 - 18.9	10.55	NO	NO	18.90

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 5-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND**			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ENDOSULFAN I *	NOT DETECTED	-	-	1 / 4	0.0021	0.0021
GAMMA-BHC (LINDANE) *	NOT DETECTED	-	-	1 / 4	0.0008	0.0008

* - Selected as a COPC

** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

5.5.2.2 Organics

Endosulfan I and gamma-BHC were each detected in one groundwater sample collected at Site 6 at concentrations of 0.0021 ug/L and 0.0008 ug/L, respectively. Neither of these compounds were detected in background groundwater samples. Explosives and related degradation products were analyzed for but not detected in groundwater samples.

5.5.2.3 Miscellaneous Parameters

Miscellaneous parameter analyses of four groundwater samples at Site 6 consisted of ammonia, BOD, COD, chlorides, nitrates, sulfates, TOC, phosphates, and turbidity. Most indicator parameters revealed lower concentrations in all downgradient wells than in upgradient well MW6-01. Downgradient concentrations were slightly greater than upgradient levels and greater than background ranges for ammonia and TOC in MW6-04 and for sulfate in MW6-03. Upgradient well MW6-01 revealed ammonia, chloride, BOD, COD, and TOC at concentrations greater than background. The wells containing maximum detected concentrations were generally consistent with the results of the previous 1993 investigation. None of the indicator parameters in upgradient or downgradient wells were high enough to be within a range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

5.5.3 Surface Water

Two surface water samples were collected in Site 6 at 1995 (06 SW 01 and 06 SW 02), and three surface water samples (06 SW 05 through 06 SW 07) were collected in 1996 (Figure 5-1). Table 5-6 presents the occurrence and distribution of inorganic and organic chemicals in site-related surface water samples and compares them to background. No organic chemicals were detected in Site 6 surface water samples. Table 5-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 5-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

5.5.3.1 Inorganics

The highest levels of metals were primarily at locations 06 SW 01 and 06 SW 06. Metals exceeding two times the background concentrations include aluminum (up to 15,100 ug/L), arsenic (up to 42.4 ug/L), barium (up to 468 ug/L), cadmium (2.7 ug/L at 06 SW 01), cobalt (up to 6.6 ug/L), copper (up to 102 ug/L), iron (up to 349,000 ug/L), lead (up to 506 ug/L), mercury (up to 0.29 ug/L), nickel (up to 27.2 ug/L), vanadium (up to 40.5 ug/L), and zinc (up to 323 ug/L). Antimony was also detected at location 06 SW 06 (3.3 ug/L), but was not detected in background samples. No analytes exceeding two times background were detected in 06 SW 02, 06 SW 05, or 06 SW 07.

TABLE 5-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL **	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM *	5 / 6	102 - 1540	2.2E+03	904.20	5 / 5	213 - 15100	3310.40	YES	YES	9594.70
ANTIMONY *	NOT DETECTED	-	-	-	1 5	3.3 3.3	2.99	YES	YES	3.30
ARSENIC *	1 / 6	9 - 9	1.3E+01	5.32	4 / 5	4.4 - 42.4	12.34	YES	NO	28.49
BARIUM	6 / 6	16.3 - 36.4	2.4E+03	55.05	5 / 5	30.1 - 468	127.78	YES	NO	309.61
BERYLLIUM	3 / 6	0.22 - 1.2	1.7E+00	0.70	4 / 5	0.14 2.4	0.81	YES	NO	2.40
CADMIUM *	1 / 6	0.18 0.18	3.2E-01	0.23	1 / 5	2.7 2.7	0.62	YES	YES	1.73
CALCIUM	6 / 6	462 - 177000	2.3E+05	71114	5 / 5	20000 - 159000	55140	NO	NO	111621
CHROMIUM	3 / 5	0.72 - 2.6	4.4E+00	1.78	1 / 4	1.1 1.1	1.44	NO	NO	1.10
COBALT	6 / 6	0.81 - 2	5.2E+00	3.10	4 / 5	0.79 6.6	2.51	NO	NO	4.73
COPPER	5 / 6	1.1 - 17.8	3.0E+02	11.92	5 / 5	6.6 - 102	29.16	YES	NO	68.16
IRON *	6 / 6	160 - 23100	3.0E+04	9576.67	5 / 5	2060 - 349000	75894	YES	YES	221526
LEAD *	2 / 6	4.4 - 16	2.2E+01	7.31	5 / 5	1.2 - 506	103.84	YES	YES	318.18
MAGNESIUM	6 / 6	369 - 559000	7.0E+05	190703	5 / 5	5360 - 447000	129810	NO	NO	447000
MANGANESE	6 / 6	14 - 203	3.8E+02	172.43	5 / 5	170 - 338	261.40	YES	NO	338.00
MERCURY	2 / 6	0.023 - 0.028	2.3E-01	0.12	3 / 5	0.043 - 0.29	0.12	NO	NO	0.29
NICKEL	6 / 6	2.1 - 7.9	8.2E+01	10.23	4 / 5	1.8 27.2	8.45	NO	NO	18.54
POTASSIUM	5 / 6	251 - 259000	3.2E+05	88923	5 / 5	3250 - 207000	60552	NO	NO	207000
SELENIUM	2 / 6	3.5 - 9.2	1.4E+01	6.27	3 / 5	3.9 - 8.5	4.08	NO	NO	8.50
SILVER	1 / 6	0.86 - 0.86	1.3E+00	0.75	1 5	0.74 0.74	0.46	NO	NO	0.71
SODIUM	3 / 3	11150 - 4340000	1.3E+07	2912233	5 / 5	53900 - 3480000	1043320	NO	NO	3480000
THALLIUM	3 / 6	3.5 - 5.5	2.8E+01	5.90	4 / 5	5.1 10.7	7.06	YES	NO	10.70
VANADIUM	4 / 6	0.225 - 9	1.2E+01	3.79	4 / 5	0.92 40.5	9.79	YES	NO	26.20
ZINC	5 / 5	7.6 - 29.4	1.5E+03	30.60	2 / 2	55.4 - 323	189.20	YES	NO	323.00

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

5.5.3.2 Miscellaneous Parameters

Miscellaneous parameter analyses of the five surface water samples taken at Site 6 consisted of ammonia, BOD, COD, chlorides, total water hardness (hardness), TOC, phosphate, and turbidity. Although several surface water indicator parameters were detected at levels greater than background (chloride, phosphate, nitrate, and ammonia), none were considered to be within a range typically associated with concentrated landfill leachate.

5.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 6 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 5.6.1. Persistence of detected chemicals in the environment is discussed in Section 5.6.2. Section 5.6.3 presents a brief discussion of contaminant trends. This section evaluates all sampling data for the 1995 RI and 1996 RI Addendum.

5.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 6 indicate a wide variety of semivolatile and pesticide compounds, in addition to several inorganics, present in the groundwater and sediment. Only inorganics were present in surface water samples. The physical transport data for the detected contaminants are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Low levels of two pesticides were detected in groundwater samples. Endosulfan I (downgradient) and gamma-BHC (upgradient) are considered somewhat mobile in groundwater, since their solubilities and K_{oc} values are more favorable for transport than those of organic compounds that are considered highly immobile (for example, PCBs and PAHs). These pesticides may have originated at source locations not identified in this investigation or from source locations that have since been depleted of these compounds. Downgradient samples 06 GW 02, 06 GW 03, and 06 GW 04 revealed elevated concentrations of cadmium, iron, and manganese. However, these data do not suggest migration of inorganic contaminants from the site because upgradient sample 06 GW 01 exhibited the same metals at higher concentrations.

No organics were detected in surface water. Higher concentrations of organics detected in the sediments may be attributable to the organic carbon present in the sediments that tends to bind the heavier organics such as PCBs and PAHs.

5.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different toxicologically or be different from a physical transport perspective. If the transformational process is known or suspected, product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

5.6.3 Observed Chemical Contaminant Trends

Surface water samples at Site 6 do not demonstrate continuous chemical migration impact from the landfill. The detected sediment contamination could be the result of runoff and erosional dispersion. Organic compounds in sediment fall into three classes: PAHs (which are considered relatively immobile), pesticides (which have varying degrees of mobility), and volatiles (which are considered mobile). Of these classes, the detected levels of PAHs are the highest, although the overall potential for PAH migration impacts is low due to the organic carbon, to which they bind, present in most sediments.

5.6.4 Conclusions

Runoff and erosional dispersion may allow limited migration of contaminated sediments, although the compounds found in the sediments may not originate at Site 6. The highest levels of inorganic and organic contaminants were primarily detected in sediment samples nearest the site, indicating that contaminants have not been dispersed into the marshland to a significant degree. An attempt to obtain surface water samples/sediments from landfill seeps was not possible despite much heavier than average rainfall over the period (1996 activities only), indicating that landfill seeps either do not exist or flow only rarely. Detected chemicals in the groundwater indicate the possibility of limited groundwater impacts for certain metals and Endosulfan I at a very low level.

5.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 6. The risk assessment was performed using the approach outlined in Section 2.4. Tables 5-7 through 5-9 provide the selected COPCs and representative concentrations of inorganics and organics in site-related groundwater, sediment, and surface water (inorganics only), respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

5.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, industrial, and recreational receptors).

5.7.1.1 Future Industrial Employee

Groundwater Exposure

RME

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 6 is 1.4E-04 (ingestion) and 2.9E-07 (dermal contact). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 6 is less than 1.0 for the ingestion exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

TABLE 5-7
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
GROUNDWATER - SITE 6 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ARSENIC	26.8
CHROMIUM	1.2
ENDOSULFAN I	0.0021
GAMMA_BHC(LINDANE)	0.0008

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TABLE 5-8
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	4.63
ARSENIC	21.6
COPPER	82.7
LEAD	163.62
MERCURY	0.27
THALLIUM	0.98
4,4'-DDD*	80.01
4,4'-DDE*	24.62
4,4'-DDT*	47.12
4-METHYL-2-PENTANONE*	2
ACENAPHTHYLENE*	160
ALPHA-CHLORDANE*	19.64
ANTHRACENE*	260
BENZ(A)ANTHRACENE*	676.57
BENZO(A)PYRENE*	852.29
BENZO(B)FLUORANTHENE*	1587.69
BENZO(G,H,I)PERYLENE*	912.89
BENZO(K)FLUORANTHENE*	451.36
BIS(2-ETHYLHEXYL)PHTHALATE*	521.76
BUTYL BENZYL PHTHALATE	300
CARBAZOLE*	140
CHRYSENE*	884.84
DIBENZ(A,H)ANTHRACENE*	385.23
DIBENZOFURAN*	78
DIELDRIN*	1.6
ENDOSULFAN II*	8.81
ENDRIN*	1.6
ENDRIN KETONE*	7.3
FLUORANTHENE*	819.63
FLUORENE*	83
GAMMA-CHLORDANE*	19.81
HEPTACHLOR*	0.35
HEPTACHLOR EPOXIDE*	2.3
INDENO(1,2,3-CD)PYRENE*	800.89
NAPHTHALENE*	90
PHENANTHRENE*	421.54
PYRENE*	884.61
TOLUENE*	31
XYLENE (TOTAL)*	3

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

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TABLE 5-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE WATER - SITE 6 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ANTIMONY	3.3
ALUMINUM	9594.7
ARSENIC	28.49
CADMIUM	1.73
IRON	221526
LEAD	318.18

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 6 in Tables 5-10 and 5-11, respectively.

CTE

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 6 is 1.6E-05 (ingestion) and 4.5E-08 (dermal contact). The total groundwater cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk is arsenic (ingestion, 98 percent of the cancer risk for this pathway).

Estimated CTE carcinogenic risks are presented for future industrial receptors exposed to groundwater at Site 6 in Table 5-12.

5.7.1.2 Future Residential Receptor

Groundwater Exposure

RME

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 6 is 6.0E-04 (ingestion), 7.3E-06 (dermal contact), and 3.9E-08 (inhalation of VOCs during showering). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 6 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (5.7 - arsenic). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 6 in Tables 5-13 and 5-14, respectively.

TABLE 5-10
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ENDOSULFAN I	N/A	N/A
GAMMA-BHC (LINDANE)	3.6E-09	N/A
ARSENIC	1.4E-04	2.88E-07
CHROMIUM	N/A	N/A
TOTAL RISK	1.4E-04	2.88E-07

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMCIAL

TABLE 5-11
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ENDOSULFAN I	3.4E-06	N/A
GAMMA-BHC (LINDANE)	2.6E-05	N/A
ARSENIC	8.7E-01	1.79E-03
CHROMIUM	1.17E-05	N/A

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-12
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ENDOSULFAN I	N/A	N/A
GAMMA-BHC (LINDANE)	4.0E-10	N/A
ARSENIC	1.55E-05	4.54E-08
CHROMIUM	N/A	N/A
TOTAL RISK	1.6E-05	4.5E-08

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-13
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	1.5E-08	N/A	3.9E-08
ARSENIC	6.0E-04	7.3E-06	N/A
CHROMIUM	N/A	N/A	N/A
TOTAL RISK	6.0E-04	7.3E-06	3.9E-08

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-14
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GW BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	2.2E-05	2.2E-05		2.2E-05		N/A	N/A
GAMMA-BHC (LINDANE)	1.7E-04			1.7E-04	1.7E-04	N/A	N/A
ARSENIC	5.7E+00		5.7E+00			7.22E-02	N/A
CHROMIUM	7.67E-05					N/A	N/A
	HI BY TARGET ORGAN	2.2E-05	5.7E+00	1.9E-04	1.7E-04		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

CTE

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 6 is 2.7E-04 (ingestion), 7.5E-08 (dermal contact), and 2.2E-09 (inhalation of VOCs during showering). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 6 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (2.7 - arsenic). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 6 in Tables 5-15 and 5-16, respectively.

5.7.1.3 Future Recreational Receptor

Sediment and Surface Water

RME

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 6 are 5.8E-07 (ingestion) and 1.6E-06 (dermal contact). The cancer risks for exposure to COPCs in surface water during wading at Site 6 are 5.6E-07 (ingestion) and 1.7E-07 (dermal contact). This sediment cancer risk is at the lower end of the 10^{-4} to 10^{-6} target acceptable risk range. The principal COPC contributing to the sediment cancer risk is arsenic (dermal contact, 100 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 6 are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated individual noncarcinogenic HQs for exposure to COPCs in surface water during wading at Site 6 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

TABLE 5-15
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	2.2E-09	N/A	2.2E-09
ARSENIC	2.72E-04	7.5E-08	N/A
CHROMIUM	N/A	N/A	N/A
TOTAL RISK	2.7E-04	7.5E-08	2.2E-09

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-16
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	1.0E-05	1.0E-05		1.0E-05		N/A	N/A
GAMMA-BHC (LINDANE)	8.0E-05			8.0E-05	8.0E-05	N/A	N/A
ARSENIC	2.7E+00		2.7E+00			3.1E-03	N/A
CHROMIUM	3.6E-05					N/A	N/A
	HI BY TARGET ORGAN	1.0E-05	2.7E+00	9.0E-05	8.0E-05		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 6 in Tables 5-17 and 5-18, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 6 in Tables 5-19 and 5-20, respectively.

CTE

No CTE analysis is required for sediment and surface water exposure.

5.7.2 Conclusions

Sediment, groundwater, and surface water were sampled at Site 6. The potential receptors considered for this site were future industrial, residential, and recreational receptors.

The RME cancer risks associated with future residential groundwater exposure exceeded the upper end of EPA's target acceptable risk range. The RME cancer risks associated with future industrial groundwater exposure was at the upper bound of EPA's target acceptable risk range. In addition, CTE cancer risks for the future residential receptor groundwater exposure were in the upper bound of EPA's target risk range. Arsenic (via ingestion of and dermal contact with groundwater) is the principal COPC that contributed to the cancer risks for these exposure scenarios.

RME estimates for noncarcinogenic HIs associated with future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenarios. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

RME risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 6 in Table 5-21 for subsurface soil and groundwater. Table 5-22 presents the relevant CTE risk estimates associated with potential receptors for groundwater, sediment, and surface water. The estimated RME cancer risk for the future industrial employee and the future residential receptor exceeds 1E-04, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1E-04, based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

TABLE 5-17
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	2.5E-10	N/A
4,4'-DDE	1.1E-10	N/A
4,4'-DDT	2.1E-10	N/A
4-METHYL-2-PENTANONE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ALPHA-CHLORDANE	3.4E-10	N/A
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	6.5E-09	N/A
BENZO(A)PYRENE	8.2E-08	N/A
BENZO(B)FLUORANTHENE	1.5E-08	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	4.3E-10	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	9.6E-11	N/A
CARBAZOLE	3.7E-11	N/A
CHRYSENE	8.5E-11	N/A
DIBENZ(A,H)ANTHRACENE	3.7E-08	N/A
DIBENZOFURAN	N/A	N/A
DIELDRIN	3.4E-10	N/A
ENDOSULFAN II	N/A	N/A
ENDRIN	N/A	N/A
ENDRIN KETONE	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	3.4E-10	N/A
HEPTACHLOR	2.1E-11	N/A
HEPTACHLOR EPOXIDE	2.8E-10	N/A
INDENO(1,2,3-CD)PYRENE	7.7E-09	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
TOLUENE	N/A	N/A
XYLENE (TOTAL)	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	4.3E-07	1.6E-06
COPPER	N/A	N/A
LEAD	N/A	N/A
MERCURY	N/A	N/A
THALLIUM	N/A	N/A
TOTAL RISK	5.8E-07	1.6E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 5-18
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	1.5E-05	NA
4-METHYL-2-PENTANONE	3.8E-09	NA
ACENAPHTHYLENE	NA	NA
ALPHA-CHLORDANE	5.0E-05	NA
ANTHRACENE	1.3E-07	NA
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALA	4.0E-06	NA
CARBAZOLE	NA	NA
CHRYSENE	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA
DIBENZOFURAN	3.0E-06	NA
DIELDRIN	4.9E-06	NA
ENDOSULFAN II	2.3E-07	NA
ENDRIN	8.2E-07	NA
ENDRIN KETONE	3.7E-06	NA
FLUORANTHENE	3.1E-06	NA
FLUORENE	3.2E-07	NA
GAMMA-CHLORDANE	5.1E-05	NA
HEPTACHLOR	1.1E-07	NA
HEPTACHLOR EPOXIDE	2.7E-05	NA
INDENO(1,2,3-CD)PYRENE	NA	NA
NAPHTHALENE	3.5E-07	NA
PHENANTHRENE	NA	NA
PYRENE	4.5E-06	NA
TOLUENE	2.4E-08	NA
XYLENE (TOTAL)	1.9E-10	NA
ANTIMONY	1.8E-03	NA
ARSENIC	1.1E-02	4.2E-05
COPPER	2.2E-04	NA
LEAD	NA	NA
THALLIUM	1.9E-03	NA

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-19
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	5.60E-07	1.7E-07
CADMIUM	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
TOTAL RISK	5.6E-07	1.7E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-20
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	1.5E-03	N/A
ANTIMONY	1.3E-03	N/A
ARSENIC	1.50E-02	4.50E-03
CADMIUM	5.30E-04	N/A
IRON	1.1E-01	N/A
LEAD	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 5-21
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	5.7E-07	N/A	N/A	N/A	N/A	1.5E-02
	Dermal Contact	N/A	N/A	N/A	1.6E-06	N/A	N/A	N/A	N/A	4.2E-05
Groundwater	Ingestion	N/A	1.4E-04	6.0E-04	N/A	N/A	8.7E-01	5.7E+00@	N/A	N/A
	Dermal Contact	N/A	2.8E-07	7.3E-06	N/A	N/A	1.8E-03	7.2E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	3.9E-08	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	5.6E-07	N/A	N/A	N/A	N/A	1.3E-01
	Dermal Contact	N/A	N/A	N/A	1.7E-07	N/A	N/A	N/A	N/A	4.5E-03
	TOTAL	-	1.4E-04	6.1E-04	2.9E-06	-	8.8E-01	5.8E+00	-	1.5E-01

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

** = No volatile noncarcinogens were detected in groundwater

*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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TABLE 5-22
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	1.6E-05	2.7E-04	N/A	N/A	N/R	2.7E+00@	N/A	N/A
	Dermal Contact	N/A	4.5E-08	7.5E-08	N/A	N/A	N/R	3.1E-03	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	2.2E-09	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	TOTAL	-	1.6E-05	2.7E-04	-	-	-	2.7E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor

N/R - Central Tendency calculation not required

N/S = Not sampled

* = During Showering, Adult Residents Only

** = No volatile noncarcinogens were detected in groundwater

*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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Only the maximum concentration of arsenic found in one groundwater sample, 26.8 ug/l, would result in calculated human health risk above the EPA guideline acceptable risk range under the RME or CTE future residential exposure scenarios. Detected arsenic concentrations in the other site-related groundwater wells were 5.1 ug/l and 8.8 ug/l. These relatively lower site-related concentrations, as well as the average concentration in the four background groundwater samples, 10.6 ug/l, would also result in calculated risk levels within (at the upper end of) EPA's guideline acceptable risk range.

5.8 ECOLOGICAL RISK ASSESSMENT

5.8.1 Background

Since Sites 6 and 17 are situated in the same area of the Waterfront complex and are part of the same watershed, they were assessed together and the full discussion of ecological risk assessment can be found in Section 9.8.

5.8.2 Summary or Ecological Risk Assessment

Significantly elevated contaminant concentrations and exceedances of threshold values noted in the 1996 RI report ecological risk screening were not sustained in surface water and sediment samples obtained farther downgradient in the marsh from Sites 6 and 17. Therefore, it is considered that the relatively short-range impact of migration of contaminants from the landfills has had minimal impact on the overall health of the salt marsh.

Concentrations of contaminants capable of bioaccumulation or biomagnification were found to be relatively low in the samples taken farther afield in the salt marsh. Additive impacts on the watershed and the potential resultant effects on organisms via the foodchain (e.g., wading birds or semi-marine predators) appear to be unlikely.

The data indicate that the assessment endpoint chosen (maintenance of receptor populations in the salt marsh) does not appear to be compromised by Sites 6 or 17 or upstream contaminant sources.

5.9 EVALUATION SUMMARY

Based on the 1995 RI results, low metals concentrations in groundwater exceed regulatory and human health risk assessment guideline cancer and non-cancer risk criteria (almost exclusively due to arsenic in groundwater). Metals in groundwater at levels above regulatory guidelines include arsenic, aluminum, cadmium, iron, magnesium, and sodium. The concentration of sodium chloride in the groundwater approaches the concentration found in sea water; therefore, shallow groundwater in this area (of tidal influence) is not consumed or consumable by humans. Considering the uncertainty stemming from the calculation of arsenic background risk levels from only four groundwater samples installation-wide and the generally (natural) low quality of the shallow groundwater in this area at the edge of the salt marsh, the calculated human health risk (at approximately the upper end of the EPA guideline) does not appear to be a serious problem at Site 6. No organic compounds were found in groundwater at concentrations above regulatory guidelines.

The ecological risk assessment (see Section 9.8) concluded that significantly elevated contaminant concentrations and exceedances of threshold values observed in RI surface water and sediment samples obtained near the toe of the landfill were not present in RI Addendum surface water and sediment samples collected farther into the marsh. Therefore, impacts of contaminants from Site 6, Site 17, and upstream areas on the marsh are low.

EPA guidance "Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance)," Directive No. 9355.0-62FS from the EPA Federal Facilities Restoration and Reuse Office may be applicable when considering disposition of the site.

6

6.0 SITE 12: BATTERY STORAGE AREA

6.1 SITE BACKGROUND AND PHYSICAL SETTING

The battery storage area is a paved area next to the loading dock east of Building R-10. This area was used as a temporary staging area for forklift batteries being sent off site to be reclaimed. The storage area occupied various portions of the paved area at different times but was generally limited to approximately 7,500 to 10,000 square feet at the northern end of the paved area adjacent to Building R-10. As reported in the 1993 SI, batteries have not been stored at the site for several years. It is unknown if a release to the environment occurred at the site in the past. No source of visible contamination, such as batteries, other residues, stressed vegetation, or surface soil staining, is present at the site. Infiltration is limited by an asphalt parking lot that covers the site. Surface runoff is directed to a stormwater collection basin that discharges through a concrete culvert to a drainage swale and eventually to a marsh north of the site. An underground storage tank was located in this general area, but it has been removed. Figure 6-1 is a map of the site.

6.2 PREVIOUS INVESTIGATIONS

6.2.1 IAS and SI

IAS

The 1983 IAS consisted of interviews and on-site inspection. The site was not recommended for a confirmation study based on the belief that any acids spilled would be buffered when they drained into the salt marsh.

SI

During the 1993 SI, one surface water sample and one sediment sample were collected from the downstream side of the stormwater culvert outflow. No surface water or sediment was present at the upgradient portion of the drainage culvert at the time these samples were taken. The sediment sample was analyzed for VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. The surface water sample was analyzed for VOCs, metals, and cyanide. Sample analysis indicated that SVOCs, VOCs, pesticides, and metals were present in the sediment sample taken at the site. Metals were detected in the surface water sample. Cyanide was not detected in either sample.

SAMPLE LOCATIONS
SITE 12 - BATTERY STORAGE AREA

FIGURE 6-1

Brown & Root Environmental

An underground storage tank, R-10, installed at the northeastern corner of Building R-10, was located approximately adjacent to the former battery storage area. The UST was removed in 1994. Visual contamination of the soil was not observed during the tank removal. Upon removal, the tank and associated piping were examined and found in good condition, free of holes, with minor rust and pitting. Four confirmation soil samples were obtained from the excavation sidewalls, and two samples were taken from the excavated soils. The excavation sidewall samples were analyzed for TPH, and all were found to contain a concentration less than the method detection limit of 56 to 61 mg/kg. The two soil pile samples showed TPH of 460 mg/kg and 520 mg/kg. The soil was disposed as nonhazardous.

6.2.2 1995 RI

In August 1995, B&R Environmental collected three surface soil samples from the northern end of Building 10 between the loading dock and southern side of the railroad tracks. In addition, two sediment samples were obtained from an area north of the railroad tracks and south of the tennis court. Samples from the battery storage area were not obtained because the asphalt cover would preclude impacts from spilled battery electrolyte solution. Instead, the samples were collected from low-lying areas where runoff may flow and collect. Figure 6-1 shows the sampling locations.

6.2.3 Summary of Conclusions

Elevated levels of metals, particularly lead, were detected in surface soil samples. PAHs, which are believed to originate from the railroad bed, were also detected. Sediment samples also showed elevated levels of metals, PAHs, and pesticides.

6.2.4 Data Gaps (Objectives of RI Addendum Field Investigation)

The RI Addendum field investigation was designed to provide further data on the areal and vertical extent of metals contamination.

6.3 RI ADDENDUM FIELD INVESTIGATION

On October 29, 1996, B&R Environmental conducted the following field investigation activities at Site 12:

- Sampling and analysis of surface soil (Section 6.3.1)
- Sampling and analysis of subsurface soil (Section 6.3.2)

B&R Environmental surveyed to establish the horizontal locations and vertical elevations of the surface and subsurface soil sample locations.

6.3.1 Surface Soil Sampling

One surface soil sample (12 SS 04), as specified by the RI Addendum work plan, was collected near the northeastern corner of the loading dock, approximately 40 feet east of 1995 RI sample 12 SS 03 (Figure 6-1). B&R Environmental collected this sample with a stainless-steel trowel and transferred the soil directly into the sampling container. Samples were submitted to IEA Laboratories and analyzed for TAL metals and TOC.

6.3.2 Subsurface Soil Sampling

Three subsurface soil samples (12 SB 02 through 12 SB 04), as specified in the RI Addendum work plan, were collected at Site 12. These samples were obtained at corresponding surface soil sample locations 12 SS 02 and 12 SS 03 from the 1995 RI sampling and 12 SS 04 (Figure 6-1). Samples were collected by advancing a hand bucket auger, supplemented with a rock bar to remove larger materials, to the desired sampling depth of 3 to 3.5 feet. The sample was removed from the auger bucket by stainless-steel trowel and transferred directly into the sample container. Samples were submitted to IEA Laboratories for TAL metals and TOC analysis.

6.4 SITE CHARACTERISTICS

6.4.1 Geology

Regional mapping places Site 12 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness and consists of tan and gray, fine- to medium-grained quartz sand with local clay beds. The presence of the Englishtown Formation beneath the site cannot be confirmed because no soil borings were drilled at the site. However, the lithology of the sediments encountered in borings at Sites 6, 15, and 17 generally agrees with the published description of the Englishtown Formation. Site 6 is located about 600 feet northeast, Site 15 is located about 1,000 feet south-southeast, and Site 17 is located about 700 feet south-southwest of Site 12. In general, the borings at these sites encountered fill material and sand, silty sand, and clayey sand.

6.4.2 Hydrogeology

Groundwater conditions beneath the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Englishtown aquifer beneath Sites 6 and 17, and presumably Site 12, occurs under unconfined conditions. The direction of shallow groundwater flow in the aquifer beneath Site 6, as indicated by both the August and October 1995 groundwater elevation measurements, is toward the north and northwest. The direction of groundwater flow in the aquifer beneath Site 17, as indicated by both the August and October groundwater contour maps for Site 17, is toward the northwest.

6.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates the occurrence and distribution of contaminants detected from the 1995 RI and RI Addendum field investigations. Surface soil, subsurface soil, and sediment sample analysis results were compared to NWS Earle site-wide background samples as presented in Section 2.4.1.

6.5.1 Surface Soils

Three surface soil samples were collected at Site 12 (12 SS 01 through 12 SS 03) in 1995. An additional surface soil sample (12 SS 04), analyzed for TAL metals, was collected during the 1996 RI Addendum field activities (Figure 6-1). Tables 6-1 and 6-2 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to background. Table 6-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 6-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

6.5.1.1 Inorganics

Elevated concentrations of certain metals, notably lead and zinc, were seen in surface soil samples. The highest concentrations of these metals in Site 12 surface soil samples were generally present in samples 12 SS 02 and 12 SS 03; however, elevated levels of metals were also detected in sample 12 SS 04. Metals present at concentrations greater than background in surface soil samples include the following: aluminum (up to 10,900 mg/kg), barium (up to 189 mg/kg), beryllium (up to 0.85 mg/kg), cadmium (up to 8.7 mg/kg), copper (up to 339 mg/kg), lead (up to 1,130 mg/kg), magnesium (up to 10,400 mg/kg), manganese (up to 373 mg/kg), mercury (up to 0.87 mg/kg), vanadium (up to 259 mg/kg), and zinc (up to 1,570 mg/kg R). Note that zinc results for the 1995 samples were qualified rejected (R), based upon data validation; however, zinc is believed to be present in these samples. The presence of zinc was confirmed in sample 12 SS 04 at a level approximately twice that of background. Antimony (up to 71.5 mg/kg) was detected in all site-related samples but was not present in background samples.

TABLE 6-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOIL AT SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	4.6E+09	5310	4 / 4	3530 - 7825	6646	YES	NO	10900
ANTIMONY *	NOT DETECTED	-	-	-	4 / 4	0.76 - 71.5	19.20	YES	-	60.27
ARSENIC *	4 / 4	1.35 - 14.4	9.6E+02	14.40	4 / 4	5.1 - 10.7	9.88	NO	NO	10.7
BARIUM	4 / 4	1.85 - 31	3.6E+03	31.00	4 / 4	28.7 - 188.5	111.08	YES	NO	188.5
BERYLLIUM*	1 / 4	0.28 - 0.28	1.6E-01	0.28	4 / 4	0.05 - 0.47	0.42	YES	YES	0.85
CADMIUM *	1 / 4	0.3975 - 0.3975	6.7E-02	0.40	3 / 4	1.4 - 8.25	3.42	YES	YES	8.25
CALCIUM	4 / 4	40.1 - 519	2.3E+07	519.00	3 / 3	1610 - 23550	15520	YES	NO	23550
CHROMIUM	4 / 4	7.8 - 59.5	6.8E+04	59.50	4 / 4	39.6 - 96.3	54.88	NO	NO	96.3
COBALT	2 / 4	0.75 - 5	1.0E+01	4.27	4 / 4	3.1 - 7.9	4.68	YES	NO	7.9
COPPER	4 / 4	0.97 - 8.4	4.5E+02	8.40	4 / 4	23.2 - 282.5	94.25	YES	NO	282.5
IRON	4 / 4	3745 - 62500	3.0E+12	62500	4 / 4	17500 - 37450	25988	NO	NO	37450
LEAD	4 / 4	1.8 - 39.4	2.1E+04	39.40	4 / 4	68.6 - 1130	558.80	YES	NO	1130
MAGNESIUM	4 / 4	71.7 - 619	1.5E+07	619.00	4 / 4	413 - 6825	2765	YES	NO	6825
MANGANESE	4 / 4	3.45 - 214	4.3E+02	182.62	4 / 4	133 - 334	169.48	NO	NO	334
MERCURY *	4 / 4	0.035 - 0.17	8.1E-03	0.17	3 / 4	0.395 - 0.87	0.44	YES	YES	0.87
NICKEL	2 / 4	1.8 - 7.2	6.2E+01	7.20	4 / 4	6.8 - 49.9	18.63	YES	NO	43.30
POTASSIUM	4 / 4	95 - 792	5.9E+07	792.00	4 / 4	649 - 851.5	1688	YES	NO	4530
SILVER *	2 / 4	0.37 - 0.67	2.3E-01	0.67	2 / 4	1.1 - 1.7	0.74	YES	YES	1.7
SODIUM	4 / 4	17.5 - 86.2	5.8E+04	86.20	3 / 4	76.3 - 685	250.95	YES	NO	595.17
THALLIUM	2 / 4	0.5025 - 1.9	4.0E+00	1.66	1 / 4	2.1 - 2.1	0.62	NO	NO	1.15
VANADIUM	4 / 4	11.05 - 64	5.0E+04	64.00	4 / 4	18 - 252	82.58	YES	NO	216.07
ZINC	3 / 4	0.665 - 27.6	6.1E+03	27.60	1 / 1	54.7 - 54.7	54.70	YES	NO	54.7

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400

TABLE 6-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	NOT DETECTED	-	-	1 / 2	19 - 19	19
4,4'-DDE *	2 / 4	16 - 330	277.86	1 / 2	29 29	29
4,4'-DDT *	2 / 4	43 - 420	355.71	3 / 3	460 235.3	460
ALDRIN *	NOT DETECTED	-	-	1 / 3	2 - 2	2
ALPHA-CHLORDANE *	NOT DETECTED	-	-	2 / 3	9.05 - 6.88	9.05
ENDRIN ALDEHYDE *	NOT DETECTED		-	2 3	60 42.5	60
GAMMA-CHLORDANE *	NOT DETECTED	-	-	3 / 3	14 - 9.27	14
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	2 / 3	170 160	170
ACENAPHTHENE *	NOT DETECTED	-	-	2 / 3	64 - 58.5	64
ACENAPHTHYLENE *	NOT DETECTED	-	-	2 / 3	135 - 122.5	135
ANTHRACENE *	NOT DETECTED	-	-	3 / 3	945 - 446.3	945
BENZ(A)ANTHRACENE *	NOT DETECTED	-	-	3 / 3	3900 - 1903	3900
BENZO(A)PYRENE *	NOT DETECTED	-	-	3 / 3	2250 - 1200	2250
BENZO(B)FLUORANTHENE *	NOT DETECTED	-	-	3 / 3	10350 - 5187	10350
BENZO(G,H,I)PERYLENE *	NOT DETECTED	-	-	3 / 3	2300 - 1600	2300
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED		-	3 / 3	1220 756	1220
BUTYLBENZYLPHTHALATE *	1 / 4	220 - 220	220	1 / 3	130 - 130	130
CARBAZOLE *	NOT DETECTED	-	-	3 / 3	980 - 542	980
CHRYSENE *	NOT DETECTED	-	-	3 / 3	8200 - 3773	8200
DI-N-BUTYLPHTHALATE *	2 / 4	45 - 48	48	2 / 3	110 - 105	110
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	3 / 3	540 - 300	540
DIBENZOFURAN *	NOT DETECTED	-	-	2 / 3	63 - 55.5	63
FLUORANTHENE *	2 / 4	40 - 84	84	3 / 3	13300 - 6073	13300
FLUORENE *	NOT DETECTED	-	-	2 / 3	94 - 90.5	94
INDENO(1,2,3-CD)PYRENE *	NOT DETECTED	-	-	3 / 3	2500 - 1380	2500
NAPHTHALENE *	NOT DETECTED	-	-	2 / 3	130 - 106.5	130
PHENANTHRENE *	NOT DETECTED	-	-	3 / 3	1900 - 1147	1900
PYRENE *	1 / 4	46 46	46	3 / 3	15500 - 7293	15500
TETRACHLOROETHENE *	NOT DETECTED	-	-	1 / 3	3 3	3

* - Selected as a COPC

TABLE 6-3a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SB02-03	12SB03-03	12SB04-03	---	---	---	ARARS & TBCs		
LOCATION:	12SB02	12SB03	12SB04	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1996 RI	1996 RI	1996 RI						
SAMPLE DATE:	10/29/96	10/29/96	10/29/96						
INORGANICS	mg/kg	mg/kg	mg/kg				mg/kg	mg/kg	mg/kg
aluminum	12400	1670	10900				-	-	-
antimony	0.82	0.40 U	0.40 U				14.0	340	-
arsenic	16.5	0.92	13.1				20.0	20.0	-
barium	32.5	5.0	30.7				700	47000	-
beryllium	1.1 E	0.11	0.87				1.00	1.00	-
calcium	410	220	6940 R				-	-	-
chromium, total	45.2	6.2 R	35.1				-	500	-
cobalt	2.7	0.79	3.5				-	-	-
copper	9.2 J	2.2	5.5 J				600	600	-
iron	40700	2040	32200				-	-	-
lead	30.1	12.7	17.7				400	600	-
magnesium	2720	114	2120				-	-	-
manganese	35.2 J	11.3 J	111 J				-	-	-
nickel	5.8	1.1	6.8				250	2400	-
potassium	8320	159	5450				-	-	-
silver	0.12 U	0.15	0.12 U				110	4100	-
sodium	240	153 U	155 U				-	-	-
vanadium	38.0	6.8	36.7				370	7100	-
zinc	43.8	8.3	30.6				1500	1500	-

TABLE 6-3a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 6-3b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		12SB02-03	12SB03-03	12SB04-03	---	---	ARARS & TBCs		
LOCATION:		12SB02	12SB03	12SB04	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1996 RI	1996 RI	1996 RI					
SAMPLE DATE:		10/29/96	10/29/96	10/29/96					
MISCELLANEOUS									
% solids	%	79.9	84.7	83.9			-	-	-
total organic carbon	mg/kg	4820	2740	2640			-	-	-

TABLE 6-3b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

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PAGE 2 of 2

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

TABLE 6-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SD01 08/07/95	12SD02 08/07/95	12SD02-DUP	---	---	---	---	SELECTED ARARS
LOCATION:	12SD01	12SD02	12SD02	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI					
SAMPLE DATE:	08/07/95	08/07/95	08/07/95					
INORGANICS	mg/kg	mg/kg	mg/kg					mg/kg
aluminum	7690	5850	4590					-
arsenic	9.8 E	14.4 E	12.4 E					8.20 L
barium	51.0 E	31.5	28.2					40.0 B
beryllium	0.66	0.72	0.43					-
calcium	4670	10900	7200					-
chromium, total	26.7	28.8	30.5					81.0 L
cobalt	1.9	2.4	1.5					50.0 T
copper	25.6	19.6	28.9					34.0 L
iron	39000	27100	23600					-
lead	67.0 E	45.0	106 E					47.0 L
magnesium	2880	3520	1360					-
manganese	127	120	103					460 O
mercury	0.012 J	0.045 J	0.026 J					0.150 L
nickel	4.0	6.0	4.9					21.0 L
potassium	2360	2150	1210					-
sodium	119	147	103					-
vanadium	23.6	31.9	29.8					-
zinc	34.1	59.2	65.8					150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
2-methylnaphthalene	360 U	53.0 J	50.0 J					330 F
benzo(a)anthracene	250 J	460 E	340 E J					330 F
benzo(a)pyrene	320 J	540 E	430 J					430 L
benzo(b)fluoranthene	520 E	890 E	790 E J					330 F
benzo(g,h,i)perylene	240 J	400 E J	310 J					330 F
benzo(k)fluoranthene	180 J	340 E J	250 J					330 F
bis(2-ethylhexyl)phthalate	67.0 J	80.0 J	110 J					890000000 S
chrysene	280 J	580 E	460 E					330 F
dibenz(a,h)anthracene	60.0 J	97.0 J	62.0 J					330 F

TABLE 6-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SD01 08/07/95	12SD02 08/07/95	12SD02-DUP	---	---	---	---	SELECTED ARARS
LOCATION:	12SD01	12SD02	12SD02	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI					
SAMPLE DATE:	08/07/95	08/07/95	08/07/95					
SEMIVOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
fluoranthene	350 J	680	500					2900 Q
indeno(1,2,3-cd)pyrene	240 J	410 E	320 J					330 F
naphthalene	360 U	51.0 J	47.0 J					480 P
phenanthrene	110 J	210 J	180 J					850 Q
pyrene	310 J	600	490					660 L
PESTICIDES	ug/kg	ug/kg	ug/kg					ug/kg
4,4'-DDD	3.6 E R	5.3 E JN	5.5 E JN					1.60 L
4,4'-DDE	11.0 E	19.0 E	18.0 E					2.20 L
4,4'-DDT	35.0 E	35.0 E	35.0 E					1.60 L
alpha-BHC	1.9 U	0.19 J	2.0 U					3.70 S
alpha-chlordane	1.0 J	1.2 J	1.2 J					7.00 O
gamma-BHC (Lindane)	1.9 U	0.070 R	2.0 U					-
gamma-chlordane	0.54 J	0.79 J	1.0 J					7.00 O
heptachlor epoxide	1.9 U	2.0 U	0.57 JN					5.00 O

TABLE 6-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 6-3d

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SS01 08/05/95	12SS02 08/05/95	12SS03 08/05/95	12SS03-DUP	12SS04 10/29/96	- - -	ARARS & TBCs		
LOCATION:	12SS01	12SS02	12SS03	12SS03	12SS04	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI				
SAMPLE DATE:	08/05/95	08/05/95	08/05/95	08/05/95	10/29/96				
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg
aluminum	3530	4330	7980	7670	10900		-	-	-
antimony	0.76	71.5 E	3.6	4.4	0.52		14.0	340	-
arsenic	10.7	5.1	6.6	7.8	16.5		20.0	20.0	-
barium	28.7	187	188	189	40.1		700	47000	-
beryllium	0.47	0.050	0.37	0.23	0.85		1.00	1.00	-
cadmium	1.4 E	4.0 E	7.8 E	8.7 E	0.051 U		1.00	100	-
calcium	1610	21400	20000	27100	2600 R		-	-	-
chromium, total	53.3 J	39.6 J	85.6 J	107 J	30.3		-	500	-
cobalt	4.6	3.1	7.5	8.3	3.1		-	-	-
copper	23.2	66.9	226	339	4.4		600	600	-
iron	20300	17500	34600	40300	28700		-	-	-
lead	68.6	1130 E	978 E	1070 E	12.6		400	600	-
magnesium	413	1950 J	3250 J	10400 J	1870		-	-	-
manganese	133	140	295	373	70.9 J		-	-	-
mercury	0.42	0.87	0.42	0.37	0.12 U		14.0	270	-
nickel	6.8	11.4	49.1	50.7	6.4		250	2400	-
potassium	649	723	893	810	4530		-	-	-
silver	0.21 U	1.7	1.1	1.1	0.12 U		110	4100	-
sodium	76.3	167	200	1170	151 U		-	-	-
thallium	0.82 U	0.86 U	2.1 E	1.0 U	0.72 UJ		2.00	2.00	-
vanadium	18.0	19.2	245	259	41.1		370	7100	-
zinc	214 R	835 R	1500 R	1570 E R	54.7		1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
2-methylnaphthalene	170 J	150 J	460 U	460 U	n/a		-	-	-
acenaphthene	380 U	64.0 J	57.0 J	49.0 J	n/a		3400000	10000000	100000
acenaphthylene	380 U	110 J	140 J	130 J	n/a		-	-	-
anthracene	44.0 J	350 J	490	1400	n/a		10000000	10000000	100000
benzo(a)anthracene	210 J	1600 E J	2300 E J	5500 E J	n/a		900	4000	500000

TABLE 6-3d

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SS01 08/05/95	12SS02 08/05/95	12SS03 08/05/95	12SS03-DUP	12SS04 10/29/96	- - -	ARARS & TBCs		
LOCATION:	12SS01	12SS02	12SS03	12SS03	12SS04	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI				
SAMPLE DATE:	08/05/95	08/05/95	08/05/95	08/05/95	10/29/96				
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
benzo(a)pyrene	250 J	1100 E J	1700 E J	2800 E J	n/a		660	660	100000
benzo(b)fluoranthene	610	4600 E J	8700 E J	12000 E J	n/a		900	4000	50000
benzo(g,h,i)perylene	800	1700 J	2200 J	2400 J	n/a		-	-	-
bis(2-ethylhexyl)phthalate	87.0 J	960 J	1700 J	740 J	n/a		49000	210000	100000
butylbenzylphthalate	380 U	410 UJ	150 J	110 J	n/a		1100000	10000000	100000
carbazole	45.0 J	600	1100	860	n/a		-	-	-
chrysene	320 J	2800 J	6400 J	10000 E J	n/a		9000	40000	500000
di-n-butylphthalate	380 U	100 J	70.0 J	150 J	n/a		5700000	10000000	100000
dibenz(a,h)anthracene	59.0 J	300 J	490 J	590 J	n/a		660	660	100000
dibenzofuran	380 U	63.0 J	48.0 J	460 U	n/a		-	-	-
fluoranthene	320 J	4600	9600	17000	n/a		2300000	10000000	100000
fluorene	380 U	94.0 J	80.0 J	94.0 J	n/a		2300000	10000000	100000
indeno(1,2,3-cd)pyrene	340 J	1300 E J	2300 E J	2700 E J	n/a		900	4000	500000
naphthalene	83.0 J	130 J	460 U	460 U	n/a		230000	4200000	100000
phenanthrene	140 J	1400	1900	1900	n/a		-	-	-
pyrene	380 J	6000 J	12000 J	19000 J	n/a		1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
tetrachloroethene	3.0 J	12.0 UJ	14.0 UJ	14.0 U	n/a		4000	6000	1000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
4,4'-DDD	19.0 JN	23.0 R	4.6 U	8.0 U	n/a		3000	12000	50000
4,4'-DDE	3.9 U	29.0 J	7.6 R	14.0 R	n/a		2000	9000	50000
4,4'-DDT	51.0	460	190 J	200 JN	n/a		2000	9000	500000
aldrin	2.0 U	2.1 U	2.0 J	0.89 R	n/a		40.0	170	50000
alpha-BHC	2.0 U	0.17 R	0.26 R	0.23 R	n/a		-	-	-
alpha-chlordane	2.0 U	4.7 JN	7.1	11.0	n/a		-	-	-
endosulfan sulfate	3.8 U	4.1 U	4.6 U	27.0 R	n/a		340000	6200000	50000
endrin aldehyde	3.9 U	25.0	46.0 J	74.0 JN	n/a		-	-	-
gamma-BHC (Lindane)	0.072 R	0.067 R	2.4 U	2.4 U	n/a		520	2200	50000

TABLE 6-3d

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	12SS01 08/05/95	12SS02 08/05/95	12SS03 08/05/95	12SS03-DUP	12SS04 10/29/96	- - -	ARARS & TBCs		
LOCATION:	12SS01	12SS02	12SS03	12SS03	12SS04	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI				
SAMPLE DATE:	08/05/95	08/05/95	08/05/95	08/05/95	10/29/96				
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
gamma-chlordane	1.8 J	12.0 JN	14.0 J	22.0 R	n/a		-	-	-
heptachlor	2.0 U	0.40 R	0.62 R	0.43 R	n/a		150	650	50000
heptachlor epoxide	0.60 R	2.5 R	2.4 U	2.4 U	n/a		-	-	-
methoxychlor	8.4 R	21.0 U	24.0 U	24.0 U	n/a		280000	5200000	50000

TABLE 6-3d
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 6-3e

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 12

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		12SS04 10/29/96	---	---	---	---	ARARS & TBCs		
LOCATION:		12SS04	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1996 RI							
SAMPLE DATE:		10/29/96							
MISCELLANEOUS									
% solids	%	85.8					-	-	-
total organic carbon	mg/kg	4250					-	-	-

TABLE 6-3e
COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

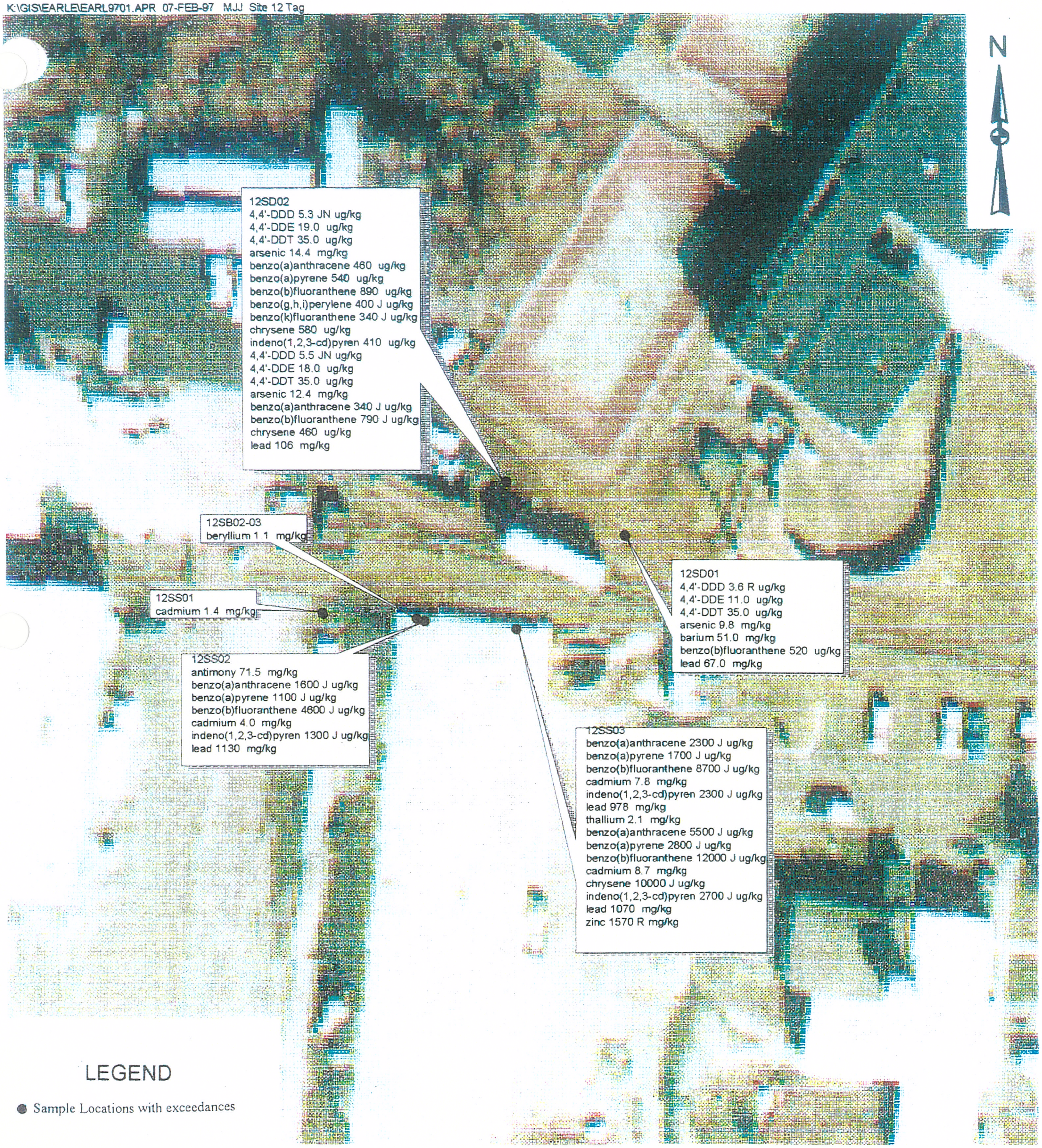
N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).



12SD02
4,4'-DDD 5.3 JN ug/kg
4,4'-DDE 19.0 ug/kg
4,4'-DDT 35.0 ug/kg
arsenic 14.4 mg/kg
benzo(a)anthracene 460 ug/kg
benzo(a)pyrene 540 ug/kg
benzo(b)fluoranthene 890 ug/kg
benzo(g,h,i)perylene 400 J ug/kg
benzo(k)fluoranthene 340 J ug/kg
chrysene 580 ug/kg
indeno(1,2,3-cd)pyren 410 ug/kg
4,4'-DDD 5.5 JN ug/kg
4,4'-DDE 18.0 ug/kg
4,4'-DDT 35.0 ug/kg
arsenic 12.4 mg/kg
benzo(a)anthracene 340 J ug/kg
benzo(b)fluoranthene 790 J ug/kg
chrysene 460 ug/kg
lead 106 mg/kg

12SB02-03
beryllium 1.1 mg/kg

12SS01
cadmium 1.4 mg/kg

12SD01
4,4'-DDD 3.6 R ug/kg
4,4'-DDE 11.0 ug/kg
4,4'-DDT 35.0 ug/kg
arsenic 9.8 mg/kg
barium 51.0 mg/kg
benzo(b)fluoranthene 520 ug/kg
lead 67.0 mg/kg

12SS02
antimony 71.5 mg/kg
benzo(a)anthracene 1600 J ug/kg
benzo(a)pyrene 1100 J ug/kg
benzo(b)fluoranthene 4600 J ug/kg
cadmium 4.0 mg/kg
indeno(1,2,3-cd)pyren 1300 J ug/kg
lead 1130 mg/kg

12SS03
benzo(a)anthracene 2300 J ug/kg
benzo(a)pyrene 1700 J ug/kg
benzo(b)fluoranthene 8700 J ug/kg
cadmium 7.8 mg/kg
indeno(1,2,3-cd)pyren 2300 J ug/kg
lead 978 mg/kg
thallium 2.1 mg/kg
benzo(a)anthracene 5500 J ug/kg
benzo(a)pyrene 2800 J ug/kg
benzo(b)fluoranthene 12000 J ug/kg
cadmium 8.7 mg/kg
chrysene 10000 J ug/kg
indeno(1,2,3-cd)pyren 2700 J ug/kg
lead 1070 mg/kg
zinc 1570 R mg/kg

CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 12 - BATTERY STORAGE AREA

50 0 50 100 Feet

FIGURE 6-2

Brown & Root Environmental

6.5.1.2 Organics

PAHs were present at levels greater than background in surface soils, with the highest levels occurring in sample 12 SS 03. Benz(a)anthracene, benzo(a)pyrene, carbazole, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzofuran, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, naphthalene, and pyrene were detected in site-related surface soil samples at levels ranging from 44 ug/kg to 15,500 ug/kg. Many of these compounds are typically associated with treated lumber such as could be found on the adjacent railroad track.

4,4'-DDT (43 ug/kg to 420 ug/kg) and 4,4'-DDE (16 ug/kg to 330 ug/kg) were each detected in two background surface soil samples. These pesticides were detected at similar levels in site-related surface soil samples, with concentrations ranging from 51 ug/kg to 460 ug/kg for 4,4'-DDT and at 29 ug/kg for 4,4'-DDE. Other pesticides, including 4,4'-DDD (19 ug/kg), aldrin (2 ug/kg), alpha-chlordane (4.7 ug/kg to 9.05 ug/kg), and gamma-chlordane (1.8 ug/kg to 14 ug/kg), were also detected in surface soil samples collected at Site 12. PCE was detected in one site-related surface soil sample (12 SS 01) at a concentration of 3 ug/kg.

6.5.1.3 Miscellaneous Parameters

Samples collected in 1996 were analyzed for TOC but did not show levels above background.

6.5.2 Subsurface Soil

Three subsurface soil samples (12 SB 02-03, 12 SB 03-03, and 12 SB 04-03) were collected and analyzed for TAL metals during the RI Addendum field activities. These samples were obtained from depths of approximately 3 feet below the ground surface. Table 6-4 presents the occurrence and distribution of inorganic chemicals in site-related samples and compare them to background. Table 6-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 6-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

6.5.2.1 Inorganics

Subsurface soils collected from a depth of approximately 3 feet below the ground surface generally contained metals in the range of subsurface soil background samples. Those metals exceeding background concentrations were at sample locations 12 SB 02-03 and 12 SB 04-03 and included aluminum (up to 12,400 mg/kg), beryllium (up to 1.1 mg/kg), and magnesium (up to 2,720 mg/kg). Antimony (0.82 mg/kg) was also detected in 12 SB 02-03 but was not detected in background samples.

TABLE 6-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	2.1E+07	5310	3 / 3	1670 - 12400	8323	YES	NO	12400
ANTIMONY *	NOT DETECTED	-	4.3E+00	-	1 / 3	0.82 - 0.82	0.41	YES	-	0.82
ARSENIC *	8 / 8	1.35 - 14.4	1.5E+02	14.40	3 / 3	0.92 - 16.5	10.17	NO	NO	16.5
BARIUM	8 / 8	0.92 - 31	3.8E+01	15.81	3 / 3	5 - 32.5	22.73	YES	NO	32.5
BERYLLIUM *	2 / 8	0.12 0.28	8.8E-02	0.28	3 3	0.11 1.1	0.69	YES	YES	1.1
CALCIUM	8 / 8	28.6 - 799	3.6E+05	799.00	2 / 2	220 - 410	315.00	NO	NO	410
CHROMIUM	8 / 8	4.7 59.5	2.5E+03	59.50	2 2	35.1 45.2	40.15	NO	NO	45.2
COBALT	4 / 8	0.75 - 5	6.1E+00	2.50	3 / 3	0.79 - 3.5	2.33	NO	NO	3.5
COPPER	8 / 8	0.97 - 8.6	1.6E+01	6.62	3 / 3	2.2 - 9.2	5.63	NO	NO	9.2
IRON	8 / 8	3745 - 62500	1.5E+09	62500	3 / 3	2040 - 40700	24980	NO	NO	40700
LEAD	8 / 8	1.4 - 39.4	5.5E+02	39.40	3 / 3	12.7 - 30.1	20.17	NO	NO	30.1
MAGNESIUM	8 / 8	18.5 619	2.9E+05	619.00	3 3	114 2720	1651	YES	NO	2720
MANGANESE	8 / 8	2.6 - 214	2.4E+02	93.90	3 / 3	11.3 - 111	52.50	NO	NO	111
NICKEL	4 / 8	1.8 - 7.2	9.7E+00	4.02	3 / 3	1.1 - 6.8	4.57	YES	NO	6.8
POTASSIUM	7 / 8	95 - 792	8.1E+05	792.00	3 / 3	159 - 8320	4643	YES	NO	8320
SILVER	2 / 8	0.37 - 0.67	8.8E-01	0.38	1 / 3	0.15 - 0.15	0.09	NO	NO	0.15
SODIUM	8 / 8	17.5 94.8	1.4E+02	60.94	1 3	240 240	131.33	YES	NO	240
VANADIUM	8 / 8	11.05 - 64	2.8E+03	61.59	3 / 3	6.8 - 38	27.17	NO	NO	38
ZINC	6 / 8	0.665 - 50.7	1.2E+03	50.70	3 / 3	8.3 - 43.8	27.57	NO	NO	43.8

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400, BGSB0105, BGSB0205, BGSB0305, BGSB0405

6.5.2.2 Miscellaneous Parameters

Samples collected in 1996 were analyzed for TOC but did not show levels above background.

6.5.3 Sediment

Two sediment samples were collected at Site 12: 12 SED 01 and 12 SED 02 (Figure 6-1). Tables 6-5 and 6-6 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to background. Table 6-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 6-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

6.5.3.1 Inorganics

The two site-related sediment samples revealed barium, iron, and manganese at levels greater than background. Arsenic, lead, and zinc were also detected at levels similar to or slightly greater than the upper range observed in background samples.

6.5.3.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, and fluorene were detected in background sediment samples at a range from 140 ug/kg to 1,800 ug/kg. Similar levels of PAHs were detected in sediment samples collected at Site 12. Bis(2-ethylhexyl) phthalate (280 ug/kg to 520 ug/kg) was detected in two site-related sediment samples but was not detected in background samples.

4,4'-DDT (43 ug/kg to 420 ug/kg), 4,4'-DDD (4.9 ug/kg to 21 ug/kg), 4,4'-DDE (16 ug/kg to 330 ug/kg), endosulfan I (0.45 ug/kg), and endrin ketone (1.6 ug/kg) were detected in background sediment samples. These pesticides were detected in site-related sediment samples collected at Site 12 at levels ranging from 11 ug/kg to 19 ug/kg for 4,4'-DDE, 240 ug/kg to 410 ug/kg for endosulfan I, at 35 ug/kg for 4,4'-DDT, 5.5 ug/kg for 4,4'-DDD, and 49 ug/kg for endrin ketone. Alpha-BHC (0.19 ug/kg) and alpha-chlordane (1 ug/kg to 1.2 ug/kg) were also detected in sediment samples collected at Site 12.

TABLE 6-5
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5460	2 / 2	5220 - 7690	6455	YES	NO	7690
ARSENIC *	5 / 6	2.4 - 9.9	2.9E+02	11.23	2 / 2	9.8 - 13.4	11.60	YES	NO	13.40
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	2 / 2	29.85 - 51	40.43	YES	NO	51.00
BERYLLIUM	4 / 6	0.34 0.57	3.3E-01	0.72	2 / 2	0.575 - 0.66	0.62	NO	YES	0.66
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	2 / 2	4670 - 9050	6860	YES	NO	9050
CHROMIUM	6 / 6	4.3 - 56	2.6E+03	40.42	2 / 2	26.7 - 29.65	28.18	NO	NO	29.65
COBALT	4 / 6	0.51 2.1	6.4E+00	2.85	2 / 2	1.9 - 1.95	1.93	NO	NO	1.95
COPPER *	6 / 6	1 - 13	1.9E+01	9.08	2 / 2	24.25 - 25.6	24.93	YES	YES	25.60
IRON	6 / 6	228 - 21400	7.2E+09	23589	2 / 2	25350 - 39000	32175	YES	NO	39000
LEAD *	6 / 6	4 - 34.3	4.8E+01	21.07	2 / 2	67 - 75.5	71.25	YES	YES	75.50
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	809.90	2 / 2	2440 - 2880	2660	YES	NO	2880
MANGANESE *	6 / 6	3.9 - 63.1	8.9E+01	36.22	2 / 2	111.5 - 127	119.25	YES	YES	127.00
MERCURY	1 / 6	0.068 0.068	8.5E-03	0.09	2 / 2	0.012 - 0.0355	0.02	NO	YES	0.04
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	2 / 2	4 - 5.45	4.73	NO	NO	5.45
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892	2 / 2	1680 - 2360	2020	YES	NO	2360
SODIUM	4 / 6	26.6 - 2280	2.9E+03	876.80	2 / 2	119 - 125	122.00	NO	NO	125.00
VANADIUM	6 / 6	5.9 - 42.7	2.1E+03	39.42	2 / 2	23.6 - 30.85	27.23	NO	NO	30.85
ZINC	6 / 6	12.5 - 34.7	1.5E+03	41.23	2 / 2	34.1 - 62.5	48.30	YES	NO	62.50

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 6-6
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X Average Concentration	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	Average Concentration	Mean > 2 X Bkgd.?	REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	1 / 2	51.5	115.75	NO	51.5
BENZO(A)ANTHRACENE *	3 / 6	85 - 560	560.00	2 / 2	250 - 460	355	NO	460
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	2 / 2	320 - 540	430	YES	540
BENZO(B)FLUORANTHENE *	3 / 6	150 490	346.54	2 / 2	520 - 890	705	YES	890
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380.00	2 / 2	240 - 355	297.5	NO	355
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470.00	2 / 2	180 - 295	237.5	NO	295
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	2 / 2	67 - 95	81	NO	95
CHRYSENE *	3 / 6	130 - 940	577.87	2 / 2	280 - 520	400	NO	520
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	,	2 / 2	60 - 79.5	69.75	NO	79.5
FLUORANTHENE *	3 / 6	240 - 1800	1024	2 / 2	350 - 590	470	NO	590
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310.00	2 / 2	240 - 410	325	YES	410
NAPHTHALENE *	NOT DETECTED	-	-	1 / 2	49	114.5	NO	49
PHENANTHRENE *	3 / 6	110 - 1900	1052	2 / 2	110 - 195	152.5	NO	195
PYRENE *	3 / 6	200 - 1900	1077	2 / 2	310 - 545	427.5	NO	545
4,4'-DDD *	2 / 6	4.9 - 21	11.98	1 / 1	5.3	5.3	NO	5.3
4,4'-DDE *	1 / 6	1.7 - 1.7	1.70	2 / 2	11 - 19	15	YES	19
4,4'-DDT *	1 / 6	19 19	10.64	2 / 2	35 - 35	35	YES	35
ALPHA-BHC *	NOT DETECTED	-	-	1 / 2	0.19	0.57	NO	0.19
ALPHA-CHLORDANE *	NOT DETECTED	-	-	2 / 2	1 - 1.2	1.1	NO	1.2
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.10	2 / 2	0.54 - 0.79	0.665	YES	0.79

* - Selected as a COPC

6.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 12 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 6.6.1. Persistence of detected chemicals in the environment is discussed in Section 6.6.2. Section 6.6.3 presents a brief discussion of contaminant trends.

6.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 12 indicate the presence of lead, zinc, and other metals in surface soil, with lower levels of metals present in sediment and subsurface soil samples. PAHs and pesticides were detected at levels greater than background in surface soil and, to a lesser degree, in sediments at Site 12. PCE was detected at a trace level in one surface soil and PCBs were detected at low levels in sediment but were not detected in surface soil. The physical transport data for the detected contaminants are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

The former battery storage area occupied portions of a paved area adjacent to Building R-10. Infiltration is limited by an asphalt parking lot that covers the site. With the exception of PCE, contaminants detected in the surface soil and sediments at Site 12 have low potential for impacts to groundwater. The detected PAHs and pesticides exhibit low solubility and are strongly bound to soil. Inorganic compounds also have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility. However, processes that transport surface soil particles, such as fugitive dust emissions and erosional transport via surface water pathways, can lead to migration of contaminated media. Surface water runoff at the site is directed to a stormwater collection basin, which discharges water through a concrete culvert, to a drainage swale, and eventually to the marsh area north of the site.

Lead, the major component of the forklift batteries stored at Site 12, was found at concentrations similar to background levels in sediments but at a higher level than background in surface soil. Lead and other metals can migrate by erosional effects of wind or surface water. The potential for lead in the soil to enter the groundwater or surface water exists and would be increased if the pH of surface soils were to decrease. Subsurface soils do not indicate the presence of lead at levels exceeding background; therefore, the potential for migration to groundwater is expected to be low.

The lead contribution at the site may be partially due to leachable lead from the railroad bed ballast; however, based on leachability testing of the ballast material, the lead contribution from the ballast is minimal (see Section 11.3.2).

PCE, which was detected in one surface soil sample, is considered volatile, soluble, and mobile in groundwater. PCE will readily leach from soils and migrate in the subsurface through groundwater transport and soil vapor migration. Volatilization from surface soils is a significant fate process.

6.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different toxicologically or different from a physical transport perspective. If the transformational process is known or suspected, product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation. PAHs can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds.

PCE, which was detected at a trace level in one surface soil, is considered to have low persistence due to its high volatility and solubility. In addition, PCE in the subsurface can be slowly degraded by microorganisms to simpler chlorinated ethenes.

6.6.3 Observed Chemical Contaminant Trends

The detected surface soil contamination indicates elevated levels of several organics and metals. A potential for groundwater contamination with lead also cannot be ruled out, since groundwater quality was not determined during this or previous investigations; however, subsurface soils do not appear to be adversely impacted by lead contamination. The potential for leaching to groundwater would be controlled by factors such as the chemical form of lead, soil cation exchange capacity, soil pH, and the buffering capacity of subsurface soil. Since the site was a temporary storage area rather than a battery reclaiming area, it is unlikely that groundwater pH would be affected. Subsurface soil samples do not indicate significant contamination by metals because levels are generally within the background range.

Organic contaminants in surface soil and sediment fall into three classes: PAHs (which are considered relatively immobile), pesticides (which have varying degrees of mobility), and volatiles (which are considered mobile). Of these classes, the detected levels of PAHs are the highest, although the overall potential for PAH migration impacts is lowest. PAH levels in site-related surface soils were notably greater than levels in background in surface soil samples. Levels of PAHs in site-related sediment samples were within a range similar to background sediment samples.

The significance of a single detection of PCE at levels below quantitation limits is unclear since VOCs were not detected elsewhere in site-related samples and are not related to known previous site activities. Based upon the limited detection, it is safe to conclude that there is not widespread potential for groundwater contamination with PCE resulting from this site.

6.6.4 Conclusions

The principal concern is metals and organics in surface soils in a small area in the vicinity of the north end of Building R-10 near the loading dock and railroad tracks. Some degree of migration of surface soil could occur through windblown particulates or through runoff and erosional dispersion; however, the greatest concern is from compounds near the surface that could be accidentally ingested via direct contact with soil. With the exception of PCE, which is of questionable origin, compounds detected in the surface soil and sediments at Site 12 have low potential for impacts to groundwater. Samples collected along the surface water drainage pathway do not indicate significant migration of lead through erosional soil transport.

The significance of a single detection of PCE at trace levels in surface soil cannot be determined. The presence of this chemical might be attributable to a spill or off-site source.

6.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 12. The risk assessment was performed using the approach outlined in Section 2.4. Tables 6-7 through 6-9 provide the selected COPCs and representative concentrations of inorganics and organics in site-related surface soil, subsurface soil (inorganics only), and sediment, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

6.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (industrial employees, residential receptors, and recreational receptors).

6.7.1.1 Current Industrial Employee

Surface Soil Exposure

RME

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 12 are 2.1E-05 (ingestion) and 4.3E-05 (dermal contact). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 41 percent of the cancer risk for this pathway; dermal contact, 100 percent of the cancer risk for this pathway), benzo(a)pyrene (ingestion, 27 percent of the cancer risk for this pathway), and benzo(b)fluoranthene (ingestion, 12 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 12 is less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 12 in Tables 6-10 and 6-11, respectively.

TABLE 6-7
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE SOIL - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	60.26
ARSENIC	10.7
BERYLLIUM	0.85
CADMIUM	8.25
MERCURY	0.87
SILVER	1.7
4,4'-DDD*	19
4,4'-DDE*	29
4,4'-DDT*	460
2-METHYLNAPHTHALENE	170
ACENAPHTHENE*	64
ACENAPHTHYLENE*	135
ALDRIN*	2
ALPHA-CHLORDANE*	9.05
ANTHRACENE*	945
BENZ(A)ANTHRACENE*	3900
BENZO(A)PYRENE*	2250
BENZO(B)FLUORANTHENE*	10350
BENZO(G,H,I)PERYLENE*	2300
BIS(2-ETHYLHEXYL)PHTHALATE*	1220
BUTYLBENZYLPHTHALATE*	130
CARBAZOLE*	980
CHRYSENE*	8200
DI-N-BUTYLPHTHALATE*	110
DIBENZ(A,H)ANTHRACENE*	540
DIBENZOFURAN*	63
ENDRIN ALDEHYDE	60
FLUORANTHENE*	13300
FLUORENE*	94
GAMMA-CHLORDANE*	14
INDENO(1,2,3-CD)PYRENE*	2500
NAPHTHALENE*	130
PHENANTHRENE*	1900
PYRENE*	15500
TETRACHLOROETHENE*	3

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 6-8
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SUBSURFACE SOIL - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	0.82
ARSENIC	16.5
BERYLLIUM	1.1

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TABLE 6-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ARSENIC	13.4
COPPER	25.6
LEAD	75.5
MANGANESE	127
2-METHYLNAPHTHALENE*	51.5
4,4'-DDD*	5.3
4,4'-DDE*	19
4,4'-DDT*	35
ALPHA-BHC*	0.19
ALPHA-CHLORDANE*	1.2
BENZO(A)ANTHRACENE*	460
BENZO(A)PYRENE*	540
BENZO(B)FLUORANTHENE*	890
BENZO(G,H,I)PERYLENE*	355
BENZO(K)FLUORANTHENE*	295
BIS(2-ETHYLHEXYL)PHTHALATE*	95
CHRYSENE*	520
DIBENZ(A,H)ANTHRACENE*	79.5
FLUORANTHENE*	590
INDENO(1,2,3-CD)PYRENE	40
NAPHTHALENE	49
PHENANTHRENE	195
PYRENE	545

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 6-10
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
2-METHYLNAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	1.59E-09	N/A	N/A
4,4'-DDE	3.4E-09	N/A	N/A
4,4'-DDT	5.47E-08	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALDRIN	1.19E-08	N/A	N/A
ALPHA-CHLORDANE	4.1E-09	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	9.9E-07	N/A	N/A
BENZO(A)PYRENE	5.7E-06	N/A	N/A
BENZO(B)FLUORANTHENE	2.6E-06	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	5.97E-09	N/A	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	6.8E-09	N/A	N/A
CHRYSENE	2.09E-08	N/A	N/A
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	1.38E-06	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
ENDRIN ALDEHYDE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	6.36E-09	N/A	N/A
INDENO(1,2,3-CD)PYRENE	6.38E-07	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
TETRACHLOROETHENE	5.5E-11	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	8.65E-06	4.32E-05	N/A
BERYLLIUM	1.28E-06	N/A	N/A
CADMIUM	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	2.1E-05	4.3E-05	N/A

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-11
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
2-METHYLNAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	9.00E-04	N/A	N/A
ACENAPHTHENE	1.4E-06	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALDRIN	6.2E-05	N/A	N/A
ALPHA-CHLORDANE	1.5E-04	N/A	N/A
ANTHRACENE	3.1E-06	N/A	N/A
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E-05	N/A	N/A
BUTYLBENZYLPHTHALATE	1.6E-02	N/A	N/A
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	1.1E-06	N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A	N/A
DIBENZOFURAN	1.5E-05	N/A	N/A
ENDRIN ALDEHYDE	2.0E-04	N/A	N/A
FLUORANTHENE	3.3E-04	N/A	N/A
FLUORENE	2.3E-06	N/A	N/A
GAMMA-CHLORDANE	2.3E-04	N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
NAPHTHALENE	3.2E-06	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	5.1E-04	N/A	N/A
TETRACHLOROETHENE	2.9E-07	N/A	N/A
ANTIMONY	1.5E-01	N/A	N/A
ARSENIC	5.4E-02	2.69E-01	N/A
BERYLLIUM	1.7E-04	N/A	N/A
CADMIUM	1.61E-02	2.52E-03	8.26E-12
MERCURY	2.84E-03	N/A	8.96E-13
SILVER	3.3E-04	N/A	N/A

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

CTE

No CTE analysis is required for surface soil exposure.

6.7.1.2 Future Industrial Employee

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 12 are 1.0E-05 (ingestion) and 4.3E-05 (dermal contact). The total subsurface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 12 are less than 1.0 for the ingestion and dermal contact. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 12 in Tables 6-12 and 6-13, respectively.

CTE

No CTE analysis is required for subsurface soil exposure.

TABLE 6-12
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTIMONY	N/A	N/A	N/A
ARSENIC	8.7E-06	4.3E-05	N/A
BERYLLIUM	1.7E-06	N/A	N/A
TOTAL RISK	1.0E-05	4.3E-05	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-13
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTIMONY	2.0E-03	N/A	N/A
ARSENIC	5.4E-02	2.7E-01	N/A
BERYLLIUM	2.2E-04	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

6.7.1.3 Future Residential Receptor

Surface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 12 are 9.5E-05 (ingestion), 1.0E-04 (dermal contact), and 5.1E-14 (inhalation of COPCs in fugitive dust). The total surface soil cancer risk is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria(ARARs). The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 41 percent of the cancer risk for this pathway; dermal contact, 100 percent of the cancer risk for this pathway), benzo(a)pyrene (ingestion, 27 percent of the cancer risk for this pathway), and benzo(b)fluoranthene (ingestion, 12 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in surface soil at Site 12 exceeded 1.0 for the ingestion exposure pathways. For surface soil ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is cardiovascular effects (1.9 - antimony). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future receptors exposed to surface soil at Site 12 in Tables 6-14 and 6-15, respectively.

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 12 are 1.5E-05 (ingestion), 5.9E-05 (dermal contact), and 1.3E-14 (inhalation of COPCs in fugitive dust). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 41 percent of the cancer risk for this pathway; dermal contact, 100 percent of the cancer risk for this pathway), benzo(a)pyrene (ingestion, 27 percent of the cancer risk for this pathway), and benzo(b)fluoranthene (ingestion, 12 percent of the cancer risk for this pathway).

TABLE 6-14
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
2-METHYLNAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	7.40E-09	N/A	N/A
4,4'-DDE	1.54E-08	N/A	N/A
4,4'-DDT	2.45E-07	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALDRIN	5.23E-08	N/A	N/A
ALPHA-CHLORDANE	1.84E-08	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	4.46E-06	N/A	N/A
BENZO(A)PYRENE	2.57E-05	N/A	9.0E-15
BENZO(B)FLUORANTHENE	1.18E-05	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	2.67E-08	N/A	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	3.07E-08	N/A	N/A
CHRYSENE	9.37E-08	N/A	N/A
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	6.17E-06	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
ENDRIN ALDEHYDE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	2.6E-08	N/A	N/A
INDENO(1,2,3-CD)PYRENE	2.86E-06	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
TETRACHLOROETHENE	2.44E-10	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	3.9E-05	9.96E-05	4.2E-14
BERYLLIUM	5.27E-06	N/A	N/A
CADMIUM	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	9.5E-05	1.0E-04	5.1E-14

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 6-15
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN										
SUBSTANCE	SURFACE SOIL INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	THYROID	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
2-METHYLNAPHTHALENE	N/A										N/A	N/A
4,4'-DDD	N/A										N/A	N/A
4,4'-DDE	N/A										N/A	N/A
4,4'-DDT	1.18E-02				1.2E-02						N/A	N/A
ACENAPHTHENE	1.4E-05			1.4E-05	1.4E-05						N/A	N/A
ACENAPHTHYLENE	N/A										N/A	N/A
ALDRIN	8.52E-04				8.5E-04		8.5E-04		8.5E-04		N/A	N/A
ALPHA-CHLORDANE	1.93E-03				1.9E-03		1.9E-03		1.9E-03		N/A	N/A
ANTHRACENE	4.0E-05										N/A	N/A
BENZO(A)ANTHRACENE	N/A										N/A	N/A
BENZO(A)PYRENE	N/A										N/A	N/A
BENZO(B)FLUORANTHENE	N/A										N/A	N/A
BENZO(G,H,I)PERYLENE	N/A										N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	7.40E-04				7.4E-04				7.4E-04		N/A	N/A
BUTYLBENZYLPHTHALATE	8.3E-06										N/A	1.2E-10
CARBAZOLE	N/A										N/A	N/A
CHRYSENE	N/A										N/A	N/A
DI-N-BUTYLPHTHALATE	1.4E-05								1.4E-05		N/A	2.1E-10
DIBENZ(A,H)ANTHRACENE	N/A										N/A	N/A
DIBENZOFURAN	2.0E-04										N/A	N/A
ENDRIN ALDEHYDE	2.6E-03										N/A	N/A
FLUORANTHENE	4.25E-03	4.3E-03		4.3E-03	4.3E-03						N/A	N/A
FLUORENE	3.0E-05	3.0E-05					3.0E-05				N/A	N/A
GAMMA-CHLORDANE	2.98E-03				3.0E-03		3.0E-03		3.0E-03		N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A										N/A	N/A
NAPHTHALENE	4.2E-05	4.2E-05		4.2E-05							N/A	N/A
PHENANTHRENE	N/A										N/A	N/A
PYRENE	6.61E-03			6.6E-03							N/A	N/A
TETRACHLOROETHENE	3.8E-06				3.8E-06						N/A	N/A
ANTIMONY	1.93E+00	1.9E+00									N/A	N/A
ARSENIC	7.03E-01		7.0E-01								1.1E+00	N/A
BERYLLIUM	2.17E-03	2.2E-03				2.2E-03		2.2E-03	2.2E-03		N/A	N/A
CADMIUM	2.11E-01			2.1E-01							1.0E-02	2.5E-10
MERCURY	3.71E-02			3.7E-02			3.7E-02		3.7E-02		N/A	3.6E-11
SILVER	4.4E-03		4.4E-03								N/A	N/A
	HI BY TARGET ORGAN	1.9E+00	7.1E-01	2.6E-01	2.3E-02	2.2E-03	4.3E-02	2.2E-03	4.6E-02			

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in surface soil at Site 12 exceeded 1.0 for the ingestion, dermal contact and inhalation exposure pathways. However, the HIs divided into their respective target organs are all less than 1.0. Adverse noncarcinogenic effects are not expected when the HIs (based on target organs) are less than 1.0.

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future receptors exposed to surface soil at Site 12 in Tables 6-16 and 6-17, respectively.

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 12 are 4.6E-05 (ingestion), 1.0E-04 (dermal contact), and 4.2E-14 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 85 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway) and beryllium (ingestion, 15 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 12 is greater than 1.0 for the dermal contact exposure pathway. For surface soil ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (1.1 - arsenic). The estimated noncarcinogenic HIs for the future residential receptor for the ingestion exposure pathway is less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil at Site 12 in Tables 6-18 and 6-19, respectively.

TABLE 6-16
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
2-METHYLNAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	1.2E-09	N/A	N/A
4,4'-DDE	2.5E-09	N/A	N/A
4,4'-DDT	3.9E-08	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALDRIN	8.5E-09	N/A	N/A
ALPHA-CHLORDANE	3.0E-09	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	7.2E-07	N/A	N/A
BENZO(A)PYRENE	4.1E-06	N/A	N/A
BENZO(B)FLUORANTHENE	1.9E-06	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	4.3E-09	N/A	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	4.9E-09	N/A	N/A
CHRYSENE	1.5E-08	N/A	N/A
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	9.9E-07	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
ENDRIN ALDEHYDE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	4.6E-09	N/A	N/A
INDENO(1,2,3-CD)PYRENE	4.6E-07	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
TETRACHLOROETHENE	3.9E-11	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	6.2E-06	5.9E-05	1.3E-14
BERYLLIUM	9.2E-07	N/A	N/A
CADMIUM	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	1.5E-05	5.9E-05	1.3E-14

N/A = NOTAPPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-17
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 12
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
2-METHYLNAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.9E-03	N/A	N/A
ACENAPHTHENE	6.8E-06	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALDRIN	4.3E-04	N/A	N/A
ALPHA-CHLORDANE	9.6E-04	N/A	N/A
ANTHRACENE	2.0E-05	N/A	N/A
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E-04	N/A	N/A
BUTYLBENZYLPHTHALATE	4.2E-06	N/A	N/A
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	7.3E-06	N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A	N/A
DIBENZOFURAN	1.0E-04	N/A	N/A
ENDRIN ALDEHYDE	1.3E-03	N/A	N/A
FLUORANTHENE	2.1E-03	N/A	N/A
FLUORENE	1.5E-05	N/A	N/A
GAMMA-CHLORDANE	1.5E-03	N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
NAPHTHALENE	2.1E-05	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	3.3E-03	N/A	N/A
TETRACHLOROETHENE	1.9E-06	N/A	N/A
ANTIMONY	9.6E-01	N/A	N/A
ARSENIC	3.5E-01	5.4E-01	N/A
BERYLLIUM	1.1E-03	N/A	N/A
CADMIUM	1.1E-01	3.0E-02	1.6E-10
MERCURY	1.9E-02	N/A	1.8E-11
SILVER	2.2E-03	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-18
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ANTIMONY	N/A	N/A	N/A
ARSENIC	3.9E-05	1.0E-04	4.2E-14
BERYLLIUM	7.4E-06	N/A	N/A
TOTAL RISK	4.6E-05	1.0E-04	4.2E-14

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-19
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL CHILD RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ANTIMONY	2.6E-02	N/A	N/A
ARSENIC	7.0E-01	1.1E+00	N/A
BERYLLIUM	2.8E-03	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 12 are 7.40E-06 (ingestion), 5.9E-05 (dermal contact), and 1.3E-14 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 85 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway) and beryllium (ingestion, 15 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 12 are less than 1.0 for the ingestion, dermal contact and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated CTE carcinogenic risks are presented for future residential receptors exposed to subsurface soil at Site 12 in Tables 6-20 and 6-21.

6.7.1.4 Future Recreational Receptor

The estimated total RME cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 12 are 2.8E-07 (ingestion) and 2.8E-08 (dermal contact). This sediment cancer risk is below the 10^{-4} to 10^{-6} target acceptable risk range.

The estimated RME HIs for the future recreational child, assuming exposure to COPCs in sediment during wading, are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HIs are below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 12 in Tables 6-22 and 6-23, respectively.

TABLE 6-20
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ANTIMONY	N/A	N/A	N/A
ARSENIC	6.2E-06	5.9E-05	1.3E-14
BERYLLIUM	1.2E-06	N/A	N/A
TOTAL RISK	7.4E-06	5.9E-05	1.3E-14

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-21
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL CHILD RECEPTORS - SITE 12
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ANTIMONY	1.3E-02	N/A	N/A
ARSENIC	3.5E-01	5.4E-01	N/A
BERYLLIUM	1.4E-03	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-22
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 12
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	1.4E-11	N/A
4,4'-DDE	7.1E-11	N/A
4,4'-DDT	1.3E-10	N/A
ALPHA-CHLORDANE	1.7E-11	N/A
2-METHYLNAPHTHALENE	N/A	N/A
BENZO(A)ANTHRACENE	3.7E-09	N/A
BENZO(A)PYRENE	4.3E-08	N/A
BENZO(B)FLUORANTHENE	7.1E-09	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	2.4E-10	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.5E-11	N/A
CHRYSENE	4.2E-11	N/A
DIBENZ(A,H)ANTHRACENE	6.4E-09	N/A
FLUORANTHENE	N/A	N/A
GAMMA-CHLORDANE	1.1E-11	N/A
INDENO(1,2,3-CD)PYRENE	3.3E-09	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ALPHA-BHC	1.3E-11	N/A
ARSENIC	2.2E-07	2.8E-08
COPPER	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
TOTAL RISK	2.8E-07	2.8E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORBANCE FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 6-23
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 12
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	8.9E-06	NA
ALPHA-CHLORDANE	2.6E-06	NA
2-METHYLNAPHTHALENE	NA	NA
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	6.1E-07	NA
CHRYSENE	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA
FLUORANTHENE	1.9E-06	NA
GAMMA-CHLORDANE	1.7E-06	NA
INDENO(1,2,3-CD)PYRENE	NA	NA
NAPHTHALENE	1.6E-07	NA
PHENANTHRENE	NA	NA
PYRENE	2.3E-06	NA
ALPHA-BHC	NA	NA
ARSENIC	5.7E-03	7.1E-04
COPPER	2.2E-03	N/A
LEAD	NA	NA
MANGANESE	3.2E-03	NA

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORBANCE FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

6.7.2 Conclusions

Surface soil, subsurface soil, and sediment were sampled at Site 12. The potential receptors considered for this site were current industrial and future industrial, residential, and recreational receptors.

The RME cancer risk associated with the future residential (surface and subsurface soil) exposure scenario is at the upper end of the target acceptable risk range. Arsenic (via ingestion of and dermal contact with surface soil and subsurface soil), benzo(a)pyrene (via ingestion of surface soil), and benzo(b)fluoranthene (via ingestion of surface soil) were the major COPCs that contributed to the cancer risk for these exposure scenarios. The RME noncarcinogenic HIs associated with the future residential (surface and subsurface soil) exposure scenarios exceeded 1.0, the cutoff point below which adverse effects are not expected to occur. Antimony (via ingestion of surface soil) and arsenic (via ingestion of subsurface soil) were the principal COPCs that contributed to the HI exceeding 1.0 for these exposure scenarios.

The CTE cancer risk associated with the future residential (surface and subsurface soil) exposure scenario is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range. Arsenic (via ingestion of and dermal contact with surface soil and subsurface soil), benzo(a)pyrene (via ingestion of surface soil), and benzo(b)fluoranthene (via ingestion of surface soil) were the major COPCs that contributed to the cancer risk for these exposure scenarios. The CTE noncarcinogenic HIs associated with the future residential (surface and subsurface soil) exposure scenarios exceeded 1.0, the cutoff point below which adverse effects are not expected to occur. Antimony (via ingestion of surface soil) was the principal COPC that contributed to the HI exceeding 1.0 for these exposure scenarios.

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 12 in Table 6-24 for surface and subsurface soil and sediment. Table 6-25 presents the relevant central tendency risk estimates associated with potential receptors for surface and subsurface soil and sediment. The estimated RME cancer risk for the future residential receptor is at the upper end of the target acceptable risk range, based mainly on ingestion of surface and subsurface soil. The estimated CTE cancer risk for the future residential receptor is also at the upper end of the target acceptable risk range, based mainly on ingestion of surface and subsurface soil. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of surface and subsurface soil. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of surface soil.

TABLE 6-24
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	2.1E-05	N/A	9.5E-05	N/A	2.4E-01	N/A	1.9E+00@	N/A	N/A
	Dermal Contact	4.3E-05	N/A	1.0E-04	N/A	2.2E-01	N/A	1.1E+00@	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/A	5.1E-14	N/A	9.6E-12	N/A	6.2E-10	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.0E-05	4.6E-05	N/A	N/A	5.6E-02	7.3E-01	N/A	N/A
	Dermal Contact	N/A	4.3E-05	1.0E-04	N/A	N/A	2.7E-01	1.1E+00@	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/A	4.2E-14	N/A	N/A	N/A	N/A	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	2.8E-07	N/A	N/A	N/A	N/A	1.1E-02
	Dermal Contact	N/A	N/A	N/A	2.8E-08	N/A	N/A	N/A	N/A	7.1E-04
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		6.4E-05	5.3E-05	3.4E-04	3.1E-07	4.6E-01	3.3E-01	4.8E+00	-	1.2E-02

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 6-25
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 12
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	1.5E-05	N/A	N/R	N/A	1.5E+00	N/A	N/A
	Dermal Contact	N/R	N/A	5.9E-05	N/A	N/R	N/A	5.6E-01	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	1.3E-14	N/A	N/R	N/A	1.8E-10	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	7.4E-06	N/A	N/A	N/R	3.7E-01	N/A	N/A
	Dermal Contact	N/A	N/R	5.9E-05	N/A	N/A	N/R	5.4E-01	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	1.3E-14	N/A	N/A	N/R	N/A	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	-	1.4E-04	-	-	-	2.9E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor

N/R = Central Tendency calculation not required

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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Arsenic ranged from 5.1 mg/kg to 16.5 mg/kg in surface soil samples; these levels would cause the risk to be in the target acceptable risk range of 10^{-4} to 10^{-6}. Benzo(a)pyrene ranged from 250 ug/kg to 2,250 ug/kg; these levels would cause the risk to be within the target risk range of 10^{-4} to 10^{-6}. Benzo(b)fluoranthene levels ranged from 610 ug/kg to 10,350 ug/kg; these levels, except the minimum of 610 ug/kg, would cause the risk range to be within the target acceptable risk range of 10^{-4} to 10^{-6}. Antimony and arsenic were detected in one of four samples each at a concentration of 71.5 mg/kg and 16.5 mg/kg, respectively. These two values were the drivers for the noncarcinogenic risks found above EPA's risk assessment acceptable risk range. However, considering the uncertainties inherent to the risk assessment calculations, arsenic levels may be within background concentrations for surface soil.

6.8 EVALUATION SUMMARY

Despite relatively high concentrations of lead in surface soils at Site 12, lead was not chosen as a COPC because the 95 percent UTL calculated from the station-wide background sample set was higher than the site-related concentrations. The consequence of this unrealistically high UTL comparison was that lead was not used to calculate human health risks.

However, the Navy intends to remove surface soils in the vicinity of Site 12 based on the RI delineation of lead concentrations. Alternative benchmark criteria for lead in soil such as 400 ppm (OSWER directive 9355.4-12) or 600 ppm (NJDEP Non-Residential Direct Contact Soil Cleanup Criteria) are available and will be used in the feasibility study (FS) to determine the appropriate clean-up standard and the approximate limits of soil removal.

It is possible that metals leaching from railroad bed ballast material may contribute to the levels of inorganics present at Site 12.

7.0 SITE 13: DEFENSE PROPERTY DISPOSAL OFFICE YARD

7.1 SITE BACKGROUND AND PHYSICAL SETTING

The defense property disposal office yard (DPDO yard) is an area of fill material extending into a marsh near the rail classification yards. Activities at the site included storage of scrap metals and batteries and the burial of material, such as cars, trucks, electronic equipment, clothing/shoes, sheet metal, furniture, scrap metal, and batteries. Additionally, batteries were broken open at the site for lead recovery, and acid was drained onto the ground. Obvious fill material is present at the ground surface at several places across the site.

The top of the site is flat, and there is little topographic relief. Runoff from the site drains to the marsh to the north and west to a perennial drainage that flows to Hockhockson Brook. A fence surrounds the DPDO yard, although this fence is not located at the edge of the landfill. The extent of fill material was not clearly defined by previous investigations. The toe of the landfill extends into the marsh area and is clearly defined by an abrupt decrease in elevation of several feet between the top of the landfill slope and the marsh. Figure 7-1 is a map of the site. Groundwater flow is generally to the north-northwest, based on groundwater-level measurements.

7.2 PREVIOUS INVESTIGATIONS

7.2.1 IAS and SI

IAS

The 1983 IAS, which consisted of interviews, concluded minimal impact based on site use as a storage area. The site was not recommended for a confirmation study.

SI

During the SI, six soil, three sediment, and three surface water samples were collected. The soil samples were collected from 0 to 3 feet bgs from the area in and around the landfill. The sediment and surface water samples were collected in the drainage west of the site. Soil samples were analyzed for SVOCs, PCBs, metals, and cyanide. Low levels of metals, pesticides, PCBs, and SVOCs were detected in soil samples. Elevated levels of two semivolatiles were also detected. Sediment samples were analyzed for SVOCs, pesticides, and PCBs. Low levels of pesticides, PCBs, and SVOCs were detected. Surface water samples

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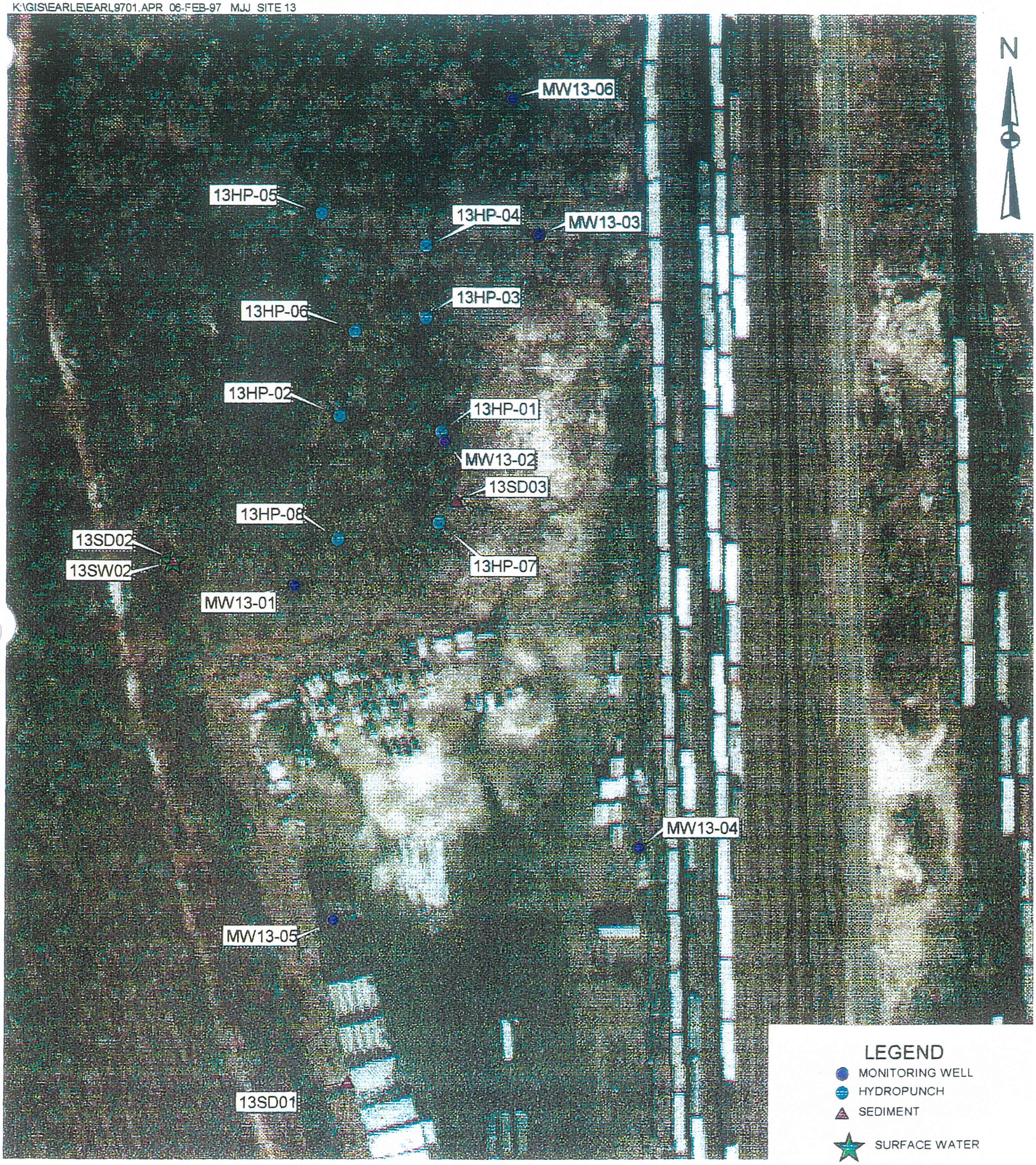

SAMPLE LOCATIONS
SITE 13 - DPDO YARD

120 0 120 240 Feet

FIGURE 7-1

Brown & Root Environmental

were analyzed for SVOCs, PCBs, pesticides, metals, and cyanide. Elevated levels of several metals were present in samples. No SVOCs, pesticides, or PCBs were detected in surface water.

7.2.2 RI

As part of the 1995 RI, B&R Environmental conducted the following field investigation activities at Site 13:

- Excavation of 12 test pits
- Sampling and analysis of surface water
- Sampling and analysis of sediment
- Drilling and installation of five shallow permanent monitoring wells
- Sampling and analysis of groundwater from the wells
- Measurement of static-water levels in the wells
- Performance of slug tests in two of the wells

B&R Environmental also conducted a survey to establish the horizontal locations and vertical elevations of the test pit locations, surface water and sediment sample locations, and the permanent monitoring wells.

7.2.3 Summary of Conclusions

Twelve test pits were excavated along the southern end of the DPDO yard. The material encountered during excavation generally consisted of brown, olive, or yellowish-brown silty sand with some wood branches and logs. Four of the test pits encountered industrial-type waste (13 TP 04, 13 TP 05, 13 TP 07, and 13 TP 12) consisting of crushed 55-gallon drums, used shell casings, electric cables, metal doors, a compressor, and rubber material.

Surface water was collected from the drainage ditch that parallels the western side of the landfill, downstream of the landfill (north of the northern fence line), to determine potential off-site impacts via surface runoff (Figure 7-1). The surface water samples were analyzed for TCL VOC, TCL SVOC, TCL pesticide/PCBs, TAL metals, BOD, TPH, ammonia, phosphate, COD, TOC, nitrite/nitrate, turbidity, chloride, and explosives. No VOCs, SVOCs, pesticide/PCBs, or explosives were detected in surface water. Most metal concentrations were similar to background ranges.

Sediment samples collected from drainage pathways along the drainage ditch that parallels the landfill showed metal concentrations similar to background ranges. Several compounds not detected in background samples, including Aroclor 1254 and Aroclor 1260, were detected in sediment samples. Alpha-chlordane and endrin aldehyde were also detected in sediment samples.

Groundwater samples showed aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, nickel, silver, thallium, vanadium, and zinc at levels that significantly exceeded background levels. 4,4'-DDT, heptachlor, 1,1,1-trichloroethane(1,1,1-TCA), 1,2-DCE, 4-methylphenol, carbon disulfide, dieldrin, endosulfan I, and vinyl chloride were also detected in groundwater samples.

Results of the 1995 RI sampling program are discussed in detail in the RI report for NWS Earle, Colts Neck, New Jersey (July 1996, prepared by B&R Environmental).

7.2.4 Data Gaps (Goals of RI Addendum Investigation)

Groundwater at the site was impacted by VOCs; however, the extent of VOC contamination could not be delineated from the RI data. The goal of the RI Addendum field activities was to provide additional groundwater sampling data, primarily concentrating in the marsh area downgradient of the DPDO fill area.

7.3 RI ADDENDUM INVESTIGATION

Between October 1996 and January 1997, B&R Environmental conducted the following field investigation activities at Site 13:

- Sampling and analysis of groundwater using Hydropunch and direct-push sampling equipment (Section 7.3.1).
- Drilling and installation of one shallow permanent monitoring well (Section 7.3.2).
- Sampling and analysis of groundwater from the newly installed wells (Section 7.3.2).

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the test pit locations, surface water and sediment sample locations, and the permanent monitoring wells. Surveying notes are provided in Appendix B.

7.3.1 Hydropunch and Direct-Push Sampling

B&R Environmental collected groundwater samples from three locations (13HP-01 through 13HP-03) between October 21 and 24, 1996 using Hydropunch equipment and from five locations (13HP-04 through 13HP-08) between December 2 and 4, 1996 using direct-push sampling equipment to determine the extent of VOC contamination. Sample locations are shown in Figure 7-1. In general, samples were collected from depths of 15, 20, and 45 feet below-grade. Twenty-two groundwater samples, including two field duplicate samples, were analyzed for TCL VOC using TRC's mobile laboratory. Table 7-1 summarizes Hydropunch and direct-push sampling activities. To confirm mobile laboratory results, 10 of the samples, including the two field duplicate samples, were also analyzed for TCL VOCs by IEA.

7.3.2 Permanent Monitoring Well Installation and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed one shallow permanent monitoring well (MW13-06) on December 6, 1996 to determine groundwater quality upgradient, downgradient, and side gradient of the landfill and to define groundwater flow directions (Figure 7-1). The boring was 57 feet deep and running sands were encountered at 20 feet below grade during drilling. The boring was completed as cased well screened across the water table. Monitoring well characteristics are summarized in Table 7-2. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

The well was constructed with 2-inch I.D., flush-jointed and threaded, NSF-certified, Schedule 40 PVC well casing and 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No. 00 sand to a height of approximately 2 feet above the top of the screen. An approximately 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height approximately 1 foot below the ground surface, and the wells were completed with 2-foot-high standpipe. A concrete pad was later poured at the ground surface, keyed 1 foot into the well annulus. The monitoring well construction sheet is in Appendix C.

The well was developed approximately 1 week after installation. Groundwater temperature, pH, conductivity, turbidity, and dissolved oxygen were monitored during development. The well was developed until removed water was visibly clear of suspended solids.

Groundwater Sampling

B&R Environmental collected groundwater samples from the newly installed monitoring well (MW13-06) to determine groundwater quality and to provide data for use in the risk assessment and the evaluation of remedial action alternatives. The well was sampled in January 3, 1997. Field measurements collected

TABLE 7-1
SITE 13 HYDROPUNCH/DIRECT- PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE,COLTS NECK, NEW JERSEY

Sample Location	Sample Number	Screened Interval (feet bgs [1])	Sample Analyzed By	Date Sample	Comments
13HP-01 [2]	13HP01-15	13-15	TRC [4]; IEA [5]	10/21/96	.
	13HP01-30	28-30	TRC; IEA	10/21/96	
	13HP01-45	43-45	TRC; IEA	10/22/96	Sandy silty/clay from 30 to 43 feet bgs.
13HP-02 [2]	13HP02-15	13-15	TRC; IEA	10/22/96	Duplicate sample 13HP05-15.
	13HP02-30	28-30	TRC	10/23/96	
	13HP02-45	43-45	TRC	10/23/96	Brown green silty sand from 0 to 42.5 feet bgs.
13HP-03 [2]	13HP03-15	13-15	TRC	10/23/96	Brown green silty clayey sand from 0 to 12.5 feet bgs.
	13HP03-30	28-30	TRC; IEA	10/23/96	Brown green silty clayey sand from 15 to 27.5 feet bgs.
	13HP03-45	43-45	TRC	10/24/96	
	13HP03-43	43-45	TRC	12/04/96	Sample collected to confirm results of 13HP03-45.
13HP-04 [3]	13HP04-17	15-17	TRC	12/02/96	
	13HP04-48	48-50	TRC	12/03/96	
13HP-05 [3]	13HP05-15	12-15	TRC; IEA	10/22/96	
	13HP05-28	28-30	TRC	12/03/96	Soil sample (olive brown silty, fine- to medium-grained sand) collected from 23-25 feet bgs.
	13HP05-48	48-50	TRC; IEA	12/03/96	DUP-06, MS/MSD.
13HP-06 [3]	13HP06-28	28-30	TRC; IEA	12/03/96	
	13HP06-48	48-50	TRC	12/04/96	
13HP-07 [3]	13HP07-15	15-17	TRC; IEA	12/04/96	
	13HP07-28	28-30	TRC	12/04/96	
13HP-08 [3]	13HP08-15	15-17	TRC	12/04/96	
	13HP08-28	28-30	TRC	12/04/96	
13HP-09 [3]					Blue green clayey, fine-grained sand at 55 feet bgs. Augered to 70 feet bgs. Running sands encountered.

TABLE 7-1
SITE 13 HYDROPUNCH/DIRECT- PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE,COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Note: All samples were analyzed for Target Compound List Volatile Organic Compounds.

1 below ground surface
2 Samples collected using Hydropunch
3 Samples collected using direct-push
4 TRC - Tracer Research Corporation (mobile laboratory)
5 IEA (fixed-base laboratory)

TABLE 7-2
SITE 13 MONITORING WELL CONSTRUCTION DETAILS
NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

Well Number	Total Depth (feet bgs)	Screened Interval (feet bgs)	Top of Filter Pack (feet bgs)	Top of Bentonite Seal (feet bgs)	Completion Date	Comments
MW-13-06	57	42-57	38	35	12/06/95	Running sands encountered at 20 bgs. Total of 250 gallons of water was added to borehole to control running sands.

during purging were pump rate (L/min), pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the well using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

The groundwater sample (13 GW 06) and associated QA/QC sample were submitted to IEA for TCL VOC analysis. Sample information is summarized in Appendix A. Sample log sheets are presented in Appendix C.

7.4 SITE CHARACTERISTICS

7.4.1 Geology

Regional mapping places Site 13 within the outcrop area of the Vincentown Formation. The Vincentown Formation ranges between 10 and 130 feet in thickness and the soil borings are no more than 19 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Vincentown Formation. In general, the borings encountered alternating beds of yellowish-brown to brown, micaceous, silty, fine- to medium-grained sand and olive, glauconitic, silty sand and sand.

Groundwater in the Vincentown aquifer beneath the site occurs under unconfined conditions. Static-water-level measurements and water-table elevations collected as part of 1995 RI activities indicate that the direction of shallow groundwater flow in the aquifer is to the north-northwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

The hydraulic conductivity calculated for slug test gathered for MW13-04 during 1995 RI activities is 2.64×10^{-5} cm/sec (0.75 ft/day).

7.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates the occurrence and distribution of samples from the 1995 RI and 1996 RI Addendum field activities. Groundwater, surface water, and sediment sample analysis results were compared to NWS Earle site-wide background samples as presented in Section 2.4.1.

7.5.1 Sediment

Three sediment samples were collected at Site 13: 13 SD 01 through 13 SD 03 (Figure 7-1). Tables 7-3 and 7-4 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to background. Table 7-5 presents a comparison of detected compounds to ARARS and TBCs. Figure 7-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

7.5.1.1 Inorganics

Concentrations of most metals in site-related sediment samples were similar to background ranges. Antimony, cadmium, and silver were detected at low levels in site-related sediment samples (the highest levels were in 13 SD 03) but were not found in background sediments. Lead was detected in 13 SD 03 at a level slightly greater than the ranges found in background samples.

7.5.1.2 Organics

The following PAHs, phthalates, and pesticides were detected in site-related sediment samples at levels generally within background concentration range: Benzo(b)fluoranthene (48 ug/kg), chrysene (56 ug/kg), fluoranthene (81 ug/kg), pyrene (67.5 ug/kg), and diethyl phthalate (51 ug/kg) were each detected in one site-related sediment sample. Gamma-chlordane (0.16 ug/kg), 4,4'-DDE (2.45 ug/kg), and 4,4'-DDT (6.4 ug/kg) were each detected in one site-related sediment sample.

Several compounds were detected in site-related sediment samples that were not found in background sediment samples. Aroclor 1254 (58 ug/kg to 3,900 ug/kg) was detected in all three site-related sediment samples, and Aroclor 1260 (33 ug/kg to 1,200 ug/kg) was detected in two sediment samples. Alpha-chlordane (11 ug/kg to 20 ug/kg) and endrin aldehyde (31 ug/kg to 90 ug/kg) were each detected in two site-related sediment samples, and endosulfan sulfate (0.3 ug/kg) was detected in one site-related sediment sample.

7.5.1.3 Miscellaneous Parameters

Miscellaneous parameter analyses of sediment samples at Site 13 consisted of percent solids, percent moisture, pH, and total organic carbon (TOC). Results are presented in Appendix A. All results are within typical background range.

TABLE 7-3
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5459.67	3 / 3	1150 - 2170	1728.33	NO	NO	2170.00
ANTIMONY *	0 / 6	-	1.4E+01	-	2 / 3	0.56 - 2.5	2.12	YES	-	2.50
ARSENIC *	5 / 6	2.4 - 9.9	2.9E+02	11.23	3 / 3	2.3 - 4.2	3.53	NO	NO	4.20
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	3 / 3	5.6 - 9.3	7.27	NO	NO	9.30
BERYLLIUM	4 / 6	0.34 0.57	3.3E-01	0.72	2 / 3	0.12 - 0.32	0.18	NO	NO	0.32
CADMIUM	2 6	0.44 - 0.46	1.1E+00	0.93	2 / 3	0.35 - 0.47	0.40	NO	NO	0.47
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	3 / 3	81.1 - 347.25	201.45	NO	NO	347.25
CHROMIUM	6 / 6	4.3 - 56	2.6E+03	40.42	3 / 3	23.2 - 72.5	42.97	YES	NO	72.50
COBALT	4 / 6	0.51 2.1	6.4E+00	2.85	2 / 3	0.43 - 0.57	0.58	NO	NO	0.57
COPPER	6 / 6	1 - 13	1.9E+01	9.08	3 / 3	2.9 - 32.7	14.40	YES	NO	32.70
IRON	6 / 6	228 - 21400	7.2E+09	23589.33	3 / 3	4355 - 9180	6921.67	NO	NO	9180.00
LEAD	6 / 6	4 - 34.3	4.8E+01	21.07	3 / 3	10.1 - 94.3	45.57	YES	NO	94.30
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	809.90	3 / 3	156 - 441	253.00	NO	NO	441.00
MANGANESE	6 / 6	3.9 - 63.1	8.9E+01	36.22	3 / 3	10.9 - 21.9	14.78	NO	NO	21.90
MERCURY *	1 / 6	0.068 0.068	8.5E-03	0.09	3 / 3	0.0295 - 0.19	0.10	YES	YES	0.19
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	2 / 3	2.4 - 3	2.22	NO	NO	3.00
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892.03	3 / 3	308 - 1530	763.00	NO	NO	1530.00
SILVER *	2 / 6	0.1125 0.15	2.8E+00	1.13	2 / 3	2.4 - 22.7	8.58	YES	YES	22.70
SODIUM	4 / 6	26.6 - 2280	2.9E+03	876.80	3 / 3	18.1 - 39.45	27.02	NO	NO	39.45
VANADIUM	6 / 6	5.9 - 42.7	2.1E+03	39.42	3 / 3	19.1 - 37.9	25.67	NO	NO	37.90
ZINC	6 / 6	12.5 - 34.7	1.5E+03	41.23	3 / 3	8.75 - 54.7	31.32	NO	NO	54.70

* - Selected as a COPC

TABLE 7-4
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDE *	1 / 6	1.7 - 1.7	1.7	1 / 3	2.45 - 2.45	2.45
4,4'-DDT *	1 / 6	19 - 19	10.63992	1 / 3	6.4 - 6.4	6.4
ALPHA-CHLORDANE *	NOT DETECTED	-	-	2 / 3	11 - 20	20
AROCLOR-1254 *	NOT DETECTED	-	-	3 / 3	58 - 3900	3900
AROCLOR-1260 *	NOT DETECTED	-	-	2 / 3	33 - 1200	1200
BENZO(B)FLUORANTHENE *	3 / 6	150 - 490	346.54105	1 / 1	48 - 48	48
CHRYSENE *	3 / 6	130 - 940	577.8735	1 / 1	56 - 56	56
DIETHYLPHTHALATE *	1 / 3	44 - 44	44	1 / 1	51 - 51	51
ENDOSULFAN SULFATE *	NOT DETECTED	-	-	1 / 3	0.3 - 0.3	0.3
ENDRIN ALDEHYDE *	NOT DETECTED	-	-	2 / 3	31 - 90	90
FLUORANTHENE *	3 / 6	240 - 1800	1024.31285	1 / 1	81 - 81	81
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.095	1 / 3	0.16 - 0.16	0.16
PYRENE *	3 / 6	200 - 1900	1076.74355	1 / 1	67.5 - 67.5	67.5

* - Selected as a COPC

TABLE 7-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13GW01	13GW01-F	13GW02	13GW02-DEC95	13GW03	13GW03-F	ARARS & TBCs		
LOCATION:	13GW01	13GW01	13GW02	13GW02	13GW03	13GW03	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI, Dec.	1995 RI	1995 RI			
SAMPLE DATE:	08/11/95	08/11/95	08/14/95	12/06/95	08/11/95	08/11/95			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	14600 E J	530 E J	4160 E J	n/a	15800 E J	13.4	-	-	200
antimony	2.7 U	2.7 U	2.7 U	n/a	2.7 U	2.7 U	6.00	3.00 a	20.0
arsenic	18.0 E	3.3 U	3.3 U	n/a	15.2 E	3.3 U	50.0	-	8.00
barium	70.1	54.7	285	n/a	10.0	2.0	2000	2000 a	2000
beryllium	1.1	0.21	0.11 U	n/a	0.90	0.11 U	4.00	4000 e	20.0
cadmium	4.8 E	5.5 E	1.0	n/a	1.6	0.56	5.00	5.00 e	4.00
calcium	8900	7850	11900	n/a	3890	3150	-	-	-
chromium, total	233 E	2.3	74.4	n/a	296 E	1.0 U	100 *	100 a	100
cobalt	4.4	2.6	2.1	n/a	3.8	1.4	-	-	-
copper	3.2	2.7	14.2	n/a	3.5	0.90	1300	-	1000
iron	31100 E	459 E	48200 E	n/a	57900 E	22700 E	-	-	300
lead	10.5 E J	1.5 UJ	6.8	n/a	13.4 E	1.5 UJ	15.0	-	10.0
magnesium	4040	1630	2340	n/a	3330	982	-	-	-
manganese	121 E	83.4 E	117 E	n/a	78.2 E	60.5 E	-	-	50.0
mercury	0.049	0.038	0.11	n/a	0.056	0.017	2.00	2.00 b	2.00
nickel	13.9	7.6	0.75 U	n/a	11.5	2.0	100	100 a	100
potassium	9330 J	3000	3920	n/a	7300 J	739	-	-	-
selenium	5.3 J	4.4 U	4.4 U	n/a	4.6 J	4.4 U	50.0	-	50.0
silver	0.94 U	0.94 U	1.0	n/a	0.94 U	0.94 U	-	100 a	-
sodium	8810	3590	6860	n/a	9780	7880	-	-	50000
thallium	3.6 UJ	3.6 U	3.6 U	n/a	10.4 E J	4.3 E	2.00	0.400 a	10.0
vanadium	111	0.61 U	35.6	n/a	146	0.61 U	-	-	-
zinc	94.6	72.8	265	n/a	34.9	7.7	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	10.0 U	n/a	10.0 U	n/a	2.0 J	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	5.0 J	n/a	10.0 U	10.0 U	10.0 U	n/a	200	200 a	30.0
1,1-dichloroethene	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

							ARARS & TBCs		
SAMPLE NUMBER:	13GW01	13GW01-F	13GW02	13GW02-DEC95	13GW03	13GW03-F	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
LOCATION:	13GW01	13GW01	13GW02	13GW02	13GW03	13GW03			
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI, Dec.	1995 RI	1995 RI			
SAMPLE DATE:	08/11/95	08/11/95	08/14/95	12/06/95	08/11/95	08/11/95			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	10.0 U	n/a	7.0 J	2.0 J	10.0 U	n/a	70.0 a	70.0 a	70.0
carbon disulfide	10.0 UJ	n/a	10.0 U	10.0 U	10.0 UJ	n/a	-	-	-
carbon tetrachloride	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	5.00	70.0 e	2.00
chloroform	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	100	100 e	6.00
methylene chloride	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	5.00	2000 d	3.00
tetrachloroethene	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	5.00	1000 e	1.00
trichloroethene	10.0 U	n/a	10.0 U	10.0 U	10.0 U	n/a	5.00	-	1.00
vinyl chloride	10.0 U	n/a	11.0 E	10.0 E J	10.0 U	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	0.051 J	n/a	0.029 J	n/a	0.10 U	n/a	-	-	0.100
alpha-BHC	0.0010 R	n/a	0.050 U	n/a	0.050 U	n/a	-	-	0.0200
delta-BHC	0.025 R	n/a	0.050 U	n/a	0.050 U	n/a	-	-	-
dieldrin	0.022 J	n/a	0.10 U	n/a	0.10 U	n/a	-	0.500 e	0.0300
endosulfan I	0.028 JN	n/a	0.050 U	n/a	0.050 U	n/a	-	-	0.400
heptachlor	0.011 J	n/a	0.0052 JN	n/a	0.050 U	n/a	0.400	5.00 e	0.400
heptachlor epoxide	0.044 R	n/a	0.013 R	n/a	0.050 U	n/a	0.200	0.100 e	0.200

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13GW04	13GW05	13GW06	13HP01-15	13HP01-30	13HP01-45	ARARS & TBCs		
LOCATION:	13GW04	13GW05	13GW06	13HP01	13HP01	13HP01	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	08/10/95	08/10/95	01/03/97	10/21/96	10/21/96	10/22/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	7430 E J	1420 E J	n/a	n/a	n/a	n/a	-	-	200
antimony	9.7 E	2.7 U	n/a	n/a	n/a	n/a	6.00	3.00 a	20.0
arsenic	39.2 E	3.3 U	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	57.8	91.3	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	1.6	0.67	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	1.2	63.9 E	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	3170	4990	n/a	n/a	n/a	n/a	-	-	-
chromium, total	252 E	26.3	n/a	n/a	n/a	n/a	100	100 a	100
cobalt	8.4	6.1	n/a	n/a	n/a	n/a	-	-	-
copper	8.1	2.6	n/a	n/a	n/a	n/a	1300	-	1000
iron	27100 E	866 E	n/a	n/a	n/a	n/a	-	-	300
lead	18.8 E	3.4 J	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	2610	2120	n/a	n/a	n/a	n/a	-	-	-
manganese	58.3 E	138 E	n/a	n/a	n/a	n/a	-	-	50.0
mercury	0.059	0.047	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	13.0	35.7	n/a	n/a	n/a	n/a	100	100 a	100
potassium	8270 J	2620	n/a	n/a	n/a	n/a	-	-	-
selenium	39.9	4.4 U	n/a	n/a	n/a	n/a	50.0	-	50.0
silver	0.94 U	0.94 U	n/a	n/a	n/a	n/a	-	100 a	-
sodium	3520	5860	n/a	n/a	n/a	n/a	-	-	50000
thallium	23.8 E J	3.6 UJ	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	152	2.6	n/a	n/a	n/a	n/a	-	-	-
zinc	52.9	1950	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	10.0 U	10.0 U	n/a	n/a	n/a	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	10.0 U	10.0 U	10.0 U	0.0020 U	0.0040 U	0.30 U	200	200 a	30.0
1,1-dichloroethene	10.0 U	10.0 U	10.0 U	2.0	0.20	0.20 U	7.00	7.00 a	2.00

TABLE 7-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13GW04	13GW05	13GW06	13HP01-15	13HP01-30	13HP01-45	ARARS & TBCs		
LOCATION:	13GW04	13GW05	13GW06	13HP01	13HP01	13HP01	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	08/10/95	08/10/95	01/03/97	10/21/96	10/21/96	10/22/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	10.0 U	10.0 U	10.0 U	120 E	18.0	2.0 U	70.0 a	70.0 a	70.0
carbon disulfide	1.0 J	10.0 UJ	10.0 U	n/a	n/a	n/a	-	-	-
carbon tetrachloride	10.0 U	10.0 U	10.0 U	0.0010 U	0.0020 U	0.010 U	5.00	70.0 e	2.00
chloroform	10.0 U	10.0 U	9.0 E J	0.010 U	0.020 U	0.080 U	100	100 e	6.00
methylene chloride	10.0 U	10.0 U	10.0 U	0.40 U	0.70 U	3.0 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	10.0 U	10.0 U	70.0 E	14.0 E	4.0 E	5.00	1000 e	1.00
trichloroethene	10.0 U	10.0 U	10.0 U	180 E	37.0 E	11.0 E	5.00	-	1.00
vinyl chloride	10.0 U	10.0 U	10.0 U	n/a	n/a	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	0.10 U	0.10 U	n/a	n/a	n/a	n/a	-	-	0.100
alpha-BHC	0.050 U	0.050 U	n/a	n/a	n/a	n/a	-	-	0.0200
delta-BHC	0.050 U	0.050 U	n/a	n/a	n/a	n/a	-	-	-
dieldrin	0.10 U	0.10 U	n/a	n/a	n/a	n/a	-	0.500 e	0.0300
endosulfan I	0.050 U	0.050 U	n/a	n/a	n/a	n/a	-	-	0.400
heptachlor	0.050 U	0.050 U	n/a	n/a	n/a	n/a	0.400	5.00 e	0.400
heptachlor epoxide	0.050 U	0.050 U	n/a	n/a	n/a	n/a	0.200	0.100 e	0.200

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13HP01-45-DUP	13HP02-15	13HP02-15-DUP	13HP02-30	13HP02-45	13HP03-15	ARARS & TBCs		
LOCATION:	13HP01	13HP02	13HP02	13HP02	13HP02	13HP03	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/22/96	10/22/96	10/22/96	10/23/96	10/23/96	10/23/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
antimony	n/a	n/a	n/a	n/a	n/a	n/a	6.00	3.00 a	20.0
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	10.0 U	0.0020 U	10.0 U	0.0020 U	0.0080 U	0.0020 U	200	200 a	30.0
1,1-dichloroethene	10.0 U	0.010	10.0 U	0.020	0.020 U	0.010 U	7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	13HP01-45-DUP 13HP01 1996 RI 10/22/96	13HP02-15 13HP02 1996 RI, Field 10/22/96	13HP02-15-DUP 13HP02 1996 RI 10/22/96	13HP02-30 13HP02 1996 RI, Field 10/23/96	13HP02-45 13HP02 1996 RI, Field 10/23/96	13HP03-15 13HP03 1996 RI, Field 10/23/96	ARARS & TBCs Maximum Contaminant Level (MCL)	 Drinking Water Health Advisory (Lowest Criterion Shown)	 NJDEP Groundwater Quality Standard
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	14.0	0.20 U	10.0 U	0.20 U	0.20 U	0.20 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	n/a	10.0 U	n/a	n/a	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0010 U	10.0 U	0.0010 U	0.0010	0.0010 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.0080 U	10.0 U	0.020 U	0.070 U	0.060 U	100	100 e	6.00
methylene chloride	10.0 U	0.30 U	10.0 U	0.30 U	1.0	0.60	5.00	2000 d	3.00
tetrachloroethene	10.0 U	0.0020 U	10.0 U	0.020 U	0.60	0.30	5.00	1000 e	1.00
trichloroethene	11.0 E	0.0040 U	10.0 U	0.0040 U	0.10 U	0.30	5.00	-	1.00
vinyl chloride	10.0 U	n/a	10.0 U	n/a	n/a	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.100
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.0200
delta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	-	0.500 e	0.0300
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.400
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	0.400	5.00 e	0.400
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	0.200	0.100 e	0.200

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13HP03-30	13HP03-30-DUP	13HP03-43	13HP03-45	13HP04-17	13HP04-48	ARARS & TBCs		
LOCATION:	13HP03	13HP03	13HP03	13HP03	13HP04	13HP04	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/23/96	10/23/96	12/04/96	10/24/96	12/02/96	12/03/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
antimony	n/a	n/a	n/a	n/a	n/a	n/a	6.00	3.00 a	20.0
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	0.090 U	10.0 U	0.0040 U	0.080 U	0.0030 U	0.0030 U	200	200 a	30.0
1,1-dichloroethene	0.020 U	10.0 U	0.20	0.80 U	0.020 U	0.020 U	7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	13HP03-30 13HP03 1996 RI, Field 10/23/96	13HP03-30-DUP 13HP03 1996 RI 10/23/96	13HP03-43 13HP03 1996 RI, Field 12/04/96	13HP03-45 13HP03 1996 RI, Field 10/24/96	13HP04-17 13HP04 1996 RI, Field 12/02/96	13HP04-48 13HP04 1996 RI, Field 12/03/96	ARARS & TBCs Maximum Contaminant Level (MCL)	 Drinking Water Health Advisory (Lowest Criterion Shown)	 NJDEP Groundwater Quality Standard
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	0.20 U	10.0 U	0.60 U	12.0 U	0.40 U	0.40 U	70.0 a	70.0 a	70.0
carbon disulfide	n/a	10.0 U	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.0010 U	10.0 U	0.0020 U	0.050 U	0.0020 U	0.0020 U	5.00	70.0 e	2.00
chloroform	0.060 U	10.0 U	0.20	0.40 U	0.40	0.20	100	100 e	6.00
methylene chloride	0.50	10.0 U	2.0	16.0 U	0.40 U	0.40 U	5.00	2000 d	3.00
tetrachloroethene	0.030 U	10.0 U	0.20	8.0 E	2.0 E	4.0 E	5.00	1000 e	1.00
trichloroethene	0.010 U	10.0 U	0.010 U	52.0 E	0.20	0.20	5.00	-	1.00
vinyl chloride	n/a	10.0 U	n/a	n/a	n/a	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.100
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.0200
delta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	-	0.500 e	0.0300
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.400
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	0.400	5.00 e	0.400
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	0.200	0.100 e	0.200

TABLE 7-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13HP05-15	13HP05-28	13HP05-48	13HP05-48-DU2	13HP05-48-DUP	13HP06-28	ARARS & TBCs		
							Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
LOCATION:	13HP05	13HP05	13HP05	13HP05	13HP05	13HP06			
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI	1996 RI, Field			
SAMPLE DATE:	10/22/96	12/03/96	12/03/96	12/03/96	12/03/96	12/03/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
antimony	n/a	n/a	n/a	n/a	n/a	n/a	6.00	3.00 a	20.0
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	10.0 U	0.020	0.0005 U	10.0 U	10.0 U	0.0010 U	200	200 a	30.0
1,1-dichloroethene	10.0 U	0.020 U	0.0040 U	10.0 U	10.0 U	0.0020 U	7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13HP05-15	13HP05-28	13HP05-48	13HP05-48-DU2	13HP05-48-DUP	13HP06-28	ARARS & TBCs		
LOCATION:	13HP05	13HP05	13HP05	13HP05	13HP05	13HP06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI	1996 RI, Field			
SAMPLE DATE:	10/22/96	12/03/96	12/03/96	12/03/96	12/03/96	12/03/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	10.0 U	0.40 U	0.10	10.0 U	10.0 U	0.040 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	n/a	n/a	10.0 U	10.0 U	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0020 U	0.0003 U	10.0 U	10.0 U	0.0002 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.10	0.020	10.0 U	10.0 U	0.010	100	100 e	6.00
methylene chloride	10.0 U	0.40 U	0.070 U	10.0 U	10.0 U	0.040 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	0.020	0.060	10.0 U	10.0 U	0.0040	5.00	1000 e	1.00
trichloroethene	10.0 U	0.0070 U	0.0010 U	10.0 U	10.0 U	0.0007 U	5.00	-	1.00
vinyl chloride	10.0 U	n/a	n/a	10.0 U	10.0 U	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.100
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.0200
delta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	-	0.500 e	0.0300
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.400
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	0.400	5.00 e	0.400
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	0.200	0.100 e	0.200

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	13HP06-28-DUP 13HP06 1996 RI 12/03/96	13HP06-48 13HP06 1996 RI, Field 12/04/96	13HP07-15 13HP07 1996 RI, Field 12/04/96	13HP07-15-DUP 13HP07 1996 RI 12/04/96	13HP07-28 13HP07 1996 RI, Field 12/04/96	13HP08-15 13HP08 1996 RI, Field 12/04/96	ARARS & TBCs Maximum Contaminant Level (MCL)	ARARS & TBCs Drinking Water Health Advisory (Lowest Criterion Shown)	ARARS & TBCs NJDEP Groundwater Quality Standard
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
antimony	n/a	n/a	n/a	n/a	n/a	n/a	6.00	3.00 a	20.0
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4-methylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-trichloroethane	10.0 U	0.0040 U	0.0040 U	10.0 U	0.0040 U	0.040	200	200 a	30.0
1,1-dichloroethene	10.0 U	0.50	0.030 U	10.0 U	0.030 U	0.030 U	7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13HP06-28-DUP	13HP06-48	13HP07-15	13HP07-15-DUP	13HP07-28	13HP08-15	ARARS & TBCs		
LOCATION:	13HP06	13HP06	13HP07	13HP07	13HP07	13HP08	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	12/03/96	12/04/96	12/04/96	12/04/96	12/04/96	12/04/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2-dichloroethene (total)	10.0 U	0.60 U	0.60 U	10.0 U	0.60 U	0.60 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	n/a	n/a	10.0 U	n/a	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0020 U	0.0020 U	10.0 U	0.0020 U	0.0020 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.020 U	0.40	10.0 U	0.20	0.20	100	100 e	6.00
methylene chloride	10.0 U	2.0	65.0 E	10.0 U	10.0 E	31.0 E	5.00	2000 d	3.00
tetrachloroethene	10.0 U	0.10	0.020	10.0 U	0.080	0.10	5.00	1000 e	1.00
trichloroethene	10.0 U	0.010 U	0.010 U	10.0 U	0.010 U	0.010 U	5.00	-	1.00
vinyl chloride	10.0 U	n/a	n/a	10.0 U	n/a	n/a	2.00	10.0 e	5.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.100
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.0200
delta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	-	0.500 e	0.0300
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	-	-	0.400
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	0.400	5.00 e	0.400
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	0.200	0.100 e	0.200

TABLE 7-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	13HP08-28 13HP08 1996 RI, Field 12/04/96	--- ---	--- ---	--- ---	--- ---	--- ---	ARARS & TBCs Maximum Contaminant Level (MCL)	ARARS & TBCs Drinking Water Health Advisory (Lowest Criterion Shown)	ARARS & TBCs NJDEP Groundwater Quality Standard
INORGANICS	ug/L						ug/L	ug/L	ug/L
aluminum	n/a						-	-	200
antimony	n/a						6.00	3.00 a	20.0
arsenic	n/a						50.0	-	8.00
barium	n/a						2000	2000 a	2000
beryllium	n/a						4.00	4000 e	20.0
cadmium	n/a						5.00	5.00 e	4.00
calcium	n/a						-	-	-
chromium, total	n/a						100	100 a	100
cobalt	n/a						-	-	-
copper	n/a						1300	-	1000
iron	n/a						-	-	300
lead	n/a						15.0	-	10.0
magnesium	n/a						-	-	-
manganese	n/a						-	-	50.0
mercury	n/a						2.00	2.00 b	2.00
nickel	n/a						100	100 a	100
potassium	n/a						-	-	-
selenium	n/a						50.0	-	50.0
silver	n/a						-	100 a	-
sodium	n/a						-	-	50000
thallium	n/a						2.00	0.400 a	10.0
vanadium	n/a						-	-	-
zinc	n/a						-	2000 a	5000
SEMIVOLATILES	ug/L						ug/L	ug/L	ug/L
4-methylphenol	n/a						-	100 a	-
VOLATILES	ug/L						ug/L	ug/L	ug/L
1,1,1-trichloroethane	0.20						200	200 a	30.0
1,1-dichloroethene	0.030 U						7.00	7.00 a	2.00

TABLE 7-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

							ARARS & TBCs		
SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	13HP08-28 13HP08 1996 RI, Field 12/04/96	- - - - - -	- - - - - -	- - - - - -	- - - - - -	- - - - - -	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
VOLATILES	ug/L						ug/L	ug/L	ug/L
1,2-dichloroethene (total)	0.60 U						70.0 a	70.0 a	70.0
carbon disulfide	n/a						-	-	-
carbon tetrachloride	0.0020 U						5.00	70.0 e	2.00
chloroform	0.30						100	100 e	6.00
methylene chloride	19.0 E						5.00	2000 d	3.00
tetrachloroethene	0.10						5.00	1000 e	1.00
trichloroethene	0.010 U						5.00	-	1.00
vinyl chloride	n/a						2.00	10.0 e	5.00
PESTICIDES	ug/L						ug/L	ug/L	ug/L
4,4'-DDT	n/a						-	-	0.100
alpha-BHC	n/a						-	-	0.0200
delta-BHC	n/a						-	-	-
dieldrin	n/a						-	0.500 e	0.0300
endosulfan I	n/a						-	-	0.400
heptachlor	n/a						0.400	5.00 e	0.400
heptachlor epoxide	n/a						0.200	0.100 e	0.200

TABLE 7-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 7-5b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		13GW01	13GW02	13GW03	13GW04	13GW05	ARARS & TBCs		
LOCATION:		13GW01	13GW02	13GW03	13GW04	13GW05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:		08/11/95	08/14/95	08/11/95	08/10/95	08/10/95			
MISCELLANEOUS									
ammonia nitrogen	mg/L	1.0 U	0.70 J	0.90 J	1.0 U	1.0 U	-	30.0	0.500
biochemical oxygen demand	mg/L	3.0	6.0	5.0	3.0	0.80 J	-	-	-
chemical oxygen demand	mg/L	12.0	24.0	39.0	22.0	4.0 J	-	-	-
chloride	mg/L	6.0	5.0	5.0	5.0	6.0	-	-	250
nitrate nitrogen	mg/L	0.24 J	0.50 U	0.50 U	0.50 U	2.3	10.0	10.0	-
sulfate	mg/L	33.0	33.0	22.0	19.0	24.0	500	-	250
total organic carbon	mg/L	1.0	4.0	4.0	5.0	1.0	-	-	-
total phosphorus as PO4	mg/L	0.40	0.20 U	0.30	0.40	0.20 U	-	-	-
turbidity	ntu	n/a	n/a	n/a	290 J	n/a	-	-	-

TABLE 7-5b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

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PAGE 2 of 2

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

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No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 7-5c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13SD01 08/24/95	13SD02 06/14/95	13SD02-DUP	13SD03 08/24/95	---	---	---	SELECTED ARARS
LOCATION:	13SD01	13SD02	13SD02	13SD03	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	08/24/95	06/14/95	06/14/95	08/24/95				
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**				**mg/kg**
aluminum	2170	1920	1810	1150				-
antimony	0.56	6.6 U	6.2 U	2.5 E				2.00 M
arsenic	4.1	1.1	3.5	4.2				8.20 L
barium	5.6	15.9	2.7	6.9				40.0 B
beryllium	0.32	0.22 U	0.21 U	0.12				-
cadmium	0.35	0.78 U	0.73 U	0.47				1.20 L
calcium	176	610	84.5	81.1				-
chromium, total	72.5 J	6.6 J	59.8 J	23.2 J				81.0 L
cobalt	0.43	1.5 U	1.4 U	0.57				50.0 T
copper	7.6	2.9	2.9	32.7				34.0 L
iron	7230	2330	6380	9180				-
lead	32.3	6.4 J	13.8 J	94.3 E				47.0 L
magnesium	441	185	139	156				-
manganese	10.9	9.0 J	14.1 J	21.9				460 O
mercury	0.092	0.037	0.022	0.19 E				0.150 L
nickel	2.4	2.5 U	2.3 U	3.0				21.0 L
potassium	1530	264	352	451				-
silver	2.4 E	1.3 U	1.2 U	22.7 E				1.00 M
sodium	23.5	36.3	42.6	18.1				-
vanadium	37.9	5.8	32.4	20.0				-
zinc	30.5 J	10.8 J	6.7 J	54.7 J				150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
benzo(b)fluoranthene	n/a	520 U	48.0 J	n/a				330 F
chrysene	n/a	520 U	56.0 J	n/a				330 F
diethylphthalate	n/a	520 U	51.0 J	n/a				630000 P
fluoranthene	n/a	520 U	81.0 J	n/a				2900 Q
pyrene	n/a	53.0 J	82.0 J	n/a				660 L

TABLE 7-5c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13SD01 08/24/95	13SD02 06/14/95	13SD02-DUP	13SD03 08/24/95	---	---	---	SELECTED ARARS
LOCATION:	13SD01	13SD02	13SD02	13SD03	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	08/24/95	06/14/95	06/14/95	08/24/95				
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg				ug/kg
4,4'-DDE	3.8 E R	2.3 E JN	2.6 E J	1.9 R				2.20 L
4,4'-DDT	16.0 E R	6.2 E	6.6 E	25.0 E R				1.60 L
Aroclor-1254	2200	60.0	56.0	3900				-
Aroclor-1260	34.0 U	35.0 J	31.0 J	1200				-
alpha-chlordane	11.0 E	2.6 U	2.5 U	20.0 E J				7.00 O
endosulfan sulfate	3.4 U	5.1 U	0.30 J	3.4 U				5.40 P
endrin aldehyde	31.0 E J	5.1 U	4.8 U	90.0 E J				20.0 Q
gamma-chlordane	1.7 U	0.11 R	0.16 J	1.8 U				7.00 O

TABLE 7-5c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 7-5d

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		13SD01 08/24/95	13SD02 06/14/95	13SD02-DUP	13SD03 08/24/95	- - -	- - -	- - -	ARARS & TBCs
LOCATION:		13SD01	13SD02	13SD02	13SD03	- - -	- - -	- - -	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:		08/24/95	06/14/95	06/14/95	08/24/95				
MISCELLANEOUS									
moisture	%	2.1	35.6	31.4	2.7				-
pH		n/a	4.2	4.4	4.7				-
petroleum hydrocarbons	mg/kg	80.0	n/a	n/a	90.0				-
total organic carbon	mg/kg	1100	2700	3600	800				-

TABLE 7-5d
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 7-5e

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13SW02 06/14/95	13SW02-DUP	---	---	ARARS & TBCs				
LOCATION:	13SW02	13SW02	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI							
SAMPLE DATE:	06/14/95	06/14/95							
INORGANICS	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	927 J	937 J			-	-	-	-	-
barium	28.3	28.6			-	-	-	-	2000
beryllium	0.28	0.28			-	-	-	-	-
cadmium	0.49	0.62			1.10 +	-	-	-	-
calcium	3000	3020			-	-	-	-	-
chromium, total	11.1	10.9			209 +	-	-	-	160
cobalt	2.5	2.6			-	-	-	-	-
copper	1.3	1.1			11.0 +	-	-	-	-
iron	1680	1710			-	-	-	-	-
lead	1.6	2.1			3.20 +	-	-	-	5.00
magnesium	1930	1950			-	-	-	-	-
manganese	41.0	41.6			-	-	-	-	-
nickel	8.6 J	9.3 J			160 +	610	4600	-	516
potassium	1640	1800			-	-	-	-	-
selenium	2.5 U	2.5			5.00	-	-	-	10.0
silver	0.63 U	1.4			1.90	-	-	-	164
sodium	4390 J	4420 J			-	-	-	-	-
vanadium	0.42	0.39			-	-	-	-	-
zinc	14.6 R	21.0 R			101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
phenol	2.0 J	10.0 U			-	21000	4600000	-	20900

TABLE 7-5e
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

\- - No standard is available for this chemical in this classification.

\+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 7-5f

COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	13SW02 06/14/95	13SW02-DUP	- - -	ARARS & TBCs				
LOCATION:	13SW02	13SW02	- - -	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI						
SAMPLE DATE:	06/14/95	06/14/95						
MISCELLANEOUS								
biochemical oxygen demand mg/L	2.0 R	4.0 R		-	-	-	-	-
chemical oxygen demand mg/L	7.0	8.0		-	-	-	-	-
chloride mg/L	9.0	10.0		-	-	-	230	230
nitrate nitrogen mg/L	0.18 J	0.21 J		-	10.0	-	-	10.0
petroleum hydrocarbons mg/L	0.10 J	0.10 J		-	-	-	-	-
total organic carbon mg/L	2.0	2.0		-	-	-	-	-
total phosphorus as PO4 mg/L	0.40 R	0.40 R		-	-	-	-	-
turbidity ntu	1.6	1.7		-	-	-	-	-

TABLE 7-5f
COMPARISON OF SURFACE WATER EXPLOSIVES AND MISC. DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

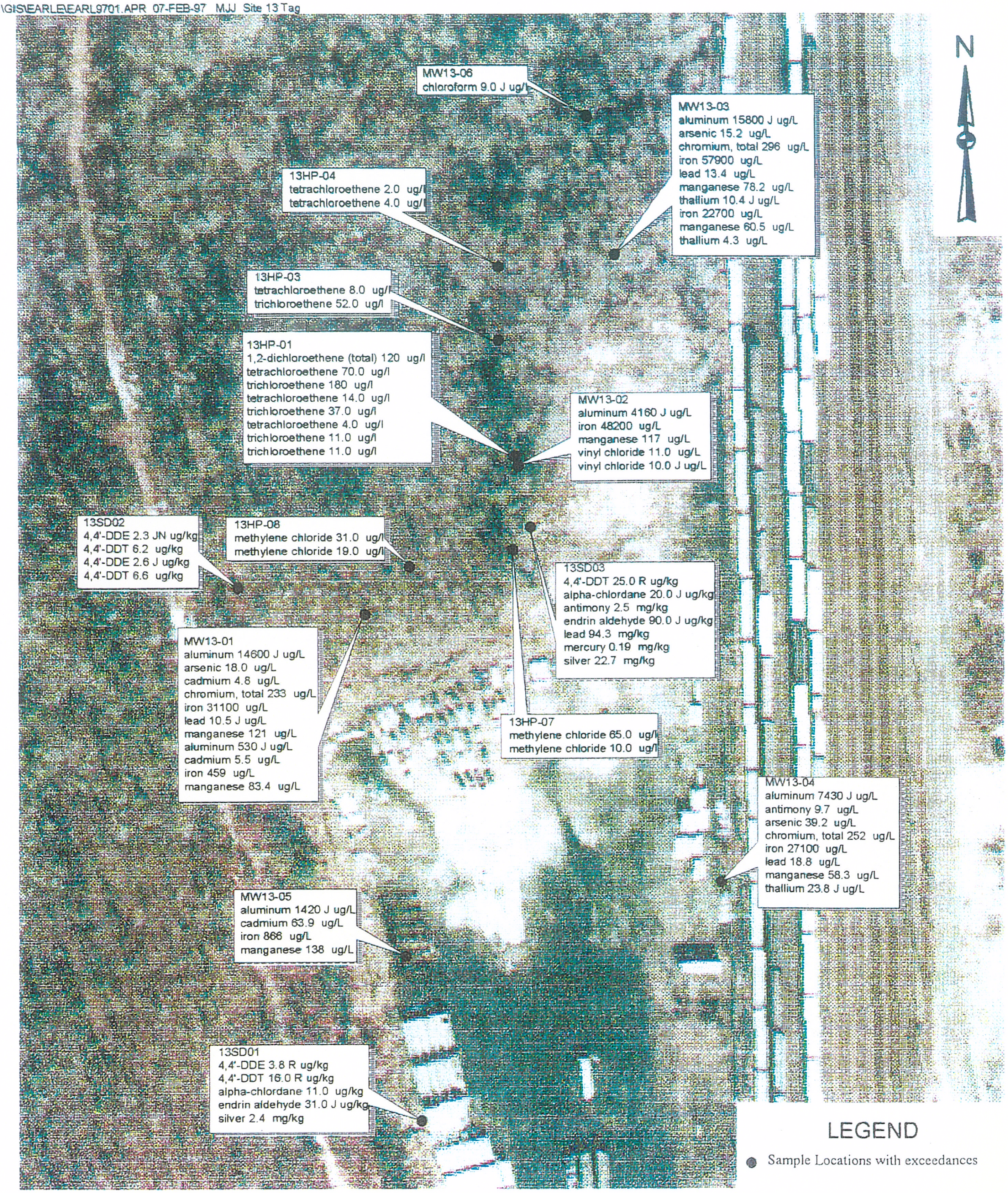
Footnotes to Ambient Water Quality Criteria:

\- - No standard is available for this chemical in this classification.

\+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L

& - Value represents the more stringent of criteria for freshwaters classified as FW2-NT, FW2-TP, and FW2-TM

K:\GIS\EARLE\EARL9701.APR 07-FEB-97 MJJ Site 13 Tag



CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 13 - DPDO YARD

FIGURE 7-2

120 0 120 240 Feet

Brown & Root Environmental

7.5.2 Groundwater

Five groundwater samples were collected at Site 13: 13 GW 01 through 13 GW 05 (from wells MW13-01 through MW13-06, respectively) during the 1995 RI. An additional monitoring well (MW13-06) was installed and sampled (13 GW 06) during the 1996 RI Addendum field work. Figure 7-1 shows groundwater sampling locations. Also, as part of the RI Addendum activities, groundwater at eight locations at Site 13 (13 HP 01 through 13 HP 08) was sampled using Hydropunch or direct-push techniques. A total of 20 samples, plus two duplicates, were obtained at various depths from these eight locations. Details of the sampling are discussed in Section 7.3.1. Tables 7-6 and 7-7 present the occurrence and distribution of inorganic and organic chemicals in site-related groundwater samples and compare them to background. Explosives were analyzed for but were not detected in Site 13 groundwater. Table 7-5 presents a comparison of detected compounds to ARARs and TBCs. Figure 7-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

7.5.2.1 Inorganics

Metals that significantly exceeded background levels were aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, nickel, silver, thallium, vanadium, and zinc. Filtered and unfiltered samples were collected from two monitoring wells where the turbidity endpoint goal could not be achieved (13 GW 03, 13 GW 03F and 13 GW 01, 13 GW 01F).

7.5.2.2 Organics

Monitoring Well Samples

4,4'-DDT (0.029 ug/L to 0.051 ug/L) and heptachlor (0.0052 ug/L to 0.011 ug/L) were each detected in two groundwater samples (13 GW 01 and 13 GW 02). Compounds detected in only one groundwater sample at Site 13 include 4-methylphenol (2 ug/L in 13 GW 03), carbon disulfide (1 ug/L in 13 GW 04), chloroform (9 ug/L in 13 GW 06), dieldrin (0.022 ug/L in 13 GW 01), endosulfan I (0.028 ug/L in 13 GW 01), 1,1,1-TCA (5 ug/L in 13 GW 01), and vinyl chloride (11 ug/L in 13 GW 02). None of these compounds were detected in background groundwater samples.

Hydropunch/Direct-Push Samples

Groundwater samples obtained by direct-push and Hydropunch sampling techniques showed elevated levels of VOCs including PCE (0.004 to 70 ug/L) in 16 samples, chloroform (0.01 to 0.4 ug/L) in 10 samples, methylene chloride (0.5 to 65 ug/L) in nine samples, TCE (0.2 to 180 ug/L) in seven samples, 1,1-DCE (0.02 to 2 ug/L) in six samples, 1,2-DCE (0.1 to 120 ug/L) in four samples, 1,1,1-TCA (0.02 to 0.2 ug/L) in three samples, and carbon tetrachloride (0.001 ug/L) in one sample. The highest levels of VOCs were detected in

TABLE 7-6

OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 13

NWS EARLE, COLTS NECK, NEW JERSEY

(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	MEAN > ACK UTL	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	9.6E+06	5097.82	5 / 5	1420 - 15800	8682.00	YES	NO	15800.00
ANTIMONY *	NOT DETECTED	-	-	-	1 / 5	9.7 9.7	3.02	YES	-	9.70
ARSENIC *	1 / 11	5.8 - 5.8	6.6E+00	4.05	3 / 5	15.2 - 39.2	15.14	YES	YES	39.20
BARIUM	11 / 11	2.6 - 518	5.8E+02	229.60	5 / 5	10 - 285	102.84	NO	NO	285.00
BERYLLIUM	4 / 11	0.21 - 1.6	1.3E+00	0.49	4 / 5	0.67 - 1.6	0.87	YES	NO	1.60
CADMIUM *	5 / 11	0.6 - 1.9	2.3E+00	1.21	5 / 5	1 - 63.9	14.50	YES	YES	40.87
CALCIUM	11 / 11	506 - 17200	1.7E+04	8306.55	5 / 5	3170 - 11900	6570.00	NO	NO	11900.00
CHROMIUM*	9 11	1.3 - 43.5	6.0E+01	29.36	5 / 5	26.3 - 296	176.34	YES	YES	296.00
COBALT	6 / 11	0.7 - 10.1	9.6E+00	4.06	5 / 5	2.1 - 8.4	4.96	YES	NO	8.40
COPPER	9 / 11	0.79 - 13.5	1.4E+01	6.53	5 / 5	2.6 - 14.2	6.32	NO	NO	14.20
IRON *	11 / 11	153 - 7690	8.5E+03	4197.09	5 / 5	866 - 57900	33033.20	YES	YES	57900.00
LEAD *	3 / 11	2.1 - 3	3.1E+00	2.44	5 / 5	3.4 - 18.8	10.58	YES	YES	18.80
MAGNESIUM	11 / 11	273 - 27400	2.3E+04	8449.64	5 / 5	2120 - 4040	2888.00	NO	NO	3950.12
MANGANESE	11 / 11	3.3 - 65	1.2E+03	46.18	5 / 5	58.3 - 138	102.50	YES	NO	138.00
MERCURY	11 / 11	0.005 - 0.12	2.0E-01	0.12	5 / 5	0.047 - 0.11	0.06	NO	NO	0.09
NICKEL	10 / 11	0.81 - 25.5	2.6E+01	11.98	4 / 5	11.5 - 35.7	14.90	YES	NO	35.70
POTASSIUM	11 / 11	350 - 3245	2.5E+06	2810.55	5 / 5	2620 - 9330	6288.00	YES	NO	9330.00
SILVER *	1 11	5.3 - 5.3	8.6E+00	4.96	3 / 5	4.6 39.9	10.84	YES	YES	26.39
SODIUM	NOT DETECTED	-	-	-	1 / 5	1 - 1	0.58	YES	-	0.88
THALLIUM	11 / 11	1850 - 11650	1.3E+04	8449.09	5 / 5	3520 - 9780	6966.00	NO	NO	9780.00
VANADIUM	3 / 11	4 - 5.1	1.1E+01	5.15	2 / 5	10.4 - 23.8	7.92	YES	NO	17.10
ZINC *	10 / 11	0.69 - 42.25	4.0E+01	16.48	5 / 5	2.6 - 152	89.44	YES	YES	152.00

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 7-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT *	NOT DETECTED	-	-	2 / 5	0.029 - 0.051	0.051
DIELDRIN *	NOT DETECTED	-	-	1 / 5	0.022 - 0.022	0.02
ENDOSULFAN I *	NOT DETECTED	-	-	1 / 5	0.028 - 0.028	0.03
HEPTACHLOR *	NOT DETECTED	-	-	2 / 5	0.0052 - 0.011	0.01
4-METHYLPHENOL *	NOT DETECTED	-	-	1 / 5	2 - 2	2.00
VOLATILE HYDROCARBONS *	NOT DETECTED	-	-	16 20	2 1300	210.46
1,1,1-TRICHLOROETHANE *	NOT DETECTED	-	-	4 / 28	0.02 - 5	2.68
1,1-DICHLOROETHENE *	NOT DETECTED	-	-	6 / 28	0.01 - 2	2.00
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	6 / 28	0.1 - 120	14.4758
CARBON DISULFIDE *	NOT DETECTED	-	-	1 / 14	1 - 1	1
CARBON TETRACHLORIDE *	NOT DETECTED	-	-	1 / 28	0.001 - 0.001	0.001
CHLOROFORM *	1 / 11	2 - 2	2	11 / 28	0.01 - 9	2.73609
METHYLENE CHLORIDE *	1 / 11	1 - 1	1	9 / 28	0.5 - 35	8.54
TETRACHLOROETHENE *	NOT DETECTED	-	-	17 / 28	0.004 - 70	9.51804
TRICHLOROETHENE *	NOT DETECTED	-	-	7 / 28	0.2 - 180	23.13233
VINYL CHLORIDE *	NOT DETECTED	-	-	2 / 14	10 - 11	6.63

* - Selected as a COPC

** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

location 13 HP 01-15; however, the samples obtained from 30 and 45 feet below the ground surface at this location also showed significant levels of VOCs. The concentrations of contaminants at this location decrease with depth. The significant VOCs detected at this location include PCE, TCE, and 1,2- DCE. Other locations where PCE and/or TCE were detected at significant levels are 13 HP 03-45, 13 HP 04-17, and 13 HP 04-48. Methylene chloride was detected at elevated levels at locations 13 HP 07 and 13 HP 08.

7.5.2.3 Miscellaneous Parameters

Miscellaneous parameter analyses of groundwater samples at Site 13 consisted of ammonia, BOD, COD, chlorides, nitrates, sulfates, TOC, phosphates, and turbidity. Results are presented in Appendix A. Most indicator parameters revealed lower concentrations in upgradient wells than in downgradient wells (MW13-01 through MW13-03). TOC levels were greater than maximum background groundwater levels in all samples. MW13-02 and MW13-03 exhibited ammonia and BOD concentrations above maximum background levels. Downgradient concentrations were greater than upgradient levels and above background ranges for sulfate in MW13-01 and MW13-02. MW13-05 exhibited levels exceeding background levels for nitrate nitrogen. Concentrations of phosphate exceeded ranges for sulfate in MW13-01 and MW13-02. None of the indicator parameters in upgradient or downgradient wells were high enough to be within a range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

7.5.3 Surface Water

One surface water sample, 13 SW 02, was collected (Figure 7-1). Table 7-8 presents the occurrence and distribution of inorganic chemicals in the site-related surface water sample and compares them to background. No organic compounds were detected in the site-related surface water sample. Explosives were analyzed for but were not detected in surface water. Table 7-5 presents a comparison of detected compounds to ARARs and TBCs. Figure 7-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

7.5.3.1 Inorganics

Concentrations of most metals in the site-related sample were similar to background ranges. Cadmium was detected at levels near the detection limit and slightly greater than the range of background samples.

TABLE 7-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND				SITE-RELATED					
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL **	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	5 / 6	102 - 1540	2.2E+03	904.20	1 / 1	932 - 932	932.00	YES	NO	932.00
BARIUM	6 / 6	16.3 - 36.4	2.4E+03	55.05	1 / 1	28.45 - 28.45	28.45	NO	NO	28.45
BERYLLIUM	3 / 6	0.22 - 1.2	1.7E+00	0.70	1 / 1	0.28 - 0.28	0.28	NO	NO	0.28
CADMIUM *	1 / 6	0.18 0.18	3.2E-01	0.23	1 / 1	0.555 - 0.555	0.56	YES	YES	0.56
CALCIUM	6 / 6	462 - 177000	2.3E+05	71114.00	1 / 1	3010 - 3010	3010.00	NO	NO	3010.00
CHROMIUM *	3 / 5	0.72 - 2.6	4.4E+00	1.78	1 / 1	11 - 11	11.00	YES	YES	11.00
COBALT	6 / 6	0.81 - 2	5.2E+00	3.10	1 / 1	2.55 - 2.55	2.55	NO	NO	2.55
COPPER	5 / 6	1.1 - 17.8	3.0E+02	11.92	1 / 1	1.2 - 1.2	1.20	NO	NO	1.20
IRON	6 / 6	160 - 23100	3.0E+04	9576.67	1 / 1	1695 - 1695	1695.00	NO	NO	1695.00
LEAD	2 / 6	4.4 - 16	2.2E+01	7.31	1 / 1	1.85 - 1.85	1.85	NO	NO	1.85
MAGNESIUM	6 / 6	369 - 559000	7.0E+05	190702.67	1 / 1	1940 - 1940	1940.00	NO	NO	1940.00
MANGANESE	6 / 6	14 - 203	3.8E+02	172.43	1 / 1	41.3 - 41.3	41.30	NO	NO	41.30
NICKEL	6 / 6	2.1 - 7.9	8.2E+01	10.23	1 / 1	8.95 - 8.95	8.95	NO	NO	8.95
POTASSIUM	5 / 6	251 - 259000	3.2E+05	88922.83	1 / 1	1720 - 1720	1720.00	NO	NO	1720.00
SILVER *	1 / 6	0.86 - 0.86	1.3E+00	0.75	1 / 1	1.4 - 1.4	1.40	YES	YES	1.40
SODIUM	3 / 3	11150 - 4340000	1.3E+07	2912233.33	1 / 1	4405 - 4405	4405.00	NO	NO	4405.00
VANADIUM	4 / 6	0.225 - 9	1.2E+01	3.79	1 / 1	0.405 - 0.405	0.41	NO	NO	0.41

* - Selected as a COPC

** - Upper Tolerance Limit

7.5.3.2 Miscellaneous Parameters

Miscellaneous parameter analyses consisted of BOD, COD, chlorides, nitrates, TOC, phosphates, and turbidity. A low level of TPH (0.100 mg/L) was detected in sample 13 SW 02. No TPH result greater than the detection limit (0.300 mg/L) was reported in the associated background surface water samples.

Concentrations of chloride, nitrate nitrogen, and phosphate were detected above maximum surface water background levels. Results are presented in Appendix A.

7.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 13 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 7.6.1.

Persistence of detected chemicals in the environment is discussed in Section 7.6.2. Section 7.6.3 presents a brief discussion of contaminant trends.

7.6.1 Detected Chemicals and Transport Potential

A wide variety of metals, volatile, semivolatile, and pesticide compounds were detected in Site 13 groundwater. PCBs, metals, semivolatiles, and pesticides were found in sediment, and limited metals were detected in surface water. The physical transport data for the detected compounds are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Groundwater samples revealed several halogenated volatile organics, carbon disulfide, a substituted phenol, and certain pesticides (4,4'-DDT, heptachlor, dieldrin, and endosulfan I). The VOCs and phenol are typically considered highly mobile; the mobility of pesticides is considered compound specific and moderate to low compared to other compounds. VOCs were detected in monitoring well samples collected downgradient of the landfill perimeter and from groundwater samples collected by direct-push methodology from locations in the wetlands north-northwest of the landfill.

Concentrations of metals in unfiltered groundwater samples from wells MW13-01 and MW13-03 were generally greater than levels in the corresponding filtered samples collected at the same locations. With the exception of cadmium and zinc, elevated levels of metals were not present in the filtered samples. Metals in suspension are expected to have a greatly diminished potential for in-situ transport compared to metals in solution. Given a geologic formation that does not include conditions conducive to solution channeling or fracture-based flow, samples from wells with high turbidity sent for analysis would show higher metals concentrations than are actually mobile in the NWS Earle aquifer. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, at most wells, low-turbidity samples could not be collected.

PCBs, which were detected in site-related sediments, are typically strongly bound to organic matter and are not expected to migrate significantly except in conjunction with surface water erosional patterns. Pesticides are also considered of low mobility when adsorbed onto high-carbon content substrates.

Antimony, cadmium, lead, and silver, which were detected in site-related sediments, are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. Of these metals, only cadmium was detected at levels slightly above background in the surface water sample.

Sorption processes appear to exert a dominant effect on the distribution of lead in the environment. Adsorption to inorganic solids, organic materials, and hydrous iron and manganese oxides usually controls the mobility of lead and results in a strong partitioning of lead to the bed sediments in aquatic systems. The sorption mechanism most important in a particular system varies with geological setting, pH, Eh, availability of liquids, dissolved and particulate concentrations, and chemical composition. Lead is strongly complexed to organic materials present in aquatic systems and soil (Clement Associates, 1985). Activities at the site have included on-site battery reclamation by splitting open batteries and draining acid onto the ground, which is supported by the fact that both sediment samples (in the drainage ditch at the toe of the landfill and in the ditch to the west of the landfill) revealed unusually low pH (4.22 to 4.67) values. Low pH in soil and sediment leads to the solubilization of lead in these media, which facilitates contaminant migration. Transport of lead over distances is also controlled by other factors, including soil cation exchange and buffering capacities.

7.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different toxicologically or from a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

All detected volatile organic groundwater contaminants are characteristically mobile in the environment (either through soil gas migration or groundwater transport) and may have originated either at source locations not identified in this investigation or from source locations that have since been depleted of these contaminants. 1,2-DCE and vinyl chloride, which were detected in groundwater, are associated with degradation of PCE and TCE (Cline and Viste, 1983). PCBs are considered highly persistent, typically exhibiting biodegradation patterns that proceed slowly and to varying degrees, depending upon the individual isomer chlorination pattern of the PCB congeners that make up the Aroclor mixtures.

7.6.3 Observed Chemical Contaminant Trends

The presence of suspended solids in samples 13 GW 01, 13 GW 02, 13 GW 03, and 13 GW 04 is indicated by very high turbidity readings and elevated levels of metals such as aluminum, whose common forms are relatively insoluble. Although only unfiltered sample results were used in calculations for the groundwater risk assessment, in accordance with the recommended conservative approach to this evaluation, an important caveat is that the filtered sample results of two wells at Site 13 appear to be more representative of dissolved-phase contamination. Elevated levels of most metals were not generally found in the filtered aliquots, with the exception of cadmium and zinc in the filtered aliquot of downgradient sample 13 GW 01 and thallium in the filtered aliquot of downgradient sample 13 GW 03. One upgradient groundwater sample (13 GW 04) displayed elevated levels of aluminum and exhibited cadmium at notable levels. Upgradient sample 13 GW 05 did not reveal high turbidity readings or aluminum at elevated levels but exhibited a notable concentration of zinc

Low levels of pesticides were noted in downgradient groundwater sample 13 GW 01. One farther downgradient well revealed fewer pesticide detections and lower concentrations. This indicates that the landfill may be the source of the pesticide compounds in groundwater.

Surface water samples at Site 13 do not demonstrate dissolved-phase inorganic chemical migration impacts from the landfill. The detected sediment contamination is likely the result of runoff and erosional dispersion. Notable contaminants in sediment fall into three classes: PCBs (which are considered relatively immobile), pesticides (which have varying degrees of mobility), and certain metals.

Aroclor 1254 was detected in sediment sample 13 SD 01 at a level of 2,200 ug/kg, which is approximately 30 times greater than that observed in the corresponding downstream sample, 13 SD 02. Sample 13 SD 03, which was collected in the drainage ditch leading from the toe of the landfill, revealed both Aroclor 1254 (3,900 ug/kg) and 1260 (1,200 ug/kg). Since Aroclor 1260 was also detected in several landfill area soil samples during a 1992 investigation, this suggests erosional dispersion impacts from Aroclor 1260 in the drainage ditch from the landfill. Lead and silver, which were both detected in landfill soil samples in the 1992 investigation, were also detected in the current investigation in the drainage ditch sample, which suggests migration of these contaminants. Antimony and cadmium were also detected at low levels in site-related sediment samples (the highest levels were in 13 SD 03) but were not found in background sediments. Low pH of sediments may facilitate additional contaminant migration, although the levels detected in the drainage ditch sample were generally low and these constituents were not present in downgradient filtered groundwater samples at elevated levels.

Low concentrations of VOCs and a soluble semivolatile were observed in three downgradient groundwater monitoring wells but were not detected at two upgradient locations, which suggests groundwater impacts from the landfill. 1,1,1-TCA was detected in 13 GW 01, 1,2-DCE and vinyl chloride were detected in 13 GW 02, and 4-methylphenol was detected in 13 GW 03. The dichloroethenes are degradation products of PCE and TCE, which were not detected in monitoring well samples, but were detected at significant levels in groundwater samples collected by Hydropunch or direct-push sampling techniques. Elevated levels of VOCs were detected at various depths, indicating vertical migration of contaminants in groundwater. VOCs were detected at significant levels in groundwater samples obtained by direct-push methodology in the wetland area north-northwest (downgradient) of the landfill.

7.6.4 **Conclusions**

Migration of impacted sediments from the landfill through runoff and erosional dispersion may be the cause of the detected PCBs and metals in sediments downstream of the landfill. The landfill appears to be the source of the elevated levels of Aroclor 1260, lead, and silver in the drainage ditch leading from the toe of the landfill. Aroclor 1260, lead, and silver were detected in the landfill during a previous investigation (1992), and historical information indicates that PCB transformers and batteries were stored on site.

Chemical constituents detected in the sediment at Site 13 have low potential for impacts to groundwater. Detected chemicals in the groundwater indicate the possibility of limited groundwater impacts by certain metals and pesticides. Cadmium was detected at an elevated level in upgradient sample 13 GW 04, and zinc was detected at an elevated level in upgradient sample 13 GW 05, which suggests that the lower levels of these metals detected in a downgradient sample might not be site related.

VOCs detected in groundwater (Hydropunch and direct-push) indicate a significant source area of VOCs, particularly PCE, TCE, and their degradation products. Results indicate that migration of VOCs in groundwater has occurred.

7.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 13. The risk assessment was performed using the approach outlined in Section 2.4. Tables 7-9 through 7-11 provide the selected COPCs and representative concentrations of inorganics and organics in site-related groundwater, sediment, and surface water (inorganics only), respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

7.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, industrial, and recreational receptors).

7.7.1.1 Future Industrial Employee

Groundwater Exposure

RME

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 13 is 2.5E-04 (ingestion) and 4.2E-07 (dermal contact). The total groundwater cancer risk is at the upper bound of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway) and vinyl chloride (ingestion, 17 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial receptor assuming exposure to COPCs in groundwater at Site 13 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by

TABLE 7-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
GROUNDWATER - SITE 13 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ANTIMONY	9.7
ARSENIC	39.2
CADMIUM	40.87
CHROMIUM	296
IRON	57900
LEAD	18.8
SILVER	26.39
ZINC	152.00
4,4'-DDT	0.051
DIELDRIN	0.022
ENDOSULFAN I	0.03
HEPTACHLOR	0.011
4-METHYLPHENOL	2
1,1,1-TRICHLOROETHANE	2.68
1,1-DICHLOROETHENE	2
1,2-DICHLOROETHENE (TOTAL)	14.47
CARBON DISULFIDE	1.00
CARBON TETRACHLORIDE\	0.001
CHLOROFORM	2.73
METHYLENE CHLORIDE	8.54
TETRACHLOROETHENE	9.51
TRICHLOROETHENE	23.13
VINYL CHLORIDE	6.63

TABLE 7-10
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	2.5
ARSENIC	4.2
MERCURY	0.19
SILVER	22.7
4,4'-DDE*	2.45
4,4'-DDT*	6.4
ALPHA-CHLORDANE*	20
AROCLOR-1254*	3900
AROCLOR-1260*	1200
BENZO(B)FLUORANTHENE*	48
CHRYSENE*	56
DIETHYLPHTHALATE*	51
ENDOSULFAN SULFATE*	0.3
ENDRIN ALDEHYDE*	90
FLUORANTHENE*	81
GAMMA-CHLORDANE*	0.16
PYRENE*	67.5

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 7-11
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE WATER - SITE 13 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
CADMIUM	0.56
CHROMIUM	11
SILVER	1.4

the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: skin (1.3 - arsenic), liver (1.9 - iron), and digestive system (1.9 - iron). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 13 in Tables 7- 12 and 7-13, respectively.

CTE

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 13 is 2.9E-05 (ingestion) and 6.6E-08 (dermal contact). The total groundwater cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 79 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway) and vinyl chloride (17 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial receptor assuming exposure to COPCs in groundwater at Site 13 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPC are as follows: liver (1.2 - iron) and digestive system (1.2 - iron). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated CTE carcinogenic risks are presented for future industrial receptors exposed to groundwater at Site 13 in Tables 7-14 and 7-15, respectively.

7.7.1.2 Future Residential Receptor

Groundwater Exposure

RME

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 13 is 1.1E-03 (ingestion), 1.1E-05 (dermal contact), and 3.4E-05 (inhalation of VOCs during showering).

TABLE 7-12
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1,1-TRICHLOROETHANE	N/A	N/A
1,1-DICHLOROETHENE	4.2E-06	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
4,4'-DDT	6.1E-08	N/A
4-METHYLPHENOL	N/A	N/A
CARBON DISULFIDE	N/A	N/A
CARBON TETRACHLORIDE	4.54E-10	N/A
CHLOROFORM	5.8E-08	N/A
DIELDRIN	1.2E-06	N/A
ENDOSULFAN I	N/A	N/A
HEPTACHLOR	1.7E-07	N/A
METHYLENE CHLORIDE	2.2E-07	N/A
TRICHLOROETHENE	8.9E-07	N/A
TETRACHLOROETHENE	1.73E-06	N/A
VINYL CHLORIDE	4.4E-05	N/A
ANTIMONY	N/A	N/A
ARSENIC	2.0E-04	4.2E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
SILVER	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	2.5E-04	4.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMCIAL

TABLE 7-13
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER INGESTION BY TARGET ORGAN										GROUNDWATER DERMAL CONTACT
		CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	PERIPHERAL NERVOUS SYSTEM	EYES	REPRO-DUCTIVE SYSTEM	
1,1,1-TRICHLOROETHANE	2.9E-04											N/A
1,1-DICHLOROETHENE	2.2E-03			2.2E-03		2.2E-03						N/A
1,2-DICHLOROETHENE (TOTAL)	1.6E-02	1.6E-02				1.6E-02						N/A
4,4'-DDT	1.0E-03					1.0E-03						N/A
4-METHYLPHENOL	3.9E-03			3.9E-03	3.9E-03	3.9E-03		3.9E-03				N/A
CARBON DISULFIDE	9.8E-05	9.8E-05	9.8E-05	9.8E-05		9.8E-05		9.8E-05	9.8E-05	9.8E-05	9.8E-05	N/A
CARBON TETRACHLORIDE	1.4E-05											N/A
CHLOROFORM	2.7E-03			2.7E-03		2.7E-03						N/A
DIELDRIN	4.3E-03					4.3E-03		4.3E-03			4.3E-03	N/A
ENDOSULFAN I	4.4E-05	4.4E-05		4.4E-05								N/A
HEPTACHLOR	2.2E-04					2.2E-04						N/A
METHYLENE CHLORIDE	1.4E-03					1.4E-03						N/A
TRICHLOROETHENE	3.8E-02	3.8E-02						3.8E-02				N/A
TETRACHLOROETHENE	9.31E-03					9.3E-03		9.3E-03				N/A
VINYL CHLORIDE	N/A					N/A		N/A				N/A
ANTIMONY	2.4E-01	2.4E-01										N/A
ARSENIC	1.3E+00		1.3E+00									2.6E-03
CADMIUM	8.0E-01			8.0E-01								1.6E-03
CHROMIUM	2.9E-03			2.9E-03								N/A
IRON	1.9E+00					1.9E+00	1.9E+00					N/A
LEAD	N/A	N/A						N/A				N/A
SILVER	1.7E-03		1.7E-03									N/A
ZINC	4.1E-02	4.1E-02										N/A
	HI BY TARGET ORGAN	3.3E-01	1.3E+00	8.1E-01	3.9E-03	1.9E+00	1.9E+00	5.6E-02	9.8E-05	9.8E-05	4.4E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 7-14
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1,1-TRICHLOROETHANE	N/A	N/A
1,1-DICHLOROETHENE	4.6E-07	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
4,4'-DDT	6.7E-09	N/A
4-METHYLPHENOL	N/A	N/A
CARBON DISULFIDE	N/A	N/A
CARBON TETRACHLORIDE	5.0E-11	N/A
CHLOROFORM	6.4E-09	N/A
DIELDRIN	1.4E-07	N/A
ENDOSULFAN I	N/A	N/A
HEPTACHLOR	1.9E-08	N/A
METHYLENE CHLORIDE	2.5E-08	N/A
TRICHLOROETHENE	9.8E-08	N/A
TETRACHLOROETHENE	1.9E-07	N/A
VINYL CHLORIDE	4.9E-06	N/A
ANTIMONY	N/A	N/A
ARSENIC	2.3E-05	6.6E-08
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
SILVER	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	2.9E-05	6.6E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 7-15

CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 13

GROUNDWATER

NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER INGESTION BY TARGET ORGAN										GROUNDWATER DERMAL CONTACT
		CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	PERIPHERAL NERVOUS SYSTEM	EYES	REPRO-DUCTIVE SYSTEM	
1,1,1-TRICHLOROETHANE	1.8E-04											N/A
1,1-DICHLOROETHENE	1.3E-03			1.3E-03		1.3E-03						N/A
1,2-DICHLOROETHENE (TOTAL)	9.7E-03	9.7E-03				9.7E-03						N/A
4,4'-DDT	6.1E-04					6.1E-04						N/A
4-METHYLPHENOL	2.4E-03			2.4E-03	2.4E-03	2.4E-03		2.4E-03				N/A
CARBON DISULFIDE	6.0E-05	6.0E-05	6.0E-05	6.0E-05		6.0E-05		6.0E-05	6.0E-05	6.0E-05	6.0E-05	N/A
CARBON TETRACHLORIDE	8.6E-06											N/A
CHLOROFORM	1.6E-03			1.6E-03		1.6E-03						N/A
DIELDRIN	2.6E-03					2.6E-03		2.6E-03			2.6E-03	N/A
ENDOSULFAN I	2.7E-05	2.7E-05		2.7E-05								N/A
HEPTACHLOR	1.3E-04					1.3E-04						N/A
METHYLENE CHLORIDE	8.5E-04					8.5E-04						N/A
TRICHLOROETHENE	2.3E-02	2.3E-02						2.3E-02				N/A
TETRACHLOROETHENE	5.7E-03					5.7E-03		5.7E-03				N/A
VINYL CHLORIDE	N/A											N/A
ANTIMONY	1.5E-01	1.5E-01										N/A
ARSENIC	7.8E-01		7.8E-01									2.3E-03
CADMIUM	4.9E-01			4.9E-01								1.4E-03
CHROMIUM	1.8E-03			1.8E-03								N/A
IRON	1.2E+00					1.2E+00	1.2E+00					N/A
LEAD	N/A											N/A
SILVER	1.1E-03		1.1E-03									N/A
ZINC	2.5E-02	2.5E-02										N/A
	HI BY TARGET ORGAN	2.0E-01	7.9E-01	5.0E-01	2.4E-03	1.2E+00	1.2E+00	3.4E-02	6.0E-05	6.0E-05	2.7E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway), vinyl chloride (ingestion, 17 percent of the cancer risk for this pathway; and inhalation, 76 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 13 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: cardiovascular system (2.2 - antimony and zinc), skin (8.4 - arsenic), kidney (5.3 - cadmium), liver (13 - iron), and digestive system (12 - iron). The estimated noncarcinogenic HI for the dermal contact and inhalation of VOC exposure pathways were less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 13 in Tables 7-16 and 7-17, respectively.

CTE

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 13 is 5.0E-04 (ingestion), 3.3E-06 (dermal contact), and 9.9E-06 (inhalation of VOCs during showering). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway) and vinyl chloride (ingestion, 17 percent of the cancer risk for this pathway; and inhalation, 76 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 13 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: skin (3.9 - arsenic), kidney (2.5 - cadmium), liver 5.9 - iron), and digestive system (5.8- iron). The estimated noncarcinogenic HI for the dermal contact and inhalation of VOC exposure pathways were less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

TABLE 7-16
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1,1-TRICHLOROETHANE	N/A	N/A	N/A
1,1-DICHLOROETHENE	1.8E-05	N/A	3.9E-06
1,2-DICHLOROETHENE (TO	N/A	N/A	N/A
4,4'-DDT	2.6E-07	N/A	3.8E-09
4-METHYLPHENOL	N/A	N/A	N/A
CARBON DISULFIDE	N/A	N/A	N/A
CARBON TETRACHLORIDE	1.93E-09	N/A	4.76E-10
CHLOROFORM	2.5E-07	N/A	2.1E-06
DIELDRIN	5.2E-06	N/A	1.3E-07
ENDOSULFAN I	N/A	N/A	N/A
HEPTACHLOR	7.4E-07	N/A	3.1E-11
METHYLENE CHLORIDE	9.5E-07	N/A	1.5E-07
TRICHLOROETHENE	3.8E-06	N/A	1.3E-06
TETRACHLOROETHENE	7.36E-06	N/A	1.54E-07
VINYL CHLORIDE	1.9E-04	N/A	2.6E-05
ANTIMONY	N/A	N/A	N/A
ARSENIC	8.8E-04	1.1E-05	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.1E-03	1.1E-05	3.4E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 7-17
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN											
SUBSTANCE	GROUNDWATER INGESTION - CHIL	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	PERIPHERAL NERVOUS SYSTEM	EYES	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,1,1-TRICHLOROETHANE	1.9E-03											N/A	2.6E-04
1,1-DICHLOROETHENE	1.4E-02			1.4E-02		1.4E-02						N/A	N/A
1,2-DICHLOROETHENE (TOT	1.0E-01	1.0E-01				1.0E-01						N/A	N/A
4,4'-DDT	6.5E-03					6.5E-03						N/A	N/A
4-METHYLPHENOL	2.6E-02			2.6E-02	2.6E-02	2.6E-02		2.6E-02				N/A	N/A
CARBON DISULFIDE	6.4E-04	6.4E-04	6.4E-04	6.4E-04		6.4E-04		6.4E-04	6.4E-04	6.4E-04	6.4E-04	N/A	1.8E-04
CARBON TETRACHLORIDE	9.13E-05											N/A	4.63E-05
CHLOROFORM	1.8E-02			1.8E-02		1.8E-02						N/A	N/A
DIELDRIN	2.8E-02					2.8E-02		2.8E-02			2.8E-02	N/A	N/A
ENDOSULFAN I	2.9E-04	2.9E-04		2.9E-04								N/A	N/A
HEPTACHLOR	1.4E-03					1.4E-03						N/A	N/A
METHYLENE CHLORIDE	9.1E-03					9.1E-03						N/A	3.2E-04
TRICHLOROETHENE	2.5E-01	2.5E-01						2.5E-01				N/A	N/A
TETRACHLOROETHENE	6.08E-02					6.1E-02		6.1E-02				N/A	N/A
VINYL CHLORIDE	N/A											N/A	N/A
ANTIMONY	1.6E+00	1.6E+00										N/A	N/A
ARSENIC	8.4E+00		8.4E+00									2.1E-01	N/A
CADMIUM	5.2E+00			5.2E+00								1.3E-01	N/A
CHROMIUM	1.9E-02			1.9E-02								N/A	N/A
IRON	1.2E+01					1.2E+01	1.2E+01					N/A	N/A
LEAD	N/A											N/A	N/A
SILVER	1.1E-02		1.1E-02									N/A	N/A
ZINC	2.7E-01	2.7E-01										N/A	N/A
	HI BY TARGET OR	2.2E+00	8.4E+00	5.3E+00	2.6E-02	1.3E+01	1.2E+01	3.7E-01	6.4E-04	6.4E-04	2.9E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 13 in Tables 7-18 and 7-19, respectively.

7.7.1.3 Future Recreational Receptor

Sediment and Surface Water

RME

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 13 are 5.0E-07 (ingestion) and 1.2E-07 (dermal contact). The sediment cancer risk is below the 10^{-4} to 10^{-6} target acceptable risk range.

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 13 are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated individual noncarcinogenic HQs for exposure to COPCs in surface water during wading at Site 13 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 13 in Tables 7-20 and 7-21, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 13 in Tables 7-22 and 7-23, respectively.

CTE

No CTE analysis is required for sediment and surface water exposure.

7.7.1.4 Lead Results

The IEUBK Lead Model (v. 0.99) was used to characterize risks from lead in soil, dust, and water for the hypothetical future residential children (ages 0 through 6), who are considered the most sensitive receptor group at Site 13. The simulated range of blood-lead values that might occur in a population as a result of exposures to lead was compared to a guideline level of 10 micrograms per deciliter (µg/dL). Based on model results, 0.6 percent of residential children exposed under similar conditions might have blood-lead levels exceeding 10 µg/dL. This is less than a protective guideline of 5 percent for the maximum proportion

TABLE 7-18
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 13
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1,1-TRICHLOROETHANE	N/A	N/A	N/A
1,1-DICHLOROETHENE	8.1E-06	N/A	1.1E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
4,4'-DDT	1.2E-07	N/A	1.1E-09
4-METHYLPHENOL	N/A	N/A	N/A
CARBON DISULFIDE	N/A	N/A	N/A
CARBON TETRACHLORIDE	8.79E-10	N/A	1.40E-10
CHLOROFORM	1.1E-07	N/A	6.3E-07
DIELDRIN	2.4E-06	N/A	3.9E-08
ENDOSULFAN I	N/A	N/A	N/A
HEPTACHLOR	3.4E-07	N/A	9.1E-12
METHYLENE CHLORIDE	4.3E-07	N/A	4.5E-08
TRICHLOROETHENE	1.7E-06	N/A	3.9E-07
TETRACHLOROETHENE	3.35E-06	N/A	N/A
VINYL CHLORIDE	8.5E-05	N/A	7.7E-06
ANTIMONY	N/A	N/A	N/A
ARSENIC	4.0E-04	3.3E-06	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	5.0E-04	3.3E-06	9.9E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 7-19

CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 13

GROUNDWATER

NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN											
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIV SYSTEM	CENTRAL NERVOUS SYSTEM	PERIPHERAL NERVOUS SYSTEM	EYES	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,1,1-TRICHLOROETHANE	8.9E-04											N/A	7.7E-05
1,1-DICHLOROETHENE	6.7E-03			6.7E-03		6.7E-03						N/A	N/A
1,2-DICHLOROETHENE (TO	4.8E-02	4.8E-02				4.8E-02						N/A	N/A
4,4'-DDT	3.1E-03					3.1E-03						N/A	N/A
4-METHYLPHENOL	1.2E-02			1.2E-02	1.2E-02	1.2E-02		1.2E-02				N/A	N/A
CARBON DISULFIDE	3.0E-04	3.0E-04	3.0E-04	3.0E-04		3.0E-04		3.0E-04	3.0E-04	3.0E-04	3.0E-04	N/A	5.2E-05
CARBON TETRACHLORIDE	4.27E-05											N/A	1.36E-05
CHLOROFORM	8.2E-03			8.2E-03		8.2E-03						N/A	N/A
DIELDRIN	1.3E-02					1.3E-02		1.3E-02			1.3E-02	N/A	N/A
ENDOSULFAN I	1.3E-04	1.3E-04		1.3E-04								N/A	N/A
HEPTACHLOR	6.6E-04					6.6E-04						N/A	N/A
METHYLENE CHLORIDE	4.3E-03					4.3E-03						N/A	9.4E-05
TRICHLOROETHENE	1.2E-01	1.2E-01						1.2E-01				N/A	N/A
TETRACHLOROETHENE	2.85E-02					2.9E-02		2.9E-02				N/A	N/A
VINYL CHLORIDE	N/A											N/A	N/A
ANTIMONY	7.3E-01	7.3E-01										N/A	N/A
ARSENIC	3.9E+00		3.9E+00									1.1E-01	N/A
CADMIUM	2.5E+00			2.5E+00								6.6E-02	N/A
CHROMIUM	8.9E-03			8.9E-03								N/A	N/A
IRON	5.8E+00					5.8E+00	5.8E+00					N/A	N/A
LEAD	N/A											N/A	N/A
SILVER	5.3E-03		5.3E-03									N/A	N/A
ZINC	1.3E-01	1.3E-01										N/A	N/A
	HI BY TARGET ORG	1.0E+00	3.9E+00	2.5E+00	1.2E-02	5.9E+00	5.8E+00	1.7E-01	3.0E-04	3.0E-04	1.3E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 7-20
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 13
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDE	9.1E-12	N/A
4,4'-DDT	2.4E-11	N/A
ALPHA-CHLORDANE	2.8E-10	N/A
AROCLOR-1254	3.3E-07	9.2E-08
AROCLOR-1260	1.0E-07	2.8E-08
BENZO(B)FLUORANTHENE	3.8E-10	N/A
CHRYSENE	4.5E-12	N/A
DIETHYLPHTHALATE	N/A	N/A
ENDOSULFAN SULFATE	N/A	N/A
ENDRIN ALDEHYDE	N/A	N/A
FLUORANTHENE	N/A	N/A
GAMMA-CHLORDANE	2.3E-12	N/A
PYRENE	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	6.9E-08	2.9E-09
MERCURY	N/A	N/A
SILVER	N/A	N/A
TOTAL RISK	5.0E-07	1.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE ESTABLISHED FOR THIS CHEMICAL

• CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 7-21
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDE	NA	N/A
4,4'-DDT	1.6E-06	N/A
ALPHA-CHLORDANE	4.3E-05	N/A
AROCLOR-1254	2.5E-02	7.0E-03
AROCLOR-1260	NA	N/A
BENZO(B)FLUORANTHENE	NA	N/A
CHRYSENE	NA	N/A
DIETHYLPHTHALATE	8.2E-09	N/A
ENDOSULFAN SULFATE	NA	N/A
ENDRIN ALDEHYDE	NA	N/A
FLUORANTHENE	2.6E-07	N/A
GAMMA-CHLORDANE	3.4E-07	N/A
PYRENE	2.9E-07	N/A
ANTIMONY	8.0E-04	N/A
ARSENIC	1.8E-03	7.5E-05
MERCURY	8.1E-05	N/A
SILVER	5.8E-04	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE ESTABLISHED FOR THIS CHEMICAL

TABLE 7-22
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 13
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
SILVER	N/A	N/A
TOTAL RISK	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 7-23
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 13
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
CADMIUM	1.4E-04	N/A
CHROMIUM	2.8E-04	N/A
SILVER	3.6E-05	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

individuals with blood levels exceeding 10 µg/dL (EPA, 1994). The model inputs assumed were default parameter values, 39.4 mg/kg lead in site-related soils, and 18.8 µg/L lead in groundwater. The IEUBK population histograms for Site 13 exposures are presented in Appendix D.

7.7.2 Conclusions

Sediment, groundwater, and surface water were sampled at Site 13. The potential receptors considered for this site were future industrial, residential, and recreational receptors.

The RME cancer risks associated with future residential exposure scenario (groundwater) exceeded the target acceptable risk range. The future industrial (groundwater) exposure scenario was at the upper end of the target acceptable risk range. In addition, CTE cancer risks also for the future residential receptor exceeded the target acceptable risk range. Arsenic (via ingestion of and dermal contact with groundwater) and vinyl chloride (via ingestion and inhalation) were the principal COPCs that contributed to the cancer risks for these exposure scenarios.

RME estimates for noncarcinogenic HIs associated with future industrial and future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic, cadmium, and iron were the COPCs that exceeded 1.0 for these exposure scenarios. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0. The target organs included cardiovascular system, skin, kidney, and liver.

RME risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 13 in Table 7-24 for subsurface soil and groundwater. Table 7-25 presents the relevant CTE risk estimates associated with potential receptors for groundwater, sediment and surface water. The estimated RME cancer risk for the future residential receptor exceeds the 10^{-4} target acceptable risk range based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 10^{-4} target acceptable risk range based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

Lead concentrations detected at the site during this RI were below the EPA guidelines and are not expected to be associated with a significant increase in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

TABLE 7-24
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

		Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
Medium	Exposure Routes							Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	5.0E-07	N/A	N/A	N/A	N/A	2.8E-02
	Dermal Contact	N/A	N/A	N/A	2.9E-09	N/A	N/A	N/A	N/A	7.5E-05
Groundwater	Ingestion	N/A	2.5E-04	1.1E-03	N/A	N/A	1.9E+00@	1.3E+01@	N/A	N/A
	Dermal Contact	N/A	4.2E-07	1.1E-05	N/A	N/A	4.2E-03	3.4E-01	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	3.4E-05	N/A	N/A	N/A	N/A	8.1E-04	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	-	N/A	N/A	N/A	N/A	5.5E-04
	Dermal Contact	N/A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A
TOTAL		-	2.5E-04	1.1E-03	5.0E-07	-	1.9E+00	1.3E+01	8.1E-04	2.9E-02

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 7-25
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident Child	Future Resident Adult	Future Recreational Child
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	2.9E-05	5.0E-04	N/A	N/A	1.2E+00@	5.9E+00@	N/A	N/A
	Dermal Contact	N/A	6.7E-08	3.3E-06	N/A	N/A	3.7E-03	1.8E-01	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	9.9E-06	N/A	N/A	N/A	N/A	2.4E-04	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	TOTAL	-	2.9E-05	5.1E-04	-	-	1.2E+00	6.1E+00	2.4E-04	-

N/A = Not applicable because this media is not associated with this potential receptor

N/R - Central Tendency calculation not required

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

Arsenic was the main cancer risk driver at Site 13 in groundwater. Arsenic levels in site-related samples (15.2 ug/l to 39.2 ug/l) was detected in three out of five samples. Arsenic levels at Site 13 are elevated above background levels (frequency 1/11, 5.8 ug/l).

7.8 EVALUATION SUMMARY

The results of the groundwater investigation indicate that significant concentrations of VOCs, particularly PCE, TCE, and their degradation products, exist north of the former landfill area.

The human health risk assessment concluded that cancer and non-cancer risks above guideline ranges result under the future industrial and future residential scenarios, based on compounds found in local groundwater.

The goal of the RI Addendum field activities was to provide additional groundwater sampling data to further characterize the nature and extent of VOCs in groundwater downgradient of the former landfill. Sufficient data exist on which to prepare a feasibility study of remedial alternatives to address site conditions.

8.0 SITE 16: SITE 16 AND EPIC SITE F

8.1 SITE BACKGROUND AND PHYSICAL SETTING

Site 16 and EPIC Site F are discussed as one site due to the relative proximity and overlap of the two sites. The 8-acre combined site consists of a heavy equipment storage yard and two railroad car storage yards that have been active since the late 1940s. Figure 8-1 is a map of the combined site. Groundwater generally flows to the north-northeast based on groundwater-level measurements.

Site 16 is located north of Building C-19, the forklift maintenance and repair shop. EPIC Site F includes two former diesel tank areas around Building C-50, an oil-water separator and leach field east of Building C-50, an oil-stained portion of tracks north of Building C-50, a drainage ditch northeast of Building C-50, and a locomotive wash area and leach field north of Building C-19. Building C-50 is known as the Roundhouse and is used for maintenance and repair of locomotives and rail cars. Investigations at these areas have been concerned with petroleum hydrocarbon contamination of soil, groundwater, surface water, and sediment.

An underground fuel line was used to transport diesel fuel from an UST located at the northeastern corner of Building C-18 to a dispensing station approximately 100 feet north of Building C-50. A leak in the fuel line was discovered in 1977, and use of the pipeline was discontinued after the leak was discovered and excavated. Part or all of the former underground diesel transfer line is still in place. This portion of the site was investigated during the 1992 SI field activities.

Waste oils from locomotive maintenance were stored in a holding tank at the southeastern side of Building C-50. This tank was removed under the UST program. Water from locomotive steam cleaning operations in the past may have discharged to sewer drains and to an oil-water separator near Building C-50. Water discharge from this oil-water separator was reportedly sent to a drainage ditch along the western side of the railroad tracks. No evidence of a suspected leach field, thought to be present near the oil-water separator, has been found. In 1989, the oil-water separator failed and the ditch on the side of Building C-50 was excavated. Excavated material was disposed of as hazardous waste. In the southwestern corner, inside Building C-50, was a locomotive engine cleaning tank (vat). The vat, approximately 10 feet by 16 feet and 6 feet deep, was used for soaking locomotive engines and potentially other oversized parts. An unknown solvent was used in the vat for cleaning. The spent solvent was directed to a leach field via two holding tanks located west of the southwestern corner of Building C-50. The operation was discontinued several years ago and the holding tanks and vat were cleaned. The vat was filled with concrete and the holding tanks and associated leach field were left in place.

The center of the railroad tracks north of Building C-50 is stained with thick oil, possibly from leaky locomotives awaiting maintenance.

K:\GIS\EARLE\EARL9701.APR 14-August-97 MJJ SITE 16

SAMPLE LOCATIONS
SITE 16 AND EPIC SITE F

FIGURE 8–1

100 0 100 200 Feet

Brown & Root Environmental

Building C-19 is used as a forklift maintenance and repair facility behind which batteries may have been stored. The railroad yard west of Building C-19 is used for rail car and heavy equipment storage.

8.2 PREVIOUS INVESTIGATIONS

8.2.1 IAS, PA Addendum, and SI Summary of Activities and Results

IAS

The 1983 IAS, which consisted of interviews, concluded minimal impact because the fuel line leak was discovered quickly and the amount of fuel lost was estimated to be minimal (less than 50 gallons). The site was not recommended for confirmation study.

PA Addendum

The PA Addendum in 1992, consisting of interviews and aerial photo analysis, indicated that the site had been an active rail yard for many years.

SI

As part of the 1992 SI field activities, five soil borings were completed in the area north of Building C-18, the reported location of the underground fuel-line leak. Each soil boring was completed to the water table, and one sample was collected approximately 8 feet bgs, below the level of the fuel pipeline and above the water table. All soil samples contained elevated levels of TPH ranging from 4,700 mg/kg to 22,000 mg/kg. Low levels of semivolatiles were also detected. A geophysical survey of the area during the SI indicated a number of buried lines at the site; however, the exact location of the leaking fuel line was not determined.

8.2.2 1995 Remedial Investigations

As part of 1995 RI, B&R Environmental conducted the following field investigation activities at Site 16/F:

- Soil gas survey and analysis at 96 locations
- Sampling and analysis of subsurface soil samples from 20 soil borings
- Sampling and analysis of surface soil
- Sampling and analysis of sediment
- Drilling and installation of six shallow permanent monitoring wells
- Sampling and analysis of groundwater from the wells

- Measurement of static-water levels in the wells
- Performance of slug tests in three of the wells

B&R Environmental also conducted a survey to establish the horizontal locations and vertical elevations of the soil gas grid corners, soil boring locations, surface soil samples, sediment samples, and the newly installed monitoring wells.

8.2.3 Summary of Conclusions

Twenty soil borings (six of which were converted into monitoring wells) were drilled to investigate subsurface soil conditions. The borings ranged in depth from 8 to 20 feet below ground surface (bgs) and saturated conditions were encountered in the borings from 6 to 11 feet below grade. Chromium concentrations were slightly greater than background levels. Numerous pesticides, VOCs, phthalates, and PAHs were detected in subsurface soil samples.

Three surface soil samples were collected to determine if wash activities have impacted the soils (Figure 8-1). Antimony, barium, cadmium, chromium, copper, lead, magnesium, nickel, silver, and zinc concentrations exceeded background levels. Fluoranthene, pyrene, benz(a)anthracene, benzo(a)pyrene, carbazole, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were detected at concentrations exceeding background levels. Various phthalates and pesticides were also detected in samples. TPH concentrations also exceeded background levels.

Five sediment samples, including two field duplicates, were collected to determine if past activities or runoff have impacted sediments and wetlands in the vicinity of the site. Low levels of antimony, cadmium, silver, and thallium were detected in sediment samples but not in background samples. 2-Methylnaphthalene, alpha-BHC, carbazole, dibenzofuran, and phthalates were also detected in sediment samples but not in background samples.

Six shallow 2-inch I.D. PVC permanent monitoring wells (MW16-01 through MW16-06) were installed in soil borings to determine the quality of groundwater and to check for free-phase or dissolved-phase product at the site (Figure 8-1). The groundwater samples were analyzed for TCL VOC, TCL SVOC, TAL metals, and TPH. Two of the samples were also analyzed for dissolved TAL metals; GC fingerprint and specific gravity analyses were performed on the oily product layer from two samples. The floating product was identified as No. 2 fuel oil. Elevated levels of arsenic and lead were detected in filtered downgradient groundwater samples and elevated levels of aluminum, arsenic, beryllium, cadmium, chromium, iron, thallium, vanadium, and zinc were detected in unfiltered downgradient samples. Chloroform, bis(2-ethylhexyl) phthalate, naphthalene, 1,2-DCE, benzene, bromodichloroethene, ethylbenzene, phenol, PCE, toluene, and xylene were detected in site, but not background, samples.

8.2.4 Site Characterization and Analysis Penetrometer System (SCAPS)

The Site Characterization and Analysis Penetrometer System (SCAPS) investigation of Site 16/F consisted of pushing a penetrometer probe (known as a "push") into the subsurface at locations in and around the site to determine soil lithology and the vertical and lateral extent of hydrocarbon contamination. The investigation was conducted from October 16 to November 4, 1995. Twenty-nine SCAPS pushes were completed and three soil samples were collected for analysis. Based on an interpolation of fluorescence results, two fuel impacted soil areas were identified. Figure 3 of Appendix G identifies the two areas of concern. Based on this analysis/interpretation, it was decided that additional fluorescence data were required in the area north of Building C-50 and in the northern portion of the impacted area adjacent to Building C-16 to fully delineate the hydrocarbon contamination.

8.2.5 Data Gaps (Objectives of RI Addendum Investigation)

The goal of the RI Addendum investigation was to further delineate the extent of petroleum contamination using CPT and induced fluorescence. Based on these data, additional monitoring wells could be selected to further delineate the impacts on groundwater.

8.3 RI ADDENDUM INVESTIGATION

In October 1996, B&R Environmental conducted the following activities at Site 16:

- Direct-push sampling (Section 8.3.1)
- Cone penetrometer stratigraphy study (Section 8.3.2)
- Induced fluorescence investigation of petroleum contamination (Section 8.3.2)
- Monitoring well installation, water-level measurements, and groundwater sampling (Section 8.3.3)

8.3.1 Direct-Push Sampling

B&R Environmental collected groundwater samples from five locations (16 HP 01 through 16 HP 05) on October 15, 1996. Sample locations are shown on Figure 8-1. The samples were collected from 13 to 15 feet below grade. Six groundwater samples, including one field duplicate sample, were analyzed for TCL VOC using TRC's mobile laboratory. To confirm mobile laboratory results, two of the samples, including the field duplicate sample, were also analyzed for TCL VOCs by IEA. Table 8-1 summarizes direct-push sampling activities.

TABLE 8-1
SITE 16 CONE PENETORMETER TESTING WITH FUEL FLUORESCENCE DETECTION TESTING AND DIRECT-PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE,COLTS NECK, NEW JERSEY

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depth (feet bgs)	Comments
16CPT-01				10/09/96	0 to 15	No apparent contamination.
	16HP01-13	8-13	TRC [2]; IEA [3]	10/15/96		Duplicate, MS/MSD Sample 16HP07-13.
16CPT-02				10/09/96	0 to 15	No apparent contamination.
	16HP02-13	8-13	TRC	10/15/96		
16CPT-03				10/09/96	0 to 18	Obvious contamination - top of product at 4.75 feet bgs, top of water at 6.0 feet bgs.
	16HP03-13	8-13	TRC	10/15/96		
16CPT-04				10/09/96	0 to 15	No apparent contamination.
	16HP04-13	8-13	TRC	10/15/96		
16CPT-05				10/09/96	0 to 15	No apparent contamination.
	16HP05-15	10-15	TRC	10/15/96		
16CPT-06				10/09/96	0 to 15	No apparent contamination
16CPT-07				10/09/96	0 to 15	No apparent contamination
16CPT-08				10/10/96	0 to 15	Possible contamination.
16CPT-09				10/10/96	0 to 15	Possible contamination between 3-5 feet bgs.
16CPT-10				10/10/96	0 to 15	No apparent contamination.

TABLE 8-1
SITE 16 CONE PENETORMETER TESTING WITH FUEL FLUORESCENCE DETECTION TESTING AND DIRECT-PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE,COLTS NECK, NEW JERSEY
PAGE 2 OF 3

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depth (feet bgs)	Comments
16CPT-11				10/10/96	0 to 15	Possible very slight contamination.
16CPT-12				10/10/96	0 to 15	No apparent contamination.
16CPT-13				10/10/96	0 to 15	Possible contamination between 0-4 feet bgs.
16CPT-14				10/10/96	0 to 15	No apparent contamination.
16CPT-15				10/10/96	0 to 14	No apparent contamination.
16CPT-16				10/10/96	0 to 14	No apparent contamination.
16CPT-17				10/10/96	0 to 14	No apparent contamination.
16CPT-18				10/10/96	0 to 18	No apparent contamination.
16CPT-19				10/10/96	0 to 18	No apparent contamination.
16CPT-20				10/10/96	0 to 15	Possible very slight contamination between 0-2 feet bgs. Possible contamination between 3-8 feet bgs.
16CPT-21				10/10/96	0 to 15	Moderate contamination between 9-11 feet bgs.
16CPT-22				10/10/96	0 to 15	No apparent contamination.
16CPT-23				10/10/96	0 to 14	No apparent contamination.
16CPT-24				10/11/96	0 to 20	Obvious contamination between 0-3 and 7-14 feet bgs. Very strong contamination at 11 feet bgs.

TABLE 8-1
SITE 16 CONE PENETORMETER TESTING WITH FUEL FLUORESCENCE DETECTION TESTING AND DIRECT-PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE,COLTS NECK, NEW JERSEY
PAGE 3 OF 3

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depth (feet bgs)	Comments
16CPT-25				10/15/96	0 to 15	Obvious contamination between 10-11.5 feet bgs.
16CPT-26				10/15/96	0 to 15	No apparent contamination.
16CPT-27				10/15/96	0 to 14.5	No apparent contamination
16CPT-28				10/15/96	0 to 15	No apparent contamination.
16CPT-29				10/15/96	0 to 15	No apparent contamination.
16CPT-30				10/15/96	0 to 21	Obvious contamination between 6.5-7.4 feet bgs. Very contaminated between 7.4-14.5 feet bgs. Contaminated between 14.5-16.5 feet bgs. Apparently clean below 16.5 feet bgs.
16CPT-31				10/15/96	0 to 17.5	Very contaminated between 11.2-14.3 feet bgs.

Note: All samples were analyzed for Target Compound List Volatile Organic Compounds.

1 bgs = below ground surface
2 TRC - Tracer Research Corporation (mobile laboratory)
3 IEA (fixed-base laboratory)

8.3.2 Lithologic Profiling

Lithologic profiling and FFD testing were performed at 31 locations (16CPT-01 through 16CPT-31) between October 9 and 15, 1996. Profile locations are shown in Figure 8-1. The maximum depth of any profile was 21 feet. The results of the profile are summarized in Table 8-1 and presented in Section 8.4.1.

Piezo-Electric Cone Penetration Tests

The penetrometer equipment was mounted inside a van body. The penetrometer probe had a conical tip and a friction sleeve that independently measured the vertical resistance beneath the tip as well as frictional resistance on the side of the probe as a function of depth. A pressure transducer in the cone measured the pore water pressure as the probe was pushed into the ground. Plots of normalized tip resistance versus friction ratio and normalized tip resistance versus penetration pore pressure were used to determine soil classification as a function of depth. Typically, a higher friction ratio indicates a type of clay or fine silts.

Fuel Fluorescence Detector Tests

The FFD is a separate module that was attached directly behind the cone to detect subsurface hydrocarbon contamination. The filter excitation light from a 254 nm ultraviolet light source is focused on the groundwater at the surface of the probe through a sapphire window, and the resulting fluorescence is returned through a fiber optic conductor to the up-hole controller.

8.3.3 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed four shallow permanent monitoring wells (MW16-07 through MW16-10) on October 17 and 18, 1996 to determine the quality of groundwater and to check for free-phase or dissolved-phase product at the site (Figure 8-1). Based on the results of the direct-push sampling program, the locations of the wells were to be outside of the "floating product" area. The borings ranged in depth from 17 to 18 feet, were drilled to approximately 8 feet below the water table, and were completed as cased wells, screened across the water table. Monitoring well characteristics are summarized in Table 8-2.

TABLE 8-2

SITE 16 MONITORING WELL CONSTRUCTION DETAILS NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

Well Number	Total Depth (feet bgs [1])	Screened Interval (feet bgs)	Top of Filter Pack (feet bgs)	Top of Bentonite Seal (feet bgs)	Completion Date
MW16-07	17.5	6.5-16.5	4.5	2.5	10/17/96
MW-16-8	18.0	7-17	5	3	10/17/96
MW16-09	17.0	6-16	4	2	10/18/96
MW16-10	17.5	6.5-16.5	4.5	2.5	10/18/96

1 bgs = below ground surface

The wells were constructed with 2-inch I.D. flush-jointed and threaded, NSF-certified, Schedule 40 PVC well casing and 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. Ten-foot screens were installed in the wells. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. A 2-foot-thick annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height approximately 1 foot below the ground surface. The wells were completed with 2-foot-high standpipes and with 4- by 4-foot concrete pad keyed into the well annulus. Monitoring well construction sheets are in Appendix C.

The wells were developed approximately 1 week after installation. Groundwater temperature, pH, conductivity, and turbidity were monitored during development. All wells were developed until removed water was visibly clear of suspended solids.

Static-Water-Level Measurements

In order to further define groundwater flow directions and horizontal and vertical groundwater gradients, B&R Environmental collected one round of static-water-level measurements on November 7, 1996 from the four newly installed wells (MW16-07 through MW16-10) and five of the existing wells (MW16-01 though MW16-03, MW16-06 and MW-1) (Table 8-3). Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 91.15 feet to 94.35 feet above MSL.

Groundwater Sampling

B&R Environmental collected groundwater samples from the newly installed monitoring wells (MW16-07 through MW16-10) to further investigate the current level and extent of contamination and to provide the data for use in the risk assessment and the evaluation of remedial action alternatives. The newly installed wells were sampled on November 7, 1996. The four new wells were fitted with dedicated laboratory-certified, contaminant-free bladder pumps before sampling. Field measurements collected during purging were pump rate (L/min.), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the wells using the micro-purge protocol, to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

The groundwater samples (16GW07 through 16GW10 which correspond to wells MW16-07 through MW16-10) and associated QA/QC samples were submitted to IEA for TCL VOC and SVOC analysis.

TABLE 8-3
SITE 16 STATIC-WATER-LEVEL MEASUREMENTS AND SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

Well Number	Date and Time of Measurement	Depth to Water (feet below TOC[1])	TOC Elevation	Groundwater Elevation	Sample Number	Date Sampled
MW-1	11/07/96 0950	9.19	103.06	93.87		
MW16-01	11/07/96 0920	8.66	103.01	94.35		
MW16-02	11/07/96 1000	6.53	99.03	92.50		
MW16-03	11/07/96 1042	7.25	99.86	92.61		
MW16-04			104.84			
MW16-05			104.80			
MW16-06	11/07/96 1050	7.55	99.31	91.76		
MW16-07	11/07/96 1035	10.32	103.53	93.21	16GW07	11/07/96
MW16-08	11/07/96 1025	10.73	103.64	92.91	16GW08/ DUP05	11/07/96
MW16-09	11/07/96 1015	9.22	100.37	91.15	16GW09	11/07/96
MW16-10	11/07/96 1005	8.72	100.70	91.98	16GW10	11/07/96

[1] TOC = Top of Casing

8.4 SITE CHARACTERISTICS

8.4.1 Geology

Regional mapping places Site 16/F within the outcrop area of the Vincentown Formation; upper colluvium may be present at the site. The upper colluvium has a maximum thickness of 10 feet, and the Vincentown Formation ranges between 10 and 130 feet in thickness. The soil borings are no more than 20 feet deep and the CPT lithologic profile locations are no more than 21 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upper colluvium and the Vincentown Formation. In general, the borings encountered fill material, brown pebbly, silty, fine- to medium-grained sand (possibly representative of the upper colluvium), and brownish-yellow, olive, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation).

Based upon the boring log descriptions, borings 16 SB 13 and 16 SB 15 penetrated fill material and upper colluvium, boring 16 SB 12 penetrated the upper colluvium, borings 16 SB 09 through 16 SB 11, 16 SB 14, and 16 SB 18 penetrated fill material, upper colluvium, and the Vincentown Formation, and wells MW16-01 through MW16-06 and borings 16 SB 07, 16 SB 08, 16 SB 16, 16 SB 17, 16 SB 19, and 16 SB 20 penetrated upper colluvium and the Vincentown Formation.

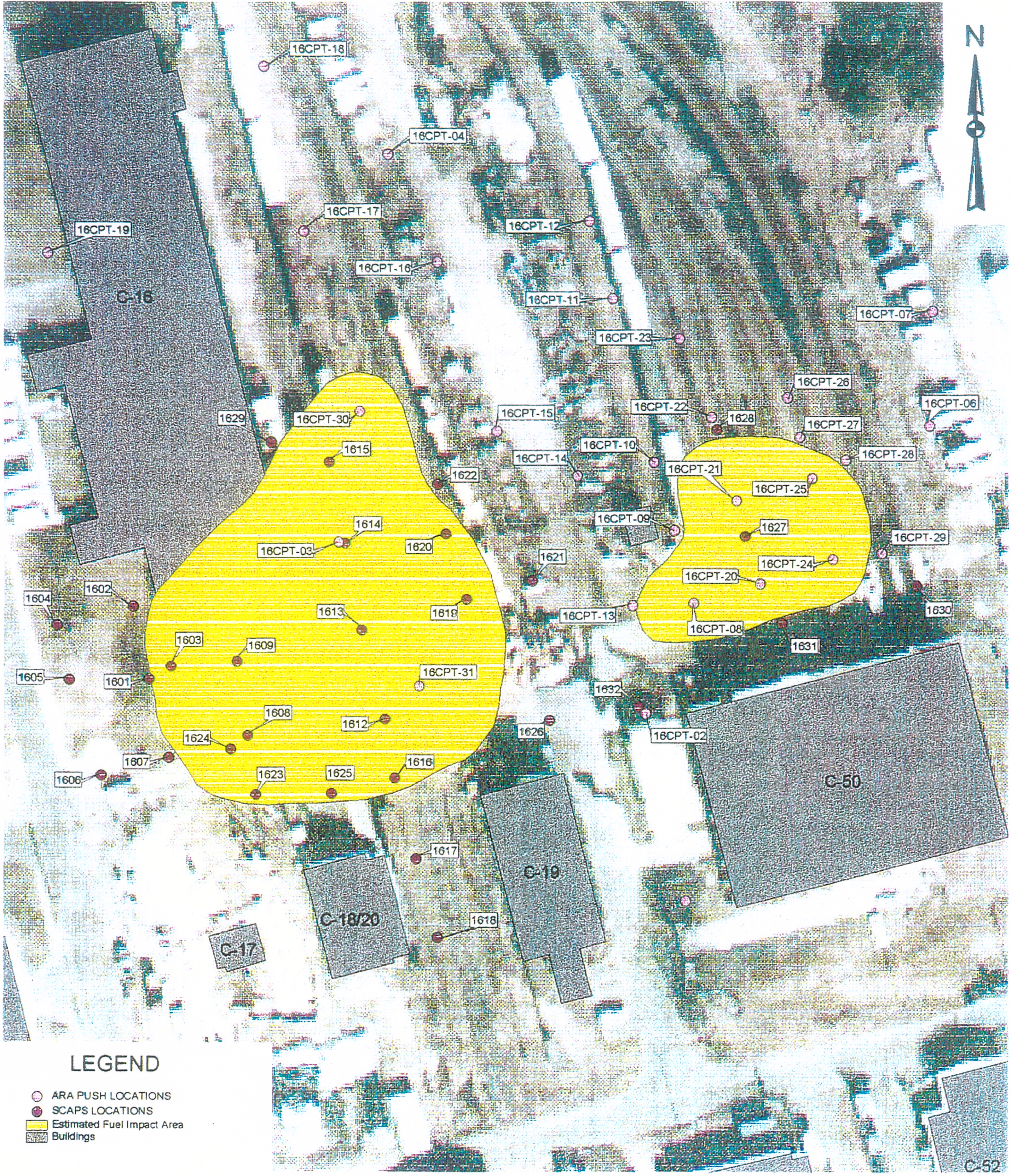
Based on CPT lithologic profiling direct-push investigations at locations 16CPT-03, 16CPT-09, 16CPT-11, 16CPT-13, 16CPT-17 through 16CPT-29 penetrated up to 6 feet of gravelly soil (possibly representative of the upper colluvium) on top of sand mixture. In general, the remaining locations penetrated sand and sand mixture.

Zones of obvious to possible contamination identified during 1996 RI Addendum activities using FFD testing in conjunction with CPT are

4.75 - 6 feet	at location	16CPT-03
3 - 5 feet	at location	16CPT-09
0 - 4 feet	at location	16CPT-13
0 - 8 feet	at location	16CPT-20
9 - 11 feet	at location	16CPT-21
0 - 14 feet	at location	16CPT-24
10 - 11.5 feet	at location	16CPT-25
6 - 16.5 feet	at location	16CPT-30
11 - 14.3 feet	at location	16CPT-31

The areal extent of contaminants was identified using ARA (1996 RI Addendum Activity) and SCAPS (1995 Navy Study) data as shown on Figure 8-2.

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ Site 16 Fuel Plume



ESTIMATED EXTENT OF FUEL IMPACTED SOIL
SITE 16 AND EPIC SITE F

80 0 80 160 Feet

FIGURE 8-2

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8.4.2 Hydrogeology

Groundwater in the upper colluvium and Vincentown aquifer beneath the site occurs under unconfined conditions, and the geologic units are interpreted to be hydraulically interconnected. A free-product layer consisting of light, non-aqueous phase liquid (LNAPL) was discovered floating on top of shallow groundwater in wells MW16-04 and MW16-05. Figure 8-2 shows the estimated areal extent of the free-product layer. Static-water-level measurements, water-table elevations, and depths to the free-product layer and product-water interface are summarized in Table 8-3. Groundwater elevations for November 6, 1996 are contoured on Figure 8-3. The direction of shallow groundwater flow in the aquifer, as indicated by the November 6, 1996 readings, is toward the north. There does not appear to be a significant seasonal variation in groundwater flow direction. Based on boring log descriptions, well MW16-06 is screened in the upper colluvium and the Vincentown Formation, and wells MW16-01 through MW16-05 are screened in the Vincentown Formation. Boring logs are not available for MW16-06 through MW16-09. The hydraulic conductivity calculated for MW16-01 (Vincentown Formation) is 3.48 x 10^{-4} cm/sec (0.99 ft/day). Two hydraulic conductivities were calculated for MW16-06 (upper colluvium and Vincentown Formation): 1.39 x 10^{-3} cm/sec (3.94 ft/day) from rising-head slug test data and 6.79 x 10^{-4} cm/sec (1.93 ft/day) from falling-head slug test data.

8.5 NATURE AND EXTENT OF CONTAMINATION

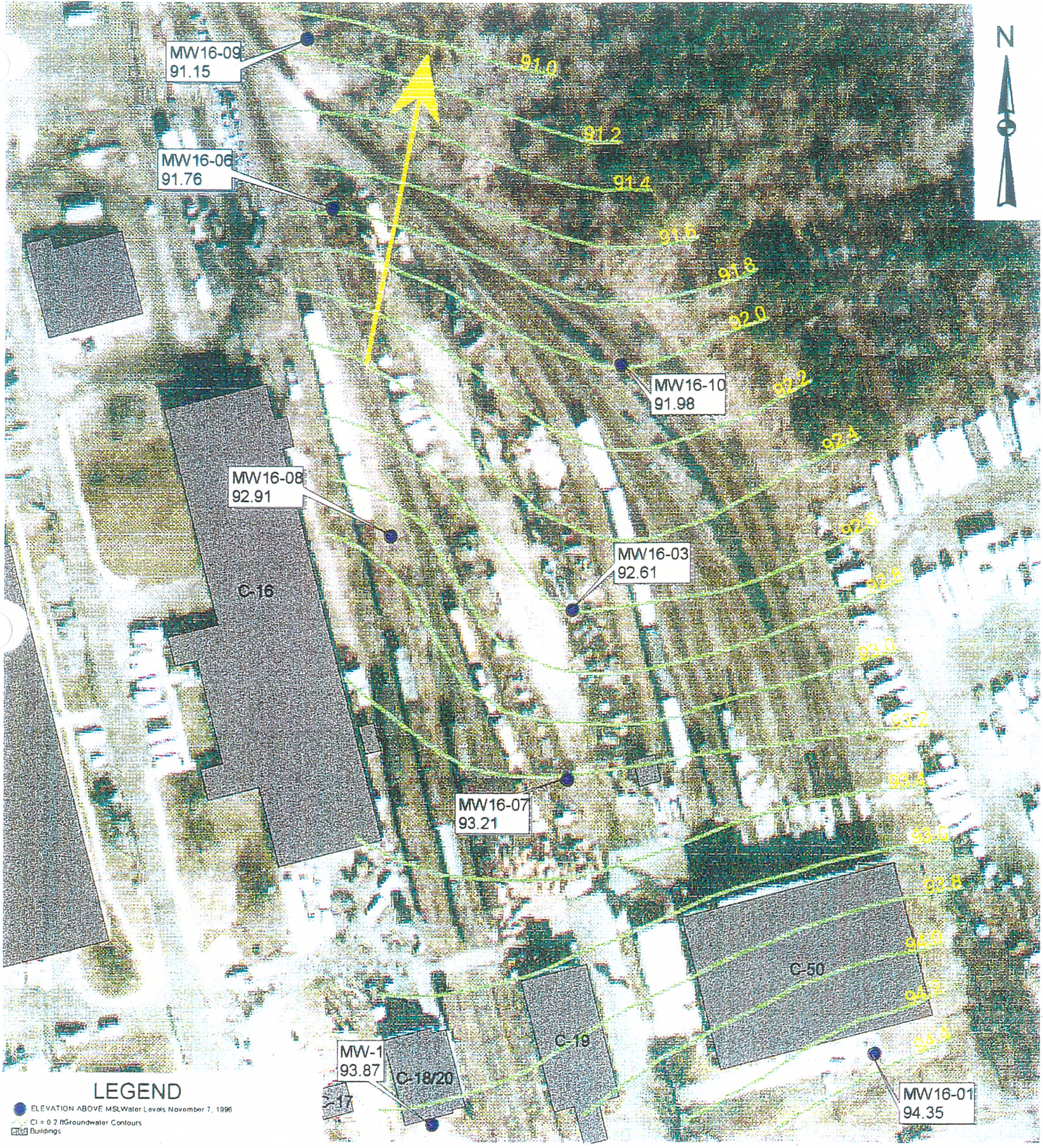
8.5.1 Surface Soils

Three site-related surface soil samples (16 SS 01 through 16 SS 03) were collected at Site 16 (Figure 8-1). Tables 8-4 and 8-5 present the occurrence and distribution of inorganic and organic chemicals detected in site-related surface soil samples and compare them to background. Table 8-6 presents a comparison of detected compounds to ARARs and TBCs. Figure 8-4 presents sample locations with concentrations of compounds found above ARARs and TBCs.

8.5.1.1 Inorganics

Concentrations of antimony, barium, cadmium, chromium, copper, lead, magnesium, nickel, silver, and zinc in all site-related samples were greater than the ranges detected in background samples. Generally, higher levels of metals were found on 16 SS 01 and 16 SS 03.

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ SITE 16 971107WC



GROUNDWATER CONTOUR MAP NOVEMBER 7, 1996
SITE 16 AND EPIC SITE F

100 0 100 200 Feet

FIGURE 8-3

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TABLE 8-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKG?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	7.5E+03	6152.50	3 / 3	2570 - 4190	3640.00	NO	NO	4190
ANTIMONY*	NOT DETECTED	-	-	-	3 / 3	0.75 - 28	11.92	YES	-	28
ARSENIC*	4 / 4	1.35 - 14.4	2.3E+01	13.43	3 / 3	5.2 - 10.5	7.03	NO	NO	10.5
BARIUM*	4 / 4	1.85 - 31	4.7E+01	22.53	3 / 3	78.3 - 133	106.77	YES	YES	133
BERYLLIUM	1 / 4	0.28	5.6E+00	0.39	3 / 3	0.13 - 0.25	0.19	NO	NO	0.25
CADMIUM*	1 / 4	0.57	7.5E-01	0.67	3 / 3	6.1 - 10.2	8.13	YES	YES	10.2
CALCIUM	4 / 4	40.1 - 519	6.8E+03	551.80	3 / 3	2280 - 4230	3186.67	YES	NO	4230
CHROMIUM*	4 / 4	7.8 - 59.5	1.1E+02	69.05	3 / 3	40.9 - 171	111.97	YES	YES	171
COBALT	2 / 4	0.75 - 5	7.6E+00	3.15	3 / 3	4 - 7.7	5.40	YES	NO	7.7
COPPER*	4 / 4	0.97 - 8.4	1.5E+01	10.06	3 / 3	49.8 - 231	158.93	YES	YES	231
IRON	4 / 4	3745 - 62500	9.6E+04	52402.50	3 / 3	26100 - 57500	37466.67	NO	NO	57500
LEAD*	4 / 4	1.8 - 39.4	4.0E+02	37.30	3 / 3	359 - 1030	688.00	YES	YES	1030
MAGNESIUM	4 / 4	71.7 - 619	9.0E+02	578.85	3 / 3	1300 - 1530	1393.33	YES	YES	1530
MANGANESE	4 / 4	3.45 - 214	3.3E+02	128.33	3 / 3	94.8 - 307	179.93	YES	NO	307
MERCURY	4 / 4	0.035 - 0.17	5.9E-01	0.18	3 / 3	0.018 - 0.28	0.14	NO	NO	0.28
NICKEL*	2 / 4	1.8 - 7.2	1.1E+01	5.18	3 / 3	10.3 - 16.5	13.40	YES	YES	16.5
POTASSIUM	4 / 4	95 - 792	4.1E+03	912.50	3 / 3	342 - 537	441.33	NO	NO	537
SILVER*	2 / 4	0.37 - 0.67	9.7E-01	0.69	3 / 3	1.8 - 25.3	12.10	YES	YES	25.3
SODIUM	4 / 4	17.5 - 86.2	1.2E+02	78.30	3 / 3	123 - 173	150.33	YES	YES	173
VANADIUM	4 / 4	11.05 - 64	2.0E+02	70.13	3 / 3	15.5 - 32.1	23.73	NO	NO	32.1
ZINC*	3 / 4	1.1 - 27.6	4.6E+02	22.80	3 / 3	111 - 1180	508.67	YES	YES	1180

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400

TABLE 8-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	NOT DETECTED	-	-	1 / 2	360	360
4,4'-DDE *	2 / 4	16 - 330	277.86	2 / 2	15 - 120	120
4,4'-DDT *	2 / 4	43 - 420	355.71	3 / 3	38 - 230	230
4-METHYLPHENOL *	NOT DETECTED	-	-	1 / 3	110	110
ACENAPHTHYLENE *	NOT DETECTED	-	-	1 / 3	100	100
ALPHA-BHC *	NOT DETECTED	-	-	2 / 3	0.047 - 0.13	0.13
ALPHA-CHLORDANE *	NOT DETECTED	-	-	1 / 3	33	33
ANTHRACENE *	NOT DETECTED	-	-	2 / 3	57 - 170	170
BENZO(A)ANTHRACENE *	NOT DETECTED	-	-	3 / 3	160 - 450	450
BENZO(A)PYRENE *	NOT DETECTED	-	-	3 / 3	160 - 1200	1200
BENZO(B)FLUORANTHENE *	NOT DETECTED	-	-	3 / 3	350 - 1000	1000
BENZO(G,H,I)PERYLENE *	NOT DETECTED	-	-	3 / 3	150 - 340	340
BENZO(K)FLUORANTHENE *	NOT DETECTED	-	-	1 / 3	86	86
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	3 / 3	1800 - 12000	12000
BUTYLBENZYLPHTHALATE *	1 / 4	220	220	1 / 3	160	160
CARBAZOLE *	NOT DETECTED	-	-	2 / 3	42 - 54	54
CHRYSENE *	NOT DETECTED	-	-	3 / 3	250 - 810	810
DI-N-BUTYLPHTHALATE *	2 / 4	45 - 48	48	2 / 3	44 - 100	100
FLUORANTHENE *	2 / 4	40 - 84	84	3 / 3	340 - 510	510
GAMMA-CHLORDANE *	NOT DETECTED	-	-	3 / 3	1.7 - 35	35
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	1 / 3	0.39	0.39
INDENO(1,2,3-CD)PYRENE *	NOT DETECTED	-	-	2 / 3	120 - 200	200
N-NITROSODIPHENYLAMINE *	NOT DETECTED	-	-	1 / 3	63	63
PHENANTHRENE *	NOT DETECTED	-	-	3 / 3	210 - 370	370
PYRENE *	1 / 4	46	46	3 / 3	670 - 4400	4400

* - Selected as a COPC

TABLE 8-6a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

							ARARS & TBCs		
SAMPLE NUMBER:	16GW01	16GW02	16GW02-F	16GW03	16GW04	16GW04-DL	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
LOCATION:	16GW01	16GW02	16GW02	16GW03	16GW04	16GW04			
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	08/12/95	08/12/95	08/14/95	08/13/95	08/31/95	08/31/95			
GENERAL CHEMISTRY	**none**	**none**	**none**	**none**	**none**	**none**	none	none	none
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	ug/L	ug/L	ug/L
aluminum	5290 E J	3720 E J	161	5480 E J	1340 E	n/a	-	-	200
arsenic	5.6	5.8	3.3 U	5.3	9.4 E	n/a	50.0	-	8.00
barium	321	356	3.1	408	4.4	n/a	2000	2000 a	2000
beryllium	0.18	0.11 U	0.11 U	0.26	5.0 U	n/a	4.00	4000 e	20.0
cadmium	0.38 U	0.38 U	0:38 U	0.38 U	0.65	n/a	5.00	5.00 e	4.00
calcium	7190	2530	1990	6160	23500	n/a	-	-	-
chromium, total	116 E	80.5	13.6	116 E	24.0	n/a	100 *	100 a	100
cobalt	1.4	1.3	0.88	1.6	0.71	n/a	-	-	-
copper	12.2	15.2	3.2	13.7	0.80	n/a	1300	-	1000
iron	14100 E	11300 E	179	15300 E	178000 E	n/a	-	-	300
lead	3.2	2.0	1.5 UJ	3.1	2.1	n/a	15.0	-	10.0
magnesium	2100	1410	602	2610	5800	n/a	-	-	-
manganese	70.2 E	10.8	10.9	25.6	47.0	n/a	-	-	50.0
mercury	0.086	0.084	0.025	0.088	0.035	n/a	2.00	2.00 b	2.00
nickel	0.75 U	0.75 U	1.9	0.75 U	40.0 U	n/a	100	100 a	100
potassium	3870	2510	323	4320	5000 U	n/a	-	-	-
selenium	4.4 U	4.4 U	4.4 U	4.4 U	13.5	n/a	50.0	-	50.0
sodium	57700 E	49400	50100 E	48000	104000 E	n/a	-	-	50000
thallium	3.6 U	3.6 U	3.6 U	3.6 U	10.0 U	n/a	2.00	0.400 a	10.0
vanadium	52.9	34.1	1.0	53.4	11.0	n/a	-	-	-
zinc	191	260	4.2	208	20.0	n/a	-	2000 a	5000
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	ug/L	ug/L	ug/L
2,4-dimethylphenol	10.0 U	10.0 U	n/a	10.0 U	100 U	400 U	-	-	100
2-methylnaphthalene	10.0 U	10.0 U	n/a	10.0 U	1900 J	1800	-	-	-
4-methylphenol	10.0 U	10.0 U	n/a	10.0 U	100 U	400 U	-	100 a	-
acenaphthene	10.0 U	10.0 U	n/a	10.0 U	91.0 J	91.0 J	-	-	400

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW01	16GW02	16GW02-F	16GW03	16GW04	16GW04-DL	ARARS & TBCs		
LOCATION:	16GW01	16GW02	16GW02	16GW03	16GW04	16GW04	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	08/12/95	08/12/95	08/14/95	08/13/95	08/31/95	08/31/95			
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	10.0 U	10.0 U	n/a	1.0 J	100 U	400 U	-	-	30.0
carbazole	10.0 U	10.0 U	n/a	10.0 U	100 U	400 U	-	-	-
dibenzofuran	10.0 U	10.0 U	n/a	10.0 U	73.0 J	63.0 J	-	-	-
fluorene	10.0 U	10.0 U	n/a	10.0 U	140	140 J	-	-	300
naphthalene	10.0 U	10.0 U	n/a	1.0 J	690 E	690 E	-	20.0 a	300
phenanthrene	10.0 U	10.0 U	n/a	10.0 U	240	230 J	-	-	-
phenol	10.0 U	10.0 U	n/a	10.0 U	100 U	400 U	-	4000 a	4000
pyrene	10.0 U	10.0 U	n/a	10.0 U	27.0 J	400 U	-	-	200
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	10.0 U	n/a	10.0 U	25.0 U	100 U	7.00	7.00 a	2.00
1,2-dichloroethane	10.0 U	10.0 U	n/a	10.0 U	25.0 U	100 U	5.00	700 e	2.00
1,2-dichloroethene (total)	10.0 U	10.0 U	n/a	10.0 U	11.0 J	10.0 J	70.0 a	70.0 a	70.0
benzene	10.0 U	10.0 U	n/a	10.0 U	350 E	340 E	5.00	200 d	1.00
bromodichloromethane	10.0 U	10.0 U	n/a	1.0 J	25.0 U	100 U	100	2000 e	1.00
carbon tetrachloride	10.0 U	10.0 U	n/a	10.0 U	25.0 U	100 U	5.00	70.0 e	2.00
chloroform	4.0 J	10.0 U	n/a	6.0 J	25.0 U	100 U	100	100 e	6.00
ethylbenzene	10.0 U	10.0 U	n/a	10.0 U	330	300	700	700 a	700
tetrachloroethene	10.0 U	10.0 U	n/a	1.0 J	25.0 U	100 U	5.00	1000 e	1.00
toluene	10.0 U	10.0 U	n/a	10.0 U	40.0	39.0	1000	1000 a	1000
trichloroethene	10.0 U	10.0 U	n/a	10.0 U	25.0 U	100 U	5.00	-	1.00
vinyl chloride	10.0 U	10.0 U	n/a	10.0 U	25.0 U	100 U	2.00	10.0 e	5.00
xylene (total)	10.0 U	10.0 U	n/a	10.0 U	1700 E J	1600 E	10000	10000 a	1000
CHARACTERISTICS									
hydrocarbon fingerprint	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 8-6a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW04-OIL	16GW05	16GW05-DL	16GW05-OIL	16GW06	16GW06-F	ARARS & TBCs		
LOCATION:	16GW04	16GW05	16GW05	16GW05	16GW06	16GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	08/31/95	08/31/95	08/31/95	08/31/95	08/12/95	08/12/95			
GENERAL CHEMISTRY	none	none	none	none	none	none	none	none	none
specific gravity	0.85	n/a	n/a	0.86	n/a	n/a	-	-	-
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	900 E	n/a	n/a	85200 E J	132	-	-	200
arsenic	n/a	10.0 U	n/a	n/a	156 E	3.6	50.0	-	8.00
barium	n/a	31.2	n/a	n/a	432	8.1	2000	2000 a	2000
beryllium	n/a	5.0 U	n/a	n/a	9.8 E	0.11 U	4.00	4000 e	20.0
cadmium	n/a	0.56	n/a	n/a	4.9 E	2.0	5.00	5.00 e	4.00
calcium	n/a	17700	n/a	n/a	3210	2490	-	-	-
chromium, total	n/a	5.3	n/a	n/a	2070 E	12.6	100	100 a	100
cobalt	n/a	50.0 U	n/a	n/a	8.8	0.75	-	-	-
copper	n/a	0.88	n/a	n/a	41.9	0.87	1300	-	1000
iron	n/a	49100 E	n/a	n/a	379000 E	53500 E	-	-	300
lead	n/a	5.4	n/a	n/a	46.5 E	1.5 UJ	15.0	-	10.0
magnesium	n/a	4660	n/a	n/a	17700	763	-	-	-
manganese	n/a	84.0 E	n/a	n/a	79.6 E	39.0	-	-	50.0
mercury	n/a	0.050	n/a	n/a	0.18	0.016	2.00	2.00 b	2.00
nickel	n/a	40.0 U	n/a	n/a	20.0	1.3	100	100 a	100
potassium	n/a	1870	n/a	n/a	54900	624	-	-	-
selenium	n/a	5.0 U	n/a	n/a	17.0	4.4 U	50.0	-	50.0
sodium	n/a	159000 E	n/a	n/a	16100	16100	-	-	50000
thallium	n/a	10.0 U	n/a	n/a	15.6 E	3.6 U	2.00	0.400 a	10.0
vanadium	n/a	50.0 U	n/a	n/a	874	0.87	-	-	-
zinc	n/a	17.2	n/a	n/a	360	10.0	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
2,4-dimethylphenol	n/a	48.0	52.0	n/a	10.0 U	n/a	-	-	100
2-methylnaphthalene	n/a	170 J	250	n/a	10.0 U	n/a	-	-	-
4-methylphenol	n/a	10.0 U	50.0 U	n/a	10.0 U	n/a	-	100 a	-
acenaphthene	n/a	8.0 J	11.0 J	n/a	10.0 U	n/a	-	-	400

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW04-OIL	16GW05	16GW05-DL	16GW05-OIL	16GW06	16GW06-F	ARARS & TBCs		
LOCATION:	16GW04	16GW05	16GW05	16GW05	16GW06	16GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	08/31/95	08/31/95	08/31/95	08/31/95	08/12/95	08/12/95			
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	n/a	92.0 E J	190 E	n/a	3.0 J	n/a	-	-	30.0
carbazole	n/a	12.0	16.0 J	n/a	10.0 U	n/a	-	-	-
dibenzofuran	n/a	6.0 J	7.0 J	n/a	10.0 U	n/a	-	-	-
fluorene	n/a	11.0	14.0 J	n/a	10.0 U	n/a	-	-	300
naphthalene	n/a	100 E J	220 E	n/a	3.0 J	n/a	-	20.0 a	300
phenanthrene	n/a	17.0	22.0 J	n/a	10.0 U	n/a	-	-	-
phenol	n/a	11.0	15.0 J	n/a	12.0	n/a	-	4000 a	4000
pyrene	n/a	10.0 U	50.0 U	n/a	10.0 U	n/a	-	-	200
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	n/a	50.0 U	100 U	n/a	10.0 U	n/a	7.00	7.00 a	2.00
1,2-dichloroethane	n/a	50.0 U	100 U	n/a	10.0 U	n/a	5.00	700 e	2.00
1,2-dichloroethene (total)	n/a	50.0 U	100 U	n/a	38.0	n/a	70.0 a	70.0 a	70.0
benzene	n/a	1700 E J	1900 E	n/a	200 E	n/a	5.00	200 d	1.00
bromodichloromethane	n/a	50.0 U	100 U	n/a	10.0 U	n/a	100	2000 e	1.00
carbon tetrachloride	n/a	50.0 U	100 U	n/a	10.0 U	n/a	5.00	70.0 e	2.00
chloroform	n/a	50.0 U	100 U	n/a	10.0 U	n/a	100	100 e	6.00
ethylbenzene	n/a	170	160	n/a	2.0 J	n/a	700	700 a	700
tetrachloroethene	n/a	50.0 U	100 U	n/a	10.0 U	n/a	5.00	1000 e	1.00
toluene	n/a	160	160	n/a	7.0 J	n/a	1000	1000 a	1000
trichloroethene	n/a	50.0 U	100 U	n/a	10.0 U	n/a	5.00	-	1.00
vinyl chloride	n/a	50.0 U	100 U	n/a	10.0 U	n/a	2.00	10.0 e	5.00
xylene (total)	n/a	250	250	n/a	26.0	n/a	10000	10000 a	1000
CHARACTERISTICS									
hydrocarbon fingerprint	NO. 2	n/a	n/a	NO. 2	n/a	n/a	-	-	-
specific gravity	0.85	n/a	n/a	0.86	n/a	n/a	-	-	-

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW07	16GW08	16GW08-DUP	16GW09	16GW10	16HP01 10/15/96	ARARS & TBCs		
LOCATION:	16GW07	16GW08	16GW08	16GW09	16GW10	16HP01	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI	1996 RI	1996 RI	1996 RI, Field			
SAMPLE DATE:	11/07/96	11/07/96	11/07/96	11/07/96	11/07/96	10/15/96			
GENERAL CHEMISTRY	none	none	none	none	none	none	none	none	none
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
2,4-dimethylphenol	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	100
2-methylnaphthalene	10.0 U	10.0 U	10.0 U	10.0 U	3.0 J	n/a	-	-	-
4-methylphenol	10.0 U	10.0 U	10.0 U	1.0 J	10.0 U	n/a	-	100 a	-
acenaphthene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	400

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW07	16GW08	16GW08-DUP	16GW09	16GW10	16HP01 10/15/96	ARARS & TBCs		
LOCATION:	16GW07	16GW08	16GW08	16GW09	16GW10	16HP01	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI	1996 RI	1996 RI	1996 RI, Field			
SAMPLE DATE:	11/07/96	11/07/96	11/07/96	11/07/96	11/07/96	10/15/96			
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	30.0
carbazole	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	-
dibenzofuran	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	-
fluorene	10.0 U	10.0 U	10.0 U	10.0 U	1.0 J	n/a	-	-	300
naphthalene	1.0 J	10.0 U	10.0 U	10.0 U	2.0 J	n/a	-	20.0 a	300
phenanthrene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	-
phenol	10.0 U	10.0 U	10.0 U	11.0	10.0 U	n/a	-	4000 a	4000
pyrene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	-	-	200
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.050	7.00	7.00 a	2.00
1,2-dichloroethane	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	4.0 E	5.00	700 e	2.00
1,2-dichloroethene (total)	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.070 U	70.0 a	70.0 a	70.0
benzene	10.0 U	10.0 U	10.0 U	40.0 E	10.0 U	0.20 U	5.00	200 d	1.00
bromodichloromethane	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	n/a	100	2000 e	1.00
carbon tetrachloride	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.0003	5.00	70.0 e	2.00
chloroform	4.0 J	10.0 U	10.0 U	10.0 U	10.0 U	0.0020 U	100	100 e	6.00
ethylbenzene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1.0 U	700	700 a	700
tetrachloroethene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.0008 U	5.00	1000 e	1.00
toluene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.60 U	1000	1000 a	1000
trichloroethene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	0.0010 U	5.00	-	1.00
vinyl chloride	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	n/a	2.00	10.0 e	5.00
xylene (total)	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	2.0 U	10000	10000 a	1000
CHARACTERISTICS									
hydrocarbon fingerprint	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16HP01-13	16HP01-13-DUP	16HP02 10/15/96	16HP03 10/15/96	16HP04 10/15/96	16HP05 10/15/96	ARARS & TBCs		
LOCATION:	16HP01	16HP01	16HP02	16HP03	16HP04	16HP05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/15/96	10/15/96	10/15/96	10/15/96	10/15/96	10/15/96			
GENERAL CHEMISTRY	**none**	**none**	**none**	**none**	**none**	**none**	none	none	none
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
arsenic	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	8.00
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
beryllium	n/a	n/a	n/a	n/a	n/a	n/a	4.00	4000 e	20.0
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
selenium	n/a	n/a	n/a	n/a	n/a	n/a	50.0	-	50.0
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
thallium	n/a	n/a	n/a	n/a	n/a	n/a	2.00	0.400 a	10.0
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	ug/L	ug/L	ug/L
2,4-dimethylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	-	100
2-methylnaphthalene	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
4-methylphenol	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
acenaphthene	n/a	n/a	n/a	n/a	n/a	n/a	-	-	400

TABLE 8-6a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16HP01-13	16HP01-13-DUP	16HP02 10/15/96	16HP03 10/15/96	16HP04 10/15/96	16HP05 10/15/96	ARARS & TBCs		
LOCATION:	16HP01	16HP01	16HP02	16HP03	16HP04	16HP05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/15/96	10/15/96	10/15/96	10/15/96	10/15/96	10/15/96			
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	n/a	n/a	n/a	n/a	n/a	n/a	-	-	30.0
carbazole	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dibenzofuran	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
fluorene	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
naphthalene	n/a	n/a	n/a	n/a	n/a	n/a	-	20.0 a	300
phenanthrene	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
phenol	n/a	n/a	n/a	n/a	n/a	n/a	-	4000 a	4000
pyrene	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	10.0 U	0.0040 U	0.0040 U	0.50	0.010	7.00	7.00 a	2.00
1,2-dichloroethane	10.0 U	10.0 U	0.70 U	0.70 U	0.80	0.70	5.00	700 e	2.00
1,2-dichloroethene (total)	14.0	10.0	0.070 U	4.0	0.090	4.0	70.0 a	70.0 a	70.0
benzene	10.0 U	10.0 U	0.20 U	0.20 U	28.0 E	44.0 E	5.00	200 d	1.00
bromodichloromethane	10.0 U	10.0 U	n/a	n/a	n/a	n/a	100	2000 e	1.00
carbon tetrachloride	10.0 U	10.0 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	5.00	70.0 e	2.00
chloroform	10.0 U	10.0 U	0.0020 U	0.060 U	0.030 U	0.030 U	100	100 e	6.00
ethylbenzene	10.0 U	10.0 U	1.0 U	1.0 U	1.0 U	1.0 U	700	700 a	700
tetrachloroethene	10.0 U	10.0 U	0.0008 U	0.0008 U	0.050 U	2.0 E	5.00	1000 e	1.00
toluene	10.0 U	10.0 U	0.60 U	0.60 U	0.60 U	0.60 U	1000	1000 a	1000
trichloroethene	10.0 U	10.0 U	0.0010 U	0.0010 U	0.10 U	0.90	5.00	-	1.00
vinyl chloride	4.0 E J	10.0 UJ	n/a	n/a	n/a	n/a	2.00	10.0 e	5.00
xylene (total)	10.0 U	10.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10000	10000 a	1000
CHARACTERISTICS									
hydrocarbon fingerprint	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16HP05-DUP	16MW01	- - -	- - -	- - -	- - -	ARARS & TBCs		
LOCATION:	16HP05	16MW01	- - -	- - -	- - -	- - -	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1995 RI							
SAMPLE DATE:	10/15/96	08/22/95							
GENERAL CHEMISTRY	**none**	**none**					**none**	**none**	**none**
specific gravity	n/a	n/a					-	-	-
INORGANICS	**ug/L**	**ug/L**					**ug/L**	**ug/L**	**ug/L**
aluminum	n/a	2110 E					-	-	200
arsenic	n/a	3.3 U					50.0	-	8.00
barium	n/a	133					2000	2000 a	2000
beryllium	n/a	0.44					4.00	4000 e	20.0
cadmium	n/a	0.41					5.00	5.00 e	4.00
calcium	n/a	14200					-	-	-
chromium, total	n/a	34.0					100 *	100 a	100
cobalt	n/a	2.6					-	-	-
copper	n/a	5.1					1300	-	1000
iron	n/a	1240 E					-	-	300
lead	n/a	2.0					15.0	-	10.0
magnesium	n/a	2880					-	-	-
manganese	n/a	77.9 E					-	-	50.0
mercury	n/a	0.084 J					2.00	2.00 b	2.00
nickel	n/a	184 E					100	100 a	100
potassium	n/a	2650					-	-	-
selenium	n/a	4.4 U					50.0	-	50.0
sodium	n/a	69300 E					-	-	50000
thallium	n/a	13.0 E					2.00	0.400 a	10.0
vanadium	n/a	1.0					-	-	-
zinc	n/a	2.0					-	2000 a	5000
SEMIVOLATILES	**ug/L**	**ug/L**					**ug/L**	**ug/L**	**ug/L**
2,4-dimethylphenol	n/a	10.0 U					-	-	100
2-methylnaphthalene	n/a	10.0 U					-	-	-
4-methylphenol	n/a	10.0 U					-	100 a	-
acenaphthene	n/a	10.0 U					-	-	400

TABLE 8-6a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16HP05-DUP	16MW01	---	---	---	---	ARARS & TBCs		
LOCATION:	16HP05	16MW01	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1995 RI							
SAMPLE DATE:	10/15/96	08/22/95							
SEMIVOLATILES	ug/L	ug/L					ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	n/a	10.0 U					-	-	30.0
carbazole	n/a	10.0 U					-	-	-
dibenzofuran	n/a	10.0 U					-	-	-
fluorene	n/a	10.0 U					-	-	300
naphthalene	n/a	10.0 U					-	20.0 a	300
phenanthrene	n/a	10.0 U					-	-	-
phenol	n/a	10.0 U					-	4000 a	4000
pyrene	n/a	10.0 U					-	-	200
VOLATILES	ug/L	ug/L					ug/L	ug/L	ug/L
1,1-dichloroethene	0.40 U	10.0 U					7.00	7.00 a	2.00
1,2-dichloroethane	69.0 U	10.0 U					5.00	700 e	2.00
1,2-dichloroethene (total)	7.0 U	10.0 U					70.0 a	70.0 a	70.0
benzene	33.0 E	10.0 U					5.00	200 d	1.00
bromodichloromethane	n/a	10.0 U					100	2000 e	1.00
carbon tetrachloride	0.030 U	10.0 U					5.00	70.0 e	2.00
chloroform	0.20 U	14.0 E					100	100 e	6.00
ethylbenzene	3.0 U	10.0 U					700	700 a	700
tetrachloroethene	2.0 E	10.0 U					5.00	1000 e	1.00
toluene	2.0 U	10.0 U					1000	1000 a	1000
trichloroethene	0.10 U	10.0 U					5.00	-	1.00
vinyl chloride	n/a	10.0 U					2.00	10.0 e	5.00
xylene (total)	4.0 U	10.0 U					10000	10000 a	1000
CHARACTERISTICS									
hydrocarbon fingerprint	n/a	n/a					-	-	-
specific gravity	n/a	n/a					-	-	-

TABLE 8-6a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 8-6b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW01	16GW02	16GW03	16GW04	16GW05	16GW06	ARARS & TBCs		
LOCATION:	16GW01	16GW02	16GW03	16GW04	16GW05	16GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	08/12/95	08/12/95	08/13/95	08/31/95	08/31/95	08/12/95			
MISCELLANEOUS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
petroleum hydrocarbons	0.30 U	0.30 U	0.30 U	190	20.0	0.20 J	-	-	-

TABLE 8-6b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	16MW01 16MW01 1995 RI 08/22/95	- - - - - -	- - - - - -	- - - - - -	- - - - - -	- - - - - -	ARARS & TBCs Maximum Contaminant Level (MCL)	 Drinking Water Health Advisory (Lowest Criterion Shown)	 NJDEP Groundwater Quality Standard
MISCELLANEOUS	mg/L						mg/L	mg/L	mg/L
petroleum hydrocarbons	0.10 J						-	-	-

TABLE 8-6b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 8-6c
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	16SB01-06 16SB01 1995 RI 07/09/95	16SB02-04 16SB02 1995 RI 07/09/95	16SB03-02 16SB03 1995 RI 07/09/95	16SB03-06 16SB03 1995 RI 07/09/95	16SB04-08 16SB04 1995 RI 07/09/95	16SB04-08-DUP 16SB04 1995 RI 07/09/95	ARARS & TBCs NJDEP Soil Residential Direct Contact Cleanup Criteria	 NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	 NJDEP Soil Impact to Groundwater Cleanup Criteria
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	2980	3170	378	2690	3180	2330	-	-	-
arsenic	8.3	11.3	0.73 U	6.1	7.8	8.0	20.0	20.0	-
barium	2.4	1.2	4.5	2.1	1.5	1.3	700	47000	-
beryllium	0.47	0.28	0.024 U	0.19	0.37	0.22	1.00	1.00	-
cadmium	0.92	1.3 E	0.10	0.86	1.0	1.0	1.00	100	-
calcium	216	58.4	98.5	111	261	215	-	-	-
chromium, total	111	125	5.5	93.2	90.9	92.2	-	500	-
cobalt	0.70 U	0.72 U	0.13	0.29	0.69 U	0.70 U	-	-	-
copper	2.0	1.9	1.5	2.1	1.4	1.4	600	600	-
iron	12100	18000	1160	11800	12700	12200	-	-	-
lead	3.3	4.3 J	70.7	4.0	3.8 J	4.8 J	400	600	-
magnesium	532	317	40.8	200	464	286	-	-	-
manganese	0.67 U	0.70 U	3.5	2.2	0.67 U	0.68 U	-	-	-
mercury	0.032 J	0.018 J	0.0022 U	0.0023 U	0.0067 UJ	0.010 J	14.0	270	-
nickel	1.0	1.1 U	0.56	1.0	1.0 U	1.0 U	250	2400	-
potassium	1730	1050	91.2	615	1580	973	-	-	-
selenium	1.0 U	1.1 U	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.49 U	0.50 U	0.21 U	0.22 U	0.49 U	0.49 U	110	4100	-
sodium	282	188	41.7	97.4	21.5	23.0	-	-	-
thallium	0.86 J	1.6 J	0.79 U	0.88	1.5 J	1.4 J	2.00	2.00	-
vanadium	58.7	79.6	6.0	59.2	47.4	47.0	370	7100	-
zinc	7.0 J	6.7 J	3.0 J	3.8 J	6.8 J	7.0 J	1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2-methylnaphthalene	380 U	400 U	360 U	390 U	130000	170000	-	-	-
acenaphthene	380 U	400 U	360 U	390 U	6900 J	8200 J	3400000	10000000	100000
anthracene	380 U	400 U	360 U	390 U	2300 J	2800 J	10000000	10000000	100000
benzo(a)anthracene	380 U	400 U	360 U	390 U	12000 U	12000 U	900	4000	500000
benzo(a)pyrene	380 U	400 U	360 U	390 U	12000 U	12000 U	660	660	100000

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TABLE 8-6

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

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SAMPLE NUMBER:	16SB01-06	16SB02-04	16SB03-02	16SB03-06	16SB04-08	16SB04-08-DUP	ARARS & TBCs		
LOCATION:	16SB01	16SB02	16SB03	16SB03	16SB04	16SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95			
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	380 U	400 U	360 U	390 U	12000 U	12000 U	900	4000	50000
benzo(k)fluoranthene	380 U	400 U	360 U	390 U	12000 U	12000 U	900	4000	500000
bis(2-ethylhexyl)phthalate	380 UJ	400 UJ	140 J	150 UJ	12000 UJ	12000 UJ	49000	210000	100000
chrysene	380 U	400 U	360 U	390 U	12000 U	12000 U	9000	40000	500000
dibenzofuran	380 U	400 U	360 U	390 U	5200 J	5900 J	-	-	-
diethylphthalate	380 U	400 U	360 U	390 U	12000 U	12000 U	10000000	10000000	50000
fluoranthene	380 U	400 U	360 U	390 U	12000 U	12000 U	2300000	10000000	100000
fluorene	380 U	400 U	360 U	390 U	13000	13000	2300000	10000000	100000
naphthalene	380 U	400 U	360 U	390 U	39000	42000	230000	4200000	100000
phenanthrene	380 U	400 U	360 U	390 U	21000	24000	-	-	-
phenol	380 U	400 U	360 U	390 U	12000 U	12000 U	10000000	10000000	50000
pyrene	380 U	400 U	360 U	390 U	1600 J	1800 J	1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	12.0 U	12.0 U	11.0 U	12.0 U	17.0 J	5800 U	79000	1000000	1000
2-butanone	12.0 U	12.0 U	11.0 U	12.0 U	58.0 UJ	5800 U	1000000	1000000	50000
benzene	12.0 U	12.0 U	11.0 U	12.0 U	300 J	5800 U	3000	13000	1000
carbon disulfide	12.0 UJ	12.0 U	11.0 UJ	12.0 UJ	58.0 UJ	5800 U	-	-	-
ethylbenzene	12.0 U	12.0 U	11.0 U	12.0 U	6300	9600	1000000	1000000	100000
methylene chloride	12.0 U	12.0 U	11.0 J	12.0 J	58.0 UJ	5800 U	49000	210000	1000
tetrachloroethene	12.0 U	12.0 U	11.0 U	12.0 U	58.0 UJ	5800 U	4000	6000	1000
toluene	12.0 U	12.0 U	11.0 U	12.0 U	620 J	5800 U	1000000	1000000	500000
trichloroethene	12.0 U	12.0 U	11.0 U	12.0 U	58.0 UJ	5800 U	23000	54000	1000
xylene (total)	12.0 U	12.0 U	11.0 U	12.0 U	36000 E	52000 E	410000	1000000	10000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4,4'-DDD	n/a	4.0 U	n/a	n/a	n/a	n/a	3000	12000	50000
4,4'-DDE	n/a	4.0 U	n/a	n/a	n/a	n/a	2000	9000	50000
4,4'-DDT	n/a	4.0 U	n/a	n/a	n/a	n/a	2000	9000	500000
Aroclor-1254	38.0 U	40.0 U	36.0 U	39.0 U	38.0 U	38.0 U	490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	16SB01-06 16SB01 1995 RI 07/09/95	16SB02-04 16SB02 1995 RI 07/09/95	16SB03-02 16SB03 1995 RI 07/09/95	16SB03-06 16SB03 1995 RI 07/09/95	16SB04-08 16SB04 1995 RI 07/09/95	16SB04-08-DUP 16SB04 1995 RI 07/09/95	ARARS & TBCs NJDEP Soil Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Impact to Groundwater Cleanup Criteria
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
aldrin	n/a	2.0 U	n/a	n/a	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
alpha-chlordane	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	4.0 U	n/a	n/a	n/a	n/a	42.0	180	50000
endosulfan I	n/a	2.0 U	n/a	n/a	n/a	n/a	340000	6200000	50000
endosulfan II	n/a	4.0 U	n/a	n/a	n/a	n/a	340000	6200000	50000
endrin	n/a	4.0 U	n/a	n/a	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	4.0 U	n/a	n/a	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	2.0 U	n/a	n/a	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
heptachlor	n/a	2.0 U	n/a	n/a	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95	07/08/95			
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	2480	1730	3470	1240	1310	3990	-	-	-
arsenic	9.3	8.5	20.3 E	2.8	1.7	7.2	20.0	20.0	-
barium	1.3	1.9	2.7	5.4	4.1	4.4	700	47000	-
beryllium	0.17	0.081	0.34	0.11	0.10	0.46	1.00	1.00	-
cadmium	1.0	0.81	1.3 E	0.28	0.31	0.086 U	1.00	100	-
calcium	113	410	261	129	102	226	-	-	-
chromium, total	103	86.3	158	18.3	12.5	94.7	-	500	-
cobalt	0.72 U	0.22	0.36	0.70 U	0.69 U	0.68 U	-	-	-
copper	1.4	2.1	2.3	3.0	2.6	3.0	600	600	-
iron	12300	11000	17800	3340	2600	13500	-	-	-
lead	2.7	3.1	4.0	7.8 J	6.6 J	5.5	400	600	-
magnesium	284	182	468	84.7	87.2	638	-	-	-
manganese	0.69 U	3.2	0.82	2.1	4.6	2.8	-	-	-
mercury	0.0071 J	0.0051	0.0023 U	0.045 J	0.033 J	0.041 J	14.0	270	-
nickel	1.1 U	0.60	1.3	1.0 U	1.0 U	2.1	250	2400	-
potassium	986	518	1470	147	180	1720 J	-	-	-
selenium	1.1 U	1.0 J	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.50 U	0.21 U	0.22 U	0.49 U	0.48 U	0.48 U	110	4100	-
sodium	32.3	13.6 U	26.2	25.6	23.9	26.8	-	-	-
thallium	0.86 U	0.81 U	0.83 U	1.2 J	1.3 J	0.82 U	2.00	2.00	-
vanadium	53.4	53.3	72.7	15.3	9.5	61.2	370	7100	-
zinc	5.3 J	3.2 J	7.0 J	11.4 J	7.6 J	7.9 J	1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2-methylnaphthalene	220000	36000	140000	390 U	380 U	380 U	-	-	-
acenaphthene	11000 J	2200 J	8900 J	390 U	380 U	380 U	3400000	10000000	100000
anthracene	3900 J	11000 U	2700 J	390 U	380 U	380 U	10000000	10000000	100000
benzo(a)anthracene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	500000
benzo(a)pyrene	12000 U	11000 U	11000 U	390 U	380 U	380 U	660	660	100000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95	07/08/95			
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	50000
benzo(k)fluoranthene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	500000
bis(2-ethylhexyl)phthalate	12000 U	11000 UJ	11000 UJ	390 UJ	380 UJ	380 U	49000	210000	100000
chrysene	12000 U	11000 U	11000 U	56.0 J	380 U	380 U	9000	40000	500000
dibenzofuran	7800 J	1300 J	5400 J	390 U	380 U	380 U	-	-	-
diethylphthalate	12000 U	11000 U	11000 U	390 U	380 U	380 U	10000000	10000000	50000
fluoranthene	12000 U	11000 U	11000 U	49.0 J	380 U	380 U	2300000	10000000	100000
fluorene	18000	3300 J	13000	390 U	380 U	380 U	2300000	10000000	100000
naphthalene	60000	8000 J	40000	390 U	380 U	380 U	230000	4200000	100000
phenanthrene	31000	6400 J	26000	50.0 J	380 U	380 U	-	-	-
phenol	12000 U	11000 U	11000 U	390 U	380 U	380 U	10000000	10000000	50000
pyrene	2800 J	11000 U	1400 J	390 U	380 U	380 U	1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	1500 U	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	79000	1000000	1000
2-butanone	1500 U	5.0 J	1400 U	12.0 U	11.0 U	11.0 UJ	1000000	1000000	50000
benzene	1300 E J	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	3000	13000	1000
carbon disulfide	1500 U	11.0 UJ	1400 U	12.0 U	11.0 U	11.0 U	-	-	-
ethylbenzene	16000	24.0	4100	12.0 U	11.0 U	11.0 U	1000000	1000000	100000
methylene chloride	1500 U	11.0 J	1400 U	12.0 U	11.0 U	7.0 J	49000	210000	1000
tetrachloroethene	1500 U	11.0 U	1400 U	12.0 U	11.0 U	6.0 J	4000	6000	1000
toluene	770 J	11.0 U	190 J	12.0 U	11.0 U	11.0 U	1000000	1000000	500000
trichloroethene	1500 U	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	23000	54000	1000
xylene (total)	92000 E	70.0	9600	12.0 U	11.0 U	11.0 U	410000	1000000	10000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	n/a	3000	12000	50000
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	n/a	2000	9000	50000
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	2000	9000	500000
Aroclor-1254	39.0 U	37.0 U	38.0 U	39.0 U	38.0 U	37.0 U	490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95	07/08/95			
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
aldrin	n/a	n/a	n/a	n/a	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	42.0	180	50000
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	340000	6200000	50000
endosulfan II	n/a	n/a	n/a	n/a	n/a	n/a	340000	6200000	50000
endrin	n/a	n/a	n/a	n/a	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	16SB08-06 16SB08 1995 RI 07/08/95		16SB09-00 16SB09 1995 RI 07/09/95		16SB09-06 16SB09 1995 RI 07/09/95		16SB10-00 16SB10 1995 RI 07/08/95		16SB10-04 16SB10 1995 RI 07/08/95		16SB11-09 16SB11 1995 RI 07/08/95		ARARS & TBCs NJDEP Soil Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Impact to Groundwater Cleanup Criteria
INORGANICS	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	mg/kg	mg/kg
aluminum	4110		914		2130		1680		1770		4180		-	-	-
arsenic	11.3		1.8		3.7		2.1		3.0		5.3		20.0	20.0	-
barium	3.6		4.2		1.5		13.8		2.4		6.9		700	47000	-
beryllium	0.49		0.12		0.10		0.068		0.10		0.52		1.00	1.00	-
cadmium	0.090	U	0.32		0.66		0.30		0.085	U	0.090	U	1.00	100	-
calcium	297		72.7		34.5		1570	J	105		1240	J	-	-	-
chromium, total	123		5.6		68.4		22.5		34.3		96.5		-	500	-
cobalt	0.71	U	0.67	U	0.74	U	0.68	U	0.67	U	0.71	U	-	-	-
copper	2.9		6.6		1.2		28.0		1.7		2.8		600	600	-
iron	16600		3760		8730		4450		4930		12500		-	-	-
lead	3.7		6.6	J	2.4		62.2		3.3		3.6		400	600	-
magnesium	526		39.8		104		865		153		1030		-	-	-
manganese	0.69	U	4.1		0.71	U	31.8		3.5		3.9		-	-	-
mercury	0.0082	J	0.028	J	0.017	J	0.024	J	0.013	J	0.013	J	14.0	270	-
nickel	1.5		1.0	U	1.1	U	2.5		1.0	U	2.1		250	2400	-
potassium	1670	J	111		297		234		389		1990	J	-	-	-
selenium	1.0	U	1.0	U	1.1	U	1.0	U	1.0	U	1.0	U	63.0	3100	-
silver	0.50	U	0.47	U	0.51	U	0.48	U	0.47	U	0.49	U	110	4100	-
sodium	18.3		23.1		25.6		21.1		20.0		27.9		-	-	-
thallium	0.85	U	0.81	U	1.4	J	0.82	U	0.80	U	0.85	U	2.00	2.00	-
vanadium	79.1		5.5		31.4		17.1		26.8		59.9		370	7100	-
zinc	4.2	J	2.9	J	1.8	J	12.2	J	2.9	J	8.3	J	1500	1500	-
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	ug/kg	ug/kg
2-methylnaphthalene	390	U	2600		400	U	5800	J	370	U	390	U	-	-	-
acenaphthene	390	U	370	U	400	U	11000	U	370	U	390	U	3400000	10000000	100000
anthracene	390	U	370	U	400	U	11000	U	370	U	390	U	10000000	10000000	100000
benzo(a)anthracene	390	U	370	U	400	U	11000	U	370	U	390	U	900	4000	500000
benzo(a)pyrene	390	U	370	U	400	U	11000	U	370	U	390	U	660	660	100000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB08-06	16SB09-00	16SB09-06	16SB10-00	16SB10-04	16SB11-09	ARARS & TBCs		
LOCATION:	16SB08	16SB09	16SB09	16SB10	16SB10	16SB11	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/09/95	07/09/95	07/08/95	07/08/95	07/08/95			
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	390 U	370 U	400 U	11000 U	370 U	390 U	900	4000	50000
benzo(k)fluoranthene	390 U	370 U	400 U	11000 U	370 U	390 U	900	4000	500000
bis(2-ethylhexyl)phthalate	390 U	370 UJ	400 UJ	1400 J	370 U	560 U	49000	210000	100000
chrysene	390 U	370 U	400 U	11000 U	370 U	390 U	9000	40000	500000
dibenzofuran	390 U	370 U	400 U	11000 U	370 U	390 U	-	-	-
diethylphthalate	390 U	370 U	400 U	11000 U	38.0 J	390 U	10000000	10000000	50000
fluoranthene	390 U	370 U	400 U	11000 U	370 U	390 U	2300000	10000000	100000
fluorene	390 U	370 U	400 U	11000 U	370 U	390 U	2300000	10000000	100000
naphthalene	390 U	430	400 U	11000 U	370 U	390 U	230000	4200000	100000
phenanthrene	390 U	46.0 J	400 U	2000 J	370 U	390 U	-	-	-
phenol	42.0 J	370 U	400 U	11000 U	52.0 J	49.0 J	10000000	10000000	50000
pyrene	390 U	370 U	400 U	11000 U	370 U	390 U	1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	12.0 U	56.0 U	12.0 U	57.0 U	11.0 U	12.0 U	79000	1000000	1000
2-butanone	12.0 UJ	56.0 U	12.0 U	57.0 U	11.0 U	12.0 UJ	1000000	1000000	50000
benzene	12.0 U	56.0 U	12.0 U	57.0 U	11.0 U	12.0 U	3000	13000	1000
carbon disulfide	12.0 U	56.0 U	12.0 U	57.0 U	11.0 U	12.0 U	-	-	-
ethylbenzene	12.0 U	97.0	12.0 U	57.0 UJ	11.0 U	12.0 U	1000000	1000000	100000
methylene chloride	5.0 J	56.0 U	12.0 U	10.0 J	4.0 J	4.0 J	49000	210000	1000
tetrachloroethene	12.0 U	56.0 U	12.0 U	7.0 J	11.0 U	12.0 U	4000	6000	1000
toluene	12.0 U	56.0 U	12.0 U	57.0 UJ	11.0 U	12.0 U	1000000	1000000	500000
trichloroethene	12.0 U	56.0 U	12.0 U	57.0 U	11.0 U	12.0 U	23000	54000	1000
xylene (total)	12.0 U	96.0	12.0 U	11.0 J	11.0 U	12.0 U	410000	1000000	10000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4,4'-DDD	n/a	3.7 U	n/a	3.7 U	n/a	n/a	3000	12000	50000
4,4'-DDE	n/a	3.7 U	n/a	8.5 R	n/a	n/a	2000	9000	50000
4,4'-DDT	n/a	6.0	n/a	3.7 U	n/a	n/a	2000	9000	500000
Aroclor-1254	39.0 U	37.0 U	10.0 J	37.0 U	37.0 U	39.0 U	490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB08-06	16SB09-00	16SB09-06	16SB10-00	16SB10-04	16SB11-09	ARARS & TBCs		
LOCATION:	16SB08	16SB09	16SB09	16SB10	16SB10	16SB11	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/09/95	07/09/95	07/08/95	07/08/95	07/08/95			
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
aldrin	n/a	1.9 U	n/a	1.4 R	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	1.9 U	n/a	0.26 R	n/a	n/a	-	-	-
alpha-chlordane	n/a	1.9 U	n/a	1.9 U	n/a	n/a	-	-	-
dieldrin	n/a	3.7 U	n/a	0.77 R	n/a	n/a	42.0	180	50000
endosulfan I	n/a	1.9 U	n/a	9.9	n/a	n/a	340000	6200000	50000
endosulfan II	n/a	3.7 U	n/a	41.0	n/a	n/a	340000	6200000	50000
endrin	n/a	3.7 U	n/a	3.7 U	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	3.7 U	n/a	25.0 R	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	0.088 R	n/a	0.40 R	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	1.9 U	n/a	0.91 R	n/a	n/a	-	-	-
heptachlor	n/a	1.9 U	n/a	1.9 U	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	1.9 U	n/a	7.8	n/a	n/a	-	-	-

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB12-02	16SB12-06	16SB13-02	16SB13-06	16SB14-04	16SB15-06	ARARS & TBCs		
LOCATION:	16SB12	16SB12	16SB13	16SB13	16SB14	16SB15	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/08/95	07/08/95			
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	1780	1730	1810	1430	3600	3170	-	-	-
arsenic	1.2	1.9	1.5	2.1	5.5	9.9	20.0	20.0	-
barium	6.6	3.3	5.5	4.9	4.9	2.6	700	47000	-
beryllium	0.039	0.15	0.14	0.14	0.22	0.31	1.00	1.00	-
cadmium	0.19	0.42	0.31	0.43	0.087 U	0.086 U	1.00	100	-
calcium	439	784	216	550	128	154	-	-	-
chromium, total	4.1	55.3	4.9	32.6	58.9	105	-	500	-
cobalt	0.40	0.14 U	0.63 U	0.67 U	0.69 U	0.68 U	-	-	-
copper	3.0	1.5	4.2	3.4	2.5	2.8	600	600	-
iron	1890	5620	3210	4430	10200	13900	-	-	-
lead	9.1	3.6	8.2 J	6.9 J	5.3	3.7	400	600	-
magnesium	175	364	162	254	253	397	-	-	-
manganese	12.1	7.1	10.7	9.9	3.2	3.8	-	-	-
mercury	0.013	0.0023 U	0.025 J	0.048 J	0.014 J	0.0073 UJ	14.0	270	-
nickel	1.4	0.72	1.1	1.0 U	1.2	1.0	250	2400	-
potassium	74.5	353	70.5	249	721	1240 J	-	-	-
selenium	1.0 U	1.0 U	0.93 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.31	0.21 U	0.44 U	1.1	0.48 U	0.47 U	110	4100	-
sodium	55.9	23.7	48.4	32.7	26.4	188	-	-	-
thallium	0.78 U	1.1	1.4 J	0.81 U	0.83 U	0.81 U	2.00	2.00	-
vanadium	4.4	27.0	5.0	18.2	41.2	61.1	370	7100	-
zinc	12.5 J	3.5 J	29.6 J	12.4 J	5.8 J	5.1 J	1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2-methylnaphthalene	350 U	4900	350 U	2200	380 U	370 U	-	-	-
acenaphthene	350 U	240 J	350 U	160 J	380 U	370 U	3400000	10000000	100000
anthracene	350 U	380 U	350 U	78.0 J	380 U	370 U	10000000	10000000	100000
benzo(a)anthracene	43.0 J	380 U	350 U	41.0 J	380 U	370 U	900	4000	500000
benzo(a)pyrene	43.0 J	380 U	350 U	41.0 J	380 U	370 U	660	660	100000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB12-02		16SB12-06		16SB13-02		16SB13-06		16SB14-04		16SB15-06		ARARS & TBCs		
LOCATION:	16SB12		16SB12		16SB13		16SB13		16SB14		16SB15		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SAMPLE DATE:	07/09/95		07/09/95		07/09/95		07/09/95		07/08/95		07/08/95				
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	38.0	J	380	U	350	U	40.0	J	380	U	370	U	900	4000	50000
benzo(k)fluoranthene	46.0	J	380	U	350	U	39.0	J	380	U	370	U	900	4000	500000
bis(2-ethylhexyl)phthalate	67.0	J	110	J	350	UJ	370	U	380	U	370	U	49000	210000	100000
chrysene	55.0	J	380	U	350	U	57.0	J	380	U	370	U	9000	40000	500000
dibenzofuran	350	U	380	U	350	U	370	U	380	U	370	U	-	-	-
diethylphthalate	350	U	380	U	350	U	370	U	73.0	J	370	U	10000000	10000000	50000
fluoranthene	110	J	380	U	350	U	140	J	380	U	370	U	2300000	10000000	100000
fluorene	350	U	610		350	U	320	J	380	U	370	U	2300000	10000000	100000
naphthalene	350	U	810		350	U	290	J	380	U	370	U	230000	4200000	100000
phenanthrene	65.0	J	1000		350	U	600		380	U	370	U	-	-	-
phenol	350	U	380	U	350	U	370	U	380	U	370	U	10000000	10000000	50000
pyrene	86.0	J	120	J	350	U	110	J	380	U	370	U	1700000	10000000	100000
VOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	11.0	U	11.0	U	10.0	U	11.0	U	96.0		11.0	U	79000	1000000	1000
2-butanone	11.0	U	11.0	U	10.0	U	11.0	U	11.0	UJ	8.0	J	1000000	1000000	50000
benzene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	3000	13000	1000
carbon disulfide	11.0	UJ	11.0	UJ	10.0	UJ	11.0	UJ	11.0	U	11.0	U	-	-	-
ethylbenzene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	1000000	1000000	100000
methylene chloride	11.0	J	11.0	J	10.0	U	11.0	U	11.0	U	2.0	J	49000	210000	1000
tetrachloroethene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	4000	6000	1000
toluene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	1000000	1000000	500000
trichloroethene	11.0	U	11.0	U	10.0	U	11.0	U	3.0	J	11.0	U	23000	54000	1000
xylene (total)	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	410000	1000000	10000
PESTICIDES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	ug/kg	ug/kg
4,4'-DDD	2.1	NJ	n/a		3.5	U	3.7	U	26.0		n/a		3000	12000	50000
4,4'-DDE	11.0		n/a		5.6		7.9		1.8	J	n/a		2000	9000	500000
4,4'-DDT	16.0		n/a		6.3		20.0		8.2		n/a		2000	9000	500000
Aroclor-1254	35.0	U	37.0	U	35.0	U	37.0	U	38.0	U	37.0	U	490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	16SB12-02 16SB12 1995 RI 07/09/95	16SB12-06 16SB12 1995 RI 07/09/95	16SB13-02 16SB13 1995 RI 07/09/95	16SB13-06 16SB13 1995 RI 07/09/95	16SB14-04 16SB14 1995 RI 07/08/95	16SB15-06 16SB15 1995 RI 07/08/95	ARARS & TBCs NJDEP Soil Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	ARARS & TBCs NJDEP Soil Impact to Groundwater Cleanup Criteria
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
aldrin	1.8 U	n/a	1.8 U	1.9 U	2.0 U	n/a	40.0	170	50000
alpha-BHC	0.032 R	n/a	1.8 U	1.9 U	2.0 U	n/a	-	-	-
alpha-chlordane	3.7	n/a	1.8 U	1.9 U	2.0 U	n/a	-	-	-
dieldrin	3.6	n/a	2.9 J	3.7 U	3.8 U	n/a	42.0	180	50000
endosulfan I	1.8 U	n/a	1.8 U	1.9 U	2.0 U	n/a	340000	6200000	50000
endosulfan II	3.5 U	n/a	3.5 U	3.7 U	3.8 U	n/a	340000	6200000	50000
endrin	3.5 U	n/a	3.5 U	3.7 U	3.8 U	n/a	17000	310000	50000
endrin aldehyde	3.5 U	n/a	3.5 U	3.7 U	3.8 U	n/a	-	-	-
gamma-BHC (Lindane)	1.8 U	n/a	1.8 U	0.23 R	2.0 U	n/a	520	2200	50000
gamma-chlordane	3.3	n/a	1.1 J	1.1 J	0.39 J	n/a	-	-	-
heptachlor	0.27 J	n/a	1.8 U	1.9 U	2.0 U	n/a	150	650	50000
heptachlor epoxide	1.8 U	n/a	1.8 U	1.9 U	2.0 U	n/a	-	-	-

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95			
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	2630	2540	3360	3700	3670	1460	-	-	-
arsenic	4.5	5.2	4.4	4.2	10.2	1.2	20.0	20.0	-
barium	2.0	2.0	4.2	4.5	1.4	6.0	700	47000	-
beryllium	0.32	0.26	0.30	0.35	0.61	0.11	1.00	1.00	-
cadmium	0.085 U	0.086 U	0.10	0.085 U	0.090 U	0.083 U	1.00	100	-
calcium	283	353	218	179	122	62.6	-	-	-
chromium, total	78.4	79.4	71.1	65.5	115	6.8	-	500	-
cobalt	0.67 U	0.68 U	0.68 U	0.67 U	0.71 U	0.75	-	-	-
copper	1.5	1.7	2.2	2.1	1.4	2.6	600	600	-
iron	9040	8530	9830	9790	15700	2860	-	-	-
lead	2.1	2.2	3.4	3.4	2.6	7.1	400	600	-
magnesium	437	365	371	486	727	52.4	-	-	-
manganese	1.0	1.2	8.4	8.2	2.2	5.5	-	-	-
mercury	0.0073 UJ	0.0074 J	0.032 J	0.028 J	0.0088 J	0.011 J	14.0	270	-
nickel	1.0 U	1.0 U	1.5	1.5	1.9	3.3	250	2400	-
potassium	1310 J	970	1140 J	1510 J	2530 J	141	-	-	-
selenium	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.47 U	0.48 U	0.47 U	0.47 U	0.49 U	0.46 U	110	4100	-
sodium	25.9	26.1	27.7	27.5	22.1	22.4	-	-	-
thallium	0.81 U	0.82 U	0.81 U	0.81 U	0.85 U	0.78 U	2.00	2.00	-
vanadium	48.1	48.9	43.4	39.9	63.6	5.7	370	7100	-
zinc	5.9 J	2.7 J	6.6 J	9.3 J	3.8 J	5.2 J	1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2-methylnaphthalene	370 U	380 U	6600 J	8800	74000	11000 U	-	-	-
acenaphthene	370 U	380 U	11000 U	370 U	3000 J	1300 J	3400000	10000000	100000
anthracene	370 U	380 U	11000 U	400	1600 J	11000 U	10000000	10000000	100000
benzo(a)anthracene	370 U	380 U	11000 U	370 U	12000 U	11000 U	900	4000	500000
benzo(a)pyrene	370 U	380 U	11000 U	370 U	12000 U	11000 U	660	660	100000

TABLE 8-6c
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95			
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	370 U	380 U	11000 U	370 U	12000 U	11000 U	900	4000	50000
benzo(k)fluoranthene	370 U	380 U	11000 U	370 U	12000 U	11000 U	900	4000	500000
bis(2-ethylhexyl)phthalate	370 U	380 U	11000 UJ	370 U	12000 UJ	11000 UJ	49000	210000	100000
chrysene	370 U	380 U	11000 U	370 U	12000 U	11000 U	9000	40000	500000
dibenzofuran	370 U	380 U	11000 U	370 U	2200 J	11000 U	-	-	-
diethylphthalate	370 U	54.0 J	11000 U	370 U	12000 U	11000 U	10000000	10000000	50000
fluoranthene	370 U	380 U	11000 U	110 J	12000 U	11000 U	2300000	10000000	100000
fluorene	370 U	380 U	1100 J	370 U	5900 J	1600 J	2300000	10000000	100000
naphthalene	370 U	380 U	11000 U	370 U	13000	11000 U	230000	4200000	100000
phenanthrene	370 U	380 U	2800 J	4100	12000	2800 J	-	-	-
phenol	370 U	380 U	11000 U	370 U	12000 U	11000 U	10000000	10000000	50000
pyrene	370 U	380 U	11000 U	220 J	12000 U	11000 U	1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	11.0 U	11.0 U	11.0 U	56.0 U	1500 U	54.0 U	79000	1000000	1000
2-butanone	11.0 U	11.0 U	11.0 UJ	56.0 U	1500 U	54.0 U	1000000	1000000	50000
benzene	11.0 U	11.0 U	11.0 U	56.0 U	1500 U	54.0 U	3000	13000	1000
carbon disulfide	11.0 U	11.0 U	2.0 J	56.0 U	1500 U	54.0 U	-	-	-
ethylbenzene	11.0 U	11.0 U	42.0	47.0 J	2100	13.0 J	1000000	1000000	100000
methylene chloride	2.0 J	2.0 J	3.0 J	56.0 U	150 J	54.0 U	49000	210000	1000
tetrachloroethene	11.0 U	11.0 U	4.0 J	10.0 J	1500 U	45.0 J	4000	6000	1000
toluene	11.0 U	11.0 U	11.0 U	56.0 U	1500 U	54.0 U	1000000	1000000	500000
trichloroethene	11.0 U	11.0 U	11.0 U	56.0 U	1500 U	54.0 U	23000	54000	1000
xylene (total)	11.0 U	11.0 U	93.0	110	2000	8.0 J	410000	1000000	10000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	3.6 U	3000	12000	50000
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	3.6 U	2000	9000	50000
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	7.4	2000	9000	500000
Aroclor-1254	37.0 U	37.0 U	37.0 U	37.0 U	39.0 U	36.0 U	490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95			
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
aldrin	n/a	n/a	n/a	n/a	n/a	1.8 U	40.0	170	50000
alpha-BHC	n/a	n/a	n/a	n/a	n/a	0.20 R	-	-	-
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	1.8 U	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	3.6 U	42.0	180	50000
endosulfan I	n/a	n/a	n/a	n/a	n/a	1.8 U	340000	6200000	50000
endosulfan II	n/a	n/a	n/a	n/a	n/a	3.6 U	340000	6200000	50000
endrin	n/a	n/a	n/a	n/a	n/a	0.29 R	17000	310000	50000
endrin aldehyde	n/a	n/a	n/a	n/a	n/a	3.6 U	-	-	-
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	n/a	1.8 U	520	2200	50000
gamma-chlordane	n/a	n/a	n/a	n/a	n/a	0.31 R	-	-	-
heptachlor	n/a	n/a	n/a	n/a	n/a	1.8 U	150	650	50000
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	0.37 R	-	-	-

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	- - -	ARARS & TBCs		
LOCATION:	16SB18	16SB19	16SB19	16SB20	16SB20	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95				
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg
aluminum	3000	3280	2700	3280	3800		-	-	-
arsenic	3.0	7.8	10.4	2.9	8.2		20.0	20.0	-
barium	2.8	3.3	1.7	2.9	3.0		700	47000	-
beryllium	0.19	0.52	0.35	0.16	0.53		1.00	1.00	-
cadmium	0.082 U	0.086	0.091 U	0.084 U	0.090 U		1.00	100	-
calcium	113	318	573	157	172		-	-	-
chromium, total	39.4	138	103	48.9	166		-	500	-
cobalt	0.64 U	0.68 U	0.72 U	0.66 U	0.71 U		-	-	-
copper	3.4	2.4	2.3	1.5	3.0		600	600	-
iron	8230	12900	14800	6580	15200		-	-	-
lead	6.4	2.4	3.9	3.0	2.6		400	600	-
magnesium	226	659	348	155	614		-	-	-
manganese	2.8	0.77	1.0	2.4	0.68 U		-	-	-
mercury	0.020 J	0.014 J	0.0077 UJ	0.0072 UJ	0.0076 J		14.0	270	-
nickel	1.2	1.4	1.1 U	1.1	1.9		250	2400	-
potassium	595	2310 J	1310 J	361	2060 J		-	-	-
selenium	0.94 U	1.0 U	1.1 U	1.0 U	1.0 U		63.0	3100	-
silver	0.45 U	0.48 U	0.50 U	0.46 U	0.50 U		110	4100	-
sodium	20.1	230	292	20.7	30.0		-	-	-
thallium	0.77 U	0.82 U	0.86 U	0.79 U	0.85 U		2.00	2.00	-
vanadium	29.0	67.4	59.6	29.6	69.6		370	7100	-
zinc	3.5 J	2.2 J	3.8 J	3.3 J	2.6 J		1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
2-methylnaphthalene	29000	78000	130000	28000	7700		-	-	-
acenaphthene	2000 J	3500 J	4800 J	1900 J	390 U		3400000	10000000	100000
anthracene	11000 U	1400 J	1600 J	11000 U	390 U		10000000	10000000	100000
benzo(a)anthracene	11000 U	11000 U	12000 U	11000 U	390 U		900	4000	500000
benzo(a)pyrene	11000 U	11000 U	12000 U	11000 U	390 U		660	660	100000

TABLE 8-6c
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	- - -	ARARS & TBCs		
LOCATION:	16SB18	16SB19	16SB19	16SB20	16SB20	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95				
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	11000 U	11000 U	12000 U	11000 U	390 U		900	4000	50000
benzo(k)fluoranthene	11000 U	11000 U	12000 U	11000 U	390 U		900	4000	500000
bis(2-ethylhexyl)phthalate	11000 UJ	11000 UJ	12000 UJ	11000 UJ	390 U		49000	210000	100000
chrysene	11000 U	11000 U	12000 U	11000 U	390 U		9000	40000	500000
dibenzofuran	2000 J	3500 J	3900 J	11000 U	390 U		-	-	-
diethylphthalate	11000 U	11000 U	12000 U	11000 U	390 U		10000000	10000000	50000
fluoranthene	11000 U	11000 U	12000 U	11000 U	82.0 J		2300000	10000000	100000
fluorene	4000 J	7600 J	9100 J	2500 J	390 U		2300000	10000000	100000
naphthalene	3000 J	21000	30000	5000 J	1200		230000	4200000	100000
phenanthrene	5500 J	13000	16000	4900 J	1400		-	-	-
phenol	11000 U	11000 U	12000 U	11000 U	390 U		10000000	10000000	50000
pyrene	11000 U	11000 U	12000 U	11000 U	98.0 J		1700000	10000000	100000
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	54.0 U	1400 U	1500 U	11.0 U	12.0 U		79000	1000000	1000
2-butanone	54.0 U	1400 U	1500 U	11.0 UJ	12.0 UJ		1000000	1000000	50000
benzene	54.0 U	1400 U	330 J	11.0 U	12.0 U		3000	13000	1000
carbon disulfide	54.0 U	1400 U	1500 U	11.0 U	12.0 U		-	-	-
ethylbenzene	120	5400	10000	150	57.0		1000000	1000000	100000
methylene chloride	6.0 J	1400 U	1500 U	3.0 J	5.0 J		49000	210000	1000
tetrachloroethene	17.0 J	1400 U	1500 U	11.0 U	9.0 J		4000	6000	1000
toluene	54.0 U	1400 U	260 J	11.0 U	12.0 U		1000000	1000000	500000
trichloroethene	54.0 U	1400 U	1500 U	11.0 U	12.0 U		23000	54000	1000
xylene (total)	120	5700	47000 E	540	310		410000	1000000	10000
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
4,4'-DDD	3.6 U	n/a	n/a	n/a	n/a		3000	12000	50000
4,4'-DDE	3.6 U	n/a	n/a	n/a	n/a		2000	9000	50000
4,4'-DDT	9.9	n/a	n/a	n/a	n/a		2000	9000	500000
Aroclor-1254	36.0 U	37.0 U	39.0 U	37.0 U	39.0 U		490	2000	50000

TABLE 8-6c

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	- - -	ARARS & TBCs		
LOCATION:	16SB18	16SB19	16SB19	16SB20	16SB20	- - -	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95				
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg		ug/kg	ug/kg	ug/kg
aldrin	0.16 R	n/a	n/a	n/a	n/a		40.0	170	50000
alpha-BHC	0.29 R	n/a	n/a	n/a	n/a		-	-	-
alpha-chlordane	1.9 U	n/a	n/a	n/a	n/a		-	-	-
dieldrin	3.6 U	n/a	n/a	n/a	n/a		42.0	180	50000
endosulfan I	0.092 R	n/a	n/a	n/a	n/a		340000	6200000	50000
endosulfan II	3.6 U	n/a	n/a	n/a	n/a		340000	6200000	50000
endrin	3.6 U	n/a	n/a	n/a	n/a		17000	310000	50000
endrin aldehyde	3.6 U	n/a	n/a	n/a	n/a		-	-	-
gamma-BHC (Lindane)	0.57 R	n/a	n/a	n/a	n/a		520	2200	50000
gamma-chlordane	1.9 U	n/a	n/a	n/a	n/a		-	-	-
heptachlor	1.9 U	n/a	n/a	n/a	n/a		150	650	50000
heptachlor epoxide	0.49 J	n/a	n/a	n/a	n/a		-	-	-

TABLE 8-6c
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB01-06	16SB02-04	16SB03-02	16SB03-06	16SB04-08	ARARS & TBCs		
LOCATION:	16SB01	16SB02	16SB03	16SB03	16SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/09/95	07/09/95	07/09/95	07/09/95	07/09/95			
MISCELLANEOUS								
moisture %	13.7	16.8	9.1	14.6	13.6	-	-	-
pH	8.2	6.1	5.6	5.9	5.0	-	-	-
petroleum hydrocarbons mg/kg	110	20.0 U	50.0	15.0 J	18000 E	10000 @	10000 @	-

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:		16SB04-08-DUP 16SB04 1995 RI 07/09/95		16SB04-10 16SB04 1995 RI 07/09/95		16SB05-06 16SB05 1995 RI 07/09/95	16SB05-08 16SB05 1995 RI 07/09/95	16SB06-02 16SB06 1995 RI 07/09/95	ARARS & TBCs NJDEP Soil Residential Direct Contact Cleanup Criteria		ARARS & TBCs NJDEP Soil Non-Residential Direct Contact Cleanup Criteria		ARARS & TBCs NJDEP Soil Impact to Groundwater Cleanup Criteria
MISCELLANEOUS													
moisture	%	14.2		16.2		11.5	13.2	14.7	-		-		-
pH		4.9		4.9		6.3	5.8	5.4	-		-		-
petroleum hydrocarbons	mg/kg	17000	E	33000	E	1800	7600	700	10000	@	10000	@	-

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SB06-06		16SB07-04		16SB08-06		16SB09-00		16SB09-06		ARARS & TBCs					
LOCATION:		16SB06		16SB07		16SB08		16SB09		16SB09		NJDEP Soil Residential Direct Contact Cleanup Criteria		NJDEP Soil Non-Residential Direct Contact Cleanup Criteria		NJDEP Soil Impact to Groundwater Cleanup Criteria	
DATA SOURCE:		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI							
SAMPLE DATE:		07/09/95		07/08/95		07/08/95		07/09/95		07/09/95							
MISCELLANEOUS																	
moisture	%	13.3		11.7		15.6		10.8		18.4		-		-		-	
pH		5.5		5.9		5.6		5.2		5.7		-		-		-	
petroleum hydrocarbons	mg/kg	70.0		20.0	U	17.0	J	1600		40.0		10000	@	10000	@	-	

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SB10-00	16SB10-04	16SB11-09	16SB12-02	16SB12-06	ARARS & TBCs		
LOCATION:		16SB10	16SB10	16SB11	16SB12	16SB12	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:		07/08/95	07/08/95	07/08/95	07/09/95	07/09/95			
MISCELLANEOUS									
moisture	%	11.8	10.3	15.1	7.2	11.7	-	-	-
pH		5.4	6.1	7.4	7.0	7.5	-	-	-
petroleum hydrocarbons	mg/kg	4900	320	90.0	40.0	800	10000 @	10000 @	-

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SB13-02	16SB13-06	16SB14-04	16SB15-06	16SB16-06	ARARS & TBCs		
LOCATION:		16SB13	16SB13	16SB14	16SB15	16SB16	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:		07/09/95	07/09/95	07/08/95	07/08/95	07/08/95			
MISCELLANEOUS									
moisture	%	5.4	10.6	13.1	11.4	11.1	-	-	-
pH		6.2	7.6	5.4	6.1	7.4	-	-	-
petroleum hydrocarbons	mg/kg	11.0 J	700	160	30.0	20.0	10000 @	10000 @	-

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/08/95	07/08/95	07/08/95	07/08/95	07/08/95			
MISCELLANEOUS								
moisture %	12.0	11.3	11.1	15.1	7.9	-	-	-
pH	7.5	5.5	5.5	5.4	5.3	-	-	-
petroleum hydrocarbons mg/kg	22.0 J	20.0 UJ	1900 J	3400	1700	10000 @	10000 @	-

TABLE 8-6d

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	ARARS & TBCs		
LOCATION:		16SB18	16SB19	16SB19	16SB20	16SB20	NJDEP Soil Residential Direct Contact	NJDEP Soil Non-Residential Direct Contact	NJDEP Soil Impact to Groundwater
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:		07/08/95	07/08/95	07/08/95	07/08/95	07/08/95	Cleanup Criteria	Cleanup Criteria	Cleanup Criteria
MISCELLANEOUS									
moisture	%	6.8	11.9	16.4	10.1	15.2	-	-	-
pH		5.8	7.1	6.7	6.2	5.2	-	-	-
petroleum hydrocarbons	mg/kg	2400	5400	5900	2200	600	10000 @	10000 @	-

TABLE 8-6d
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

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R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

TABLE 8-6e

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SD01 07/11/95	16SD01-DUP	16SD02 07/11/95	16SD02-DUP	16SD03 07/11/95	---	---	SELECTED ARARS
LOCATION:	16SD01	16SD01	16SD02	16SD02	16SD03	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/11/95	07/11/95	07/11/95	07/11/95	07/11/95			
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg
aluminum	1220	1580	4250	4340	2820			-
antimony	1.5	0.74 U	0.81 U	0.81 U	0.73 U			2.00 M
arsenic	2.2	2.8	8.9 E	6.0	5.7			8.20 L
barium	20.7	24.0	19.4	22.1	16.5			40.0 B
beryllium	0.12	0.13	0.39	0.33	0.23			-
cadmium	2.8 E J	2.0 E J	1.9 E J	2.5 E J	1.9 E J			1.20 L
calcium	443	458	1690 J	2010 J	1160			-
chromium, total	18.3	18.6	59.7	57.7	56.3			81.0 L
cobalt	0.89	0.83	1.9	2.6	1.8			50.0 T
copper	21.2	17.7	21.9	29.3	26.7			34.0 L
iron	11400	10900	12900	14900	11000			-
lead	51.0 E	53.3 E	39.5	50.3 E	57.9 E			47.0 L
magnesium	176	187	1340	1740	1120			-
manganese	41.3	36.1	79.1	107	57.4			460 O
mercury	0.072	0.051	0.063	0.055	0.021			0.150 L
nickel	3.4	3.7	4.9	6.1	4.6			21.0 L
potassium	110	147	1080	804	519			-
silver	0.41	0.33	0.52	0.45	0.63			1.00 M
sodium	29.8	49.9	112	159	110			-
thallium	1.0 UJ	1.0 UJ	1.1 UJ	1.6 J	1.3 J			-
vanadium	9.3	8.4	38.2	43.3	37.2			-
zinc	132	81.1	111	146	132			150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg			ug/kg
2-methylnaphthalene	160 J	79.0 J	490 U	500 U	440 U			330 F
acenaphthene	160 J	130 J	490 U	500 U	440 U			620 Q
anthracene	210 J	220 J	490 U	500 U	440 U			330 F
benzo(a)anthracene	410 E J	660 E	81.0 J	160 J	63.0 J			330 F
benzo(a)pyrene	360 J	590 E	92.0 J	130 J	75.0 J			430 L

TABLE 8-6e

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SD01 07/11/95	16SD01-DUP	16SD02 07/11/95	16SD02-DUP	16SD03 07/11/95	---	---	SELECTED ARARS
LOCATION:	16SD01	16SD01	16SD02	16SD02	16SD03	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/11/95	07/11/95	07/11/95	07/11/95	07/11/95			
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg			ug/kg
benzo(b)fluoranthene	590 E J	750 E	180 J	320 J	150 J			330 F
benzo(g,h,i)perylene	260 J	440 E J	59.0 J	140 J	71.0 J			330 F
benzo(k)fluoranthene	200 J	300 J	490 U	96.0 J	440 UJ			330 F
bis(2-ethylhexyl)phthalate	330 J	360 J	250 J	220 J	460			890000000 S
butylbenzylphthalate	440 U	460 U	65.0 J	500 U	440 U			11000 Q
carbazole	170 J	160 J	490 U	500 U	440 U			330 F
chrysene	430 E J	690 E	140 J	250 J	120 J			330 F
dibenz(a,h)anthracene	60.0 J	120 J	490 U	500 UJ	440 UJ			330 F
dibenzofuran	100 J	59.0 J	490 U	500 U	440 U			2000 P
fluoranthene	1100	1400	190 J	360 J	110 J			2900 Q
fluorene	150 J	110 J	490 U	500 U	440 U			540 P
indeno(1,2,3-cd)pyrene	210 J	370 E J	81.0 J	110 J	71.0 J			330 F
naphthalene	98.0 J	47.0 J	490 U	500 U	440 U			480 P
phenanthrene	940 E	990 E	81.0 J	90.0 J	59.0 J			850 Q
pyrene	1500 E	2100 E	280 J	410 J	220 J			660 L
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg			ug/kg
4,4'-DDD	72.0 E	61.0 E	8.3 U	8.3 U	4.5 U			1.60 L
4,4'-DDE	16.0 E	17.0 E	5.0 E	5.1 E	4.9 E			2.20 L
4,4'-DDT	36.0 E J	41.0 E	19.0 E	20.0 E	8.1 E			1.60 L
alpha-BHC	2.3 U	2.4 U	2.5 U	0.045 J	2.3 U			3.70 S
gamma-BHC (Lindane)	2.3 U	2.4 U	2.5 U	2.6 U	0.036 R			-
gamma-chlordane	2.8 J	3.4 J	2.9	2.8	3.0			7.00 O
methoxychlor	23.0 U	24.0 U	25.0 U	25.0 U	9.6 J			19.0 P

TABLE 8-6e
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. .The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

02/05/97

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TABLE 8-6f

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SD01 07/11/95	16SD01-DUP	16SD02 07/11/95	16SD02-DUP	16SD03 07/11/95	- - -	- - -	ARARS & TBCs
LOCATION:		16SD01	16SD01	16SD02	16SD02	16SD03	- - -	- - -	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:		07/11/95	07/11/95	07/11/95	07/11/95	07/11/95			
MISCELLANEOUS									
moisture	%	25.5	28.2	33.3	33.5	26.1			-
pH		6.6	6.7	6.8	6.8	6.9			-
petroleum hydrocarbons	mg/kg	1300 J	1300 J	1300 J	900 J	1400 J			-
total organic carbon	mg/kg	2500 J	n/a	7600 J	n/a	3200 J			-

TABLE 8-6f
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 8-6g

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SS01 07/11/95	16SS02 07/11/95	16SS03 07/11/95	---	---	---	ARARS & TBCs		
LOCATION:	16SS01	16SS02	16SS03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI						
SAMPLE DATE:	07/11/95	07/11/95	07/11/95						
INORGANICS	mg/kg	mg/kg	mg/kg				mg/kg	mg/kg	mg/kg
aluminum	2570	4160	4190				-	-	-
antimony	28.0 E	0.75	7.0				14.0	340	-
arsenic	5.2	10.5 J	5.4				20.0	20.0	-
barium	78.3	133	109				700	47000	-
beryllium	0.13	0.25	0.19				1.00	1.00	-
cadmium	6.1 E J	8.1 E J	10.2 E J				1.00	100	-
calcium	4230 J	2280 J	3050 J				-	-	-
chromium, total	40.9	124	171				-	500	-
cobalt	4.0	7.7	4.5				-	-	-
copper	49.8	196	231				600	600	-
iron	26100	57500	28800				-	-	-
lead	1030 E	359	675 E				400	600	-
magnesium	1350	1300	1530				-	-	-
manganese	138	307	94.8				-	-	-
mercury	0.018	0.12	0.28				14.0	270	-
nickel	10.3	13.4	16.5				250	2400	-
potassium	342	537	445				-	-	-
silver	1.8	9.2	25.3				110	4100	-
sodium	155	123	173				-	-	-
vanadium	15.5	23.6	32.1				370	7100	-
zinc	111	235	1180				1500	1500	-
SEMIVOLATILES	ug/kg	ug/kg	ug/kg				ug/kg	ug/kg	ug/kg
4-methylphenol	380 U	380 U	110 J				2800000	10000000	-
N-nitrosodiphenylamine (1)	380 U	63.0 J	1000 U				140000	600000	100000
acenaphthylene	380 U	380 U	100 J				-	-	-
anthracene	380 U	57.0 J	170 J				10000000	10000000	100000
benzo(a)anthracene	160 J	240 J	450 J				900	4000	500000
benzo(a)pyrene	160 J	260 J	1200 E J				660	660	100000

TABLE 8-6g

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SS01 07/11/95	16SS02 07/11/95	16SS03 07/11/95	---	---	---	ARARS & TBCs		
LOCATION:	16SS01	16SS02	16SS03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI						
SAMPLE DATE:	07/11/95	07/11/95	07/11/95						
SEMIVOLATILES	ug/kg	ug/kg	ug/kg				ug/kg	ug/kg	ug/kg
benzo(b)fluoranthene	350 J	700 J	1000 E J				900	4000	50000
benzo(g,h,i)perylene	150 J	200 J	340 J				-	-	-
benzo(k)fluoranthene	86.0 J	380 U	1000 UJ				900	4000	500000
bis(2-ethylhexyl)phthalate	1800	7000 J	12000 J				49000	210000	100000
butylbenzylphthalate	160 J	380 UJ	1000 UJ				1100000	10000000	100000
carbazole	54.0 J	42.0 J	1000 U				-	-	-
chrysene	250 J	360 J	810 J				9000	40000	500000
di-n-butylphthalate	100 J	44.0 J	1000 U				5700000	10000000	100000
fluoranthene	510	340 J	480 J				2300000	10000000	100000
indeno(1,2,3-cd)pyrene	120 J	200 J	1000 UJ				900	4000	500000
phenanthrene	210 J	230 J	370 J				-	-	-
pyrene	670	1100 J	4400 J				1700000	10000000	100000
PESTICIDES	ug/kg	ug/kg	ug/kg				ug/kg	ug/kg	ug/kg
4,4'-DDD	3.9 U	7.6 R	360 J				3000	12000	50000
4,4'-DDE	3.9 R	15.0	120				2000	9000	50000
4,4'-DDT	38.0	230	43.0				2000	9000	500000
alpha-BHC	0.047 J	0.13 J	2.6 U				-	-	-
alpha-chlordane	1.9 U	7.0 U	33.0				-	-	-
gamma-BHC (Lindane)	1.9 U	0.13 R	0.13 R				520	2200	50000
gamma-chlordane	1.7 J	7.0 J	35.0				-	-	-
heptachlor	1.9 U	1.5 JN	2.6 U				150	650	50000
heptachlor epoxide	0.39 J	2.0 U	2.6 U				-	-	-

TABLE 8-6g
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 8-6h

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SS01 07/11/95	16SS02 07/11/95	16SS03 07/11/95	---	---	ARARS & TBCs		
LOCATION:		16SS01	16SS02	16SS03	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1995 RI	1995 RI	1995 RI					
SAMPLE DATE:		07/11/95	07/11/95	07/11/95					
MISCELLANEOUS									
moisture	%	12.2	12.9	34.3			-	-	-
pH		7.9	5.4	6.6			-	-	-
petroleum hydrocarbons	mg/kg	1300 J	2900 J	20000 E J			10000 @	10000 @	-

TABLE 8-6h
COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

DRAFT
PAGE 2 of 2

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

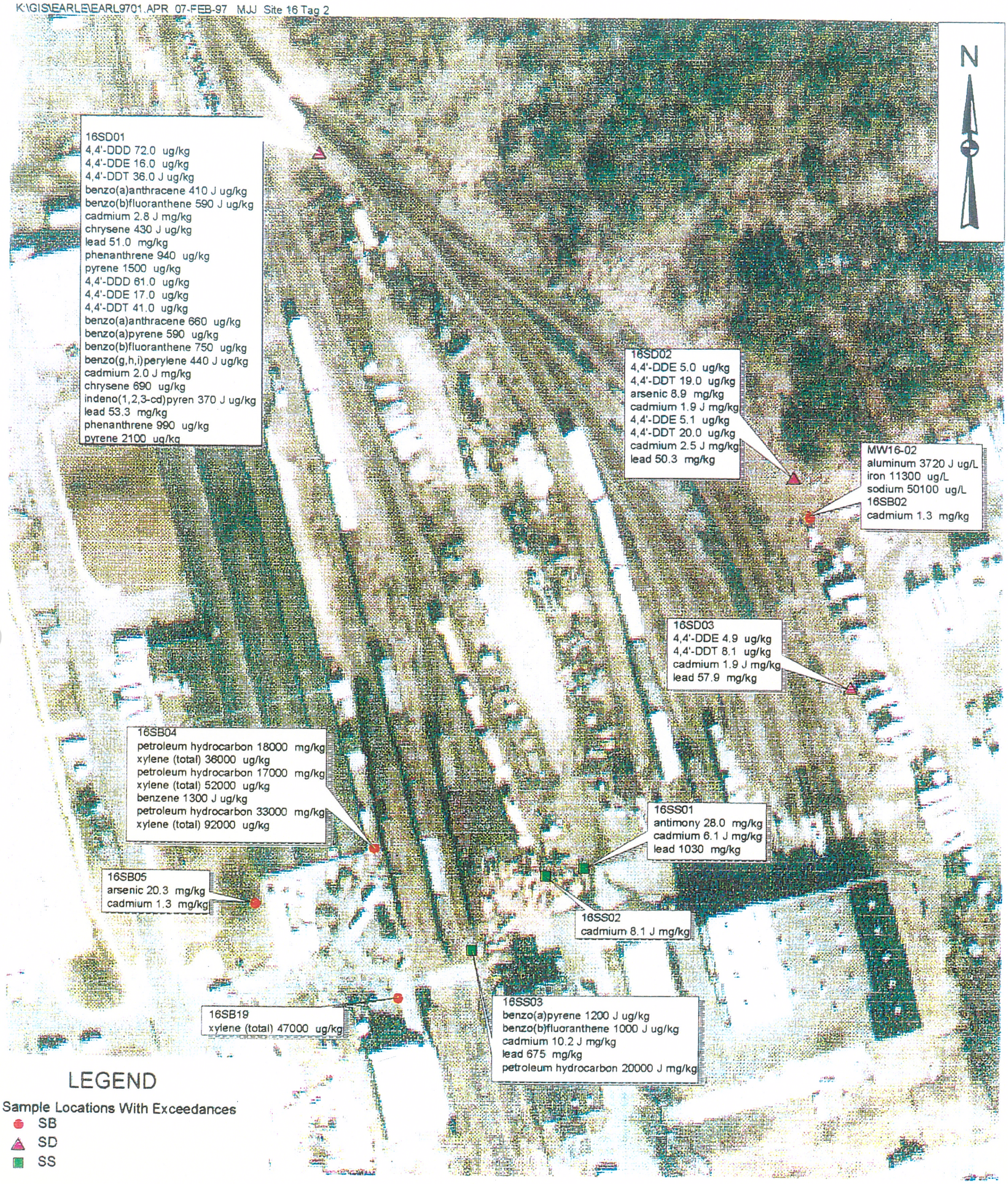
N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).



CONCENTRATIONS IN SOIL ABOVE SCREENING LEVELS
SITE 16 AND EPIC SITE F

FIGURE 8-4

100 0 100 200 Feet

Brown & Root Environmental

8.5.1.2 Organics

Fluoranthene (40 ug/kg to 84 ug/kg), pyrene (46 ug/kg), di-n-butyl phthalate (45 ug/kg to 48 ug/kg), and butylbenzyl phthalate (220 ug/kg) were detected in background surface soil samples. PAHs including benz(a)anthracene, benzo(a)pyrene, carbazole, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, and pyrene were detected in all site-related surface soil samples at levels greater than background, ranging from 42 ug/kg to 4,400 ug/kg. The highest levels of PAHs were detected in sample 16 SS 03.

Phthalates including bis(2-ethylhexyl)- (1,800 ug/kg to 12,000 ug/kg), butylbenzyl- (160 ug/kg), and di-n-butyl- (44 ug/kg to 100 ug/kg) were detected in surface soil samples collected at Site 16. N-nitrosodiphenylamine (63 ug/kg) and 4-methylphenol (110 ug/kg) were each detected in one site-related surface soil sample. 4,4'-DDT (43 ug/kg to 420 ug/kg) and 4,4'-DDE (16 ug/kg to 330 ug/kg) were each detected in two background surface soil samples. These pesticides were detected at similar levels in site-related surface soil samples, from 38 ug/kg to 230 ug/kg for 4,4'-DDT and 15 ug/kg to 120 ug/kg for 4,4'-DDE. Other pesticides, including 4',4'-DDD (360 ug/kg), alpha-BHC (0.047 ug/kg to 0.13 ug/kg), alpha-chlordane (33 ug/kg), heptachlor epoxide (0.39 ug/kg), and gamma-chlordane (1.7 ug/kg to 35 ug/kg), were also detected in surface soil samples collected at Site 16.

8.5.1.3 Miscellaneous Parameters

Three surface soil samples for Site 16 were analyzed for moisture, pH, and TPH. All samples contained TPH concentrations exceeding maximum background levels. Sample 16 SS 03 contained the highest level of TPH (20,000 mg/kg). TPH in background surface soils ranged from 9 mg/kg to 110 mg/kg.

8.5.2 Subsurface Soils

Thirty-two site-related subsurface soil samples were collected at Site 16 (locations 16 SB 01 through 16 SB 20 in Figure 8-1) at varying depths of up to 9 feet. Tables 8-7 and 8-8 present the occurrence and distribution of inorganic and organic chemicals detected in site-related subsurface soil samples and compare them to background. Table 8-6 presents a comparison of detected compounds to ARARs and TBCs. Figure 8-4 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

8.5.2.1 Inorganics

Concentrations of most metals in site-related samples were within the range of background. Concentrations of chromium were slightly greater than background in samples 16 SB 05-08 and 16 SB 20-06.

TABLE 8-7
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE BKG CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKG?	MEAN > BKG UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5.9E+03	5370.00	32 / 32	378 - 4180	2556.31	NO	NO	3158.75
ARSENIC*	8 / 8	1.35 - 14.4	1.7E+01	13.29	31 / 32	1.2 - 20.3	5.81	NO	-	7.10
BARIUM	8 / 8	0.92 - 31	3.0E+01	17.92	32 / 32	1.2 - 13.8	3.72	NO	NO	4.45
BERYLLIUM	2 / 8	0.12 - 0.28	1.2E+00	0.28	31 / 32	0.039 - 0.61	0.25	NO	NO	0.30
CADMIUM	1 / 8	0.57	5.2E-01	0.58	19 / 32	0.086 - 1.3	0.35	NO	NO	0.47
CALCIUM	8 / 8	28.6 - 799	8.6E+02	577.55	32 / 32	34.5 - 1570	299.60	NO	NO	400.95
CHROMIUM	8 / 8	4.7 - 59.5	7.3E+01	54.73	32 / 32	4.1 - 166	71.08	YES	NO	150.53
COBALT	4 / 8	0.75 - 5	4.7E+00	2.77	6 / 32	0.13 - 0.75	0.34	NO	NO	0.39
COPPER	8 / 8	0.97 - 8.6	1.1E+01	8.66	32 / 32	1.2 - 28	3.26	NO	NO	4.65
IRON	8 / 8	3745 - 62500	6.0E+04	40871.25	32 / 32	1160 - 18000	9410.47	NO	NO	13157.99
LEAD	8 / 8	1.4 - 39.4	4.0E+01	24.33	32 / 32	2.15 - 70.7	8.39	NO	NO	13.00
MAGNESIUM	8 / 8	18.5 - 619	1.6E+03	504.05	32 / 32	39.8 - 1030	348.20	NO	NO	422.81
MANGANESE	8 / 8	2.6 - 214	1.9E+02	92.51	25 / 32	0.77 - 31.8	4.24	NO	NO	6.03
MERCURY	8 / 8	0.03 - 0.17	1.7E-01	0.13	25 / 32	0.0051 - 0.048	0.02	NO	NO	0.02
NICKEL	4 / 8	1.8 - 7.2	7.3E+00	4.75	21 / 32	0.56 - 3.3	1.13	NO	NO	1.34
POTASSIUM	7 / 8	95 - 792	2.8E+03	793.35	32 / 32	70.5 - 2530	899.52	YES	NO	1120.44
SELENIUM	2 / 8	0.57 - 0.93	8.8E-01	0.79	1 / 32	1	0.52	NO	NO	0.54
SILVER	2 / 8	0.37 - 0.67	6.2E-01	0.51	2 / 32	0.31 - 1.1	0.25	NO	NO	0.30
SODIUM	8 / 8	17.5 - 94.8	1.0E+02	79.35	31 / 32	18.3 - 292	61.72	NO	-	85.61
THALLIUM	4 / 8	0.7 - 1.9	1.8E+00	1.38	9 / 32	0.86 - 1.6	0.64	NO	NO	0.76
VANADIUM	8 / 8	11.05 - 64	9.7E+01	64.71	32 / 32	4.4 - 79.6	40.86	NO	NO	68.01
ZINC	6 / 8	1.1 - 50.7	5.0E+01	31.35	32 / 32	1.8 - 29.6	6.49	NO	NO	8.05

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400, BGSB0105, BGSB0205, BGSB0305, BGSB0405

TABLE 8-8
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL) *	NOT DETECTED	-	-	2 / 32	17 - 96	96.0
2-BUTANONE *	NOT DETECTED	-	-	2 / 32	5 - 8	8.00
BENZENE *	NOT DETECTED	-	-	3 / 32	300 - 1300	226
CARBON DISULFIDE *	NOT DETECTED	-	-	1 / 32	2	2.00
ETHYLBENZENE *	NOT DETECTED	-	-	13 / 32	13 - 16000	2524
METHYLENE CHLORIDE *	NOT DETECTED	-	-	17 / 32	2 - 150	150
TETRACHLOROETHENE *	NOT DETECTED	-	-	6 / 32	6 - 45	45.0
TOLUENE *	NOT DETECTED	-	-	4 / 32	190 - 770	181
TRICHLOROETHENE *	NOT DETECTED	-	-	1 / 32	3	3.00
XYLENE (TOTAL) *	NOT DETECTED	-	-	14 / 32	8 - 92000	12067
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	15 / 32	2200 - 220000	45515
ACENAPHTHENE *	NOT DETECTED	-	-	12 / 32	160 - 11000	2774
ANTHRACENE *	NOT DETECTED	-	-	8 / 32	78 - 3900	2016
BENZO(A)ANTHRACENE *	NOT DETECTED	-	-	2 / 32	41 - 43	43.0
BENZO(A)PYRENE *	NOT DETECTED	-	-	2 / 32	41 - 43	43.0
BENZO(K)FLUORANTHENE *	NOT DETECTED	-	-	2 / 32	39 - 46	46.0
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	4 / 32	67 - 1400	1400
CHRYSENE *	NOT DETECTED	-	-	3 / 32	55 - 57	57.0
DIBENZOFURAN *	NOT DETECTED	-	-	8 / 32	1300 - 7800	4548
DIETHYLPHTHALATE *	NOT DETECTED	-	-	3 / 32	38 - 73	73.0
FLUORANTHENE *	2 / 8	40 - 84	84	5 / 32	49 - 140	140
FLUORENE *	NOT DETECTED	-	-	13 / 32	320 - 18000	4161
NAPHTHALENE *	NOT DETECTED	-	-	13 / 32	290 - 60000	11993
PHENANTHRENE *	NOT DETECTED	-	-	18 / 32	46 - 31000	7208
PYRENE *	1 / 8	46	46	8 / 32	86 - 2800	2415
4,4'-DDD *	NOT DETECTED	-	-	2 / 9	2.1 - 26	9.54
4,4'-DDE *	2 / 8	16 - 330	121.91	4 / 8	1.8 - 11	6.61
4,4'-DDT *	2 / 8	43 - 420	157.34	7 / 9	6 - 20	20.0
ALPHA-CHLORDANE *	NOT DETECTED	-	-	1 / 9	3.7	1.82
AROCLOR-1254 *	NOT DETECTED	-	-	1 / 32	10	10.0
ENDOSULFAN I *	NOT DETECTED	-	-	1 / 8	9.9	4.18
ENDOSULFAN II *	NOT DETECTED	-	-	1 / 9	41	14.28
GAMMA-CHLORDANE *	NOT DETECTED	-	-	4 / 7	0.39 - 3.3	1.94
HEPTACHLOR *	NOT DETECTED	-	-	1 / 9	0.27	0.27
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	2 / 8	0.49 - 7.8	3.39

* - Selected as a COPC

** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400, BGSB0105, BGSB0205, BGSB0305, BGSB0405

8.5.2.2 Organics

Fluoranthene (40 ug/kg to 84 ug/kg) and pyrene (46 ug/kg) were detected in background subsurface soil samples. PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(k)fluoranthene, dibenzofuran, fluoranthene, fluorene, naphthalene, and pyrene were detected in numerous site-related subsurface soil samples at a range from 41 ug/kg to 220,000 ug/kg. 2-Methylnaphthalene was generally the PAH present at the highest concentration, followed by naphthalene (both PAHs are prevalent in diesel fuel). These PAHs were found at the highest levels (over 30,000 ug/kg) near the area where monitoring wells containing free product are located (within a region bounded by Buildings C-16, C-18, and C-19, close to the location of a former leaking underground diesel line). Samples exhibiting individual PAHs at levels above 30,000 ug/kg include 16 SB 04-08, 16 SB 04-10, 16 SB 05-06, 16 SB 05-08, 16 SB 17-06, 16 SB 19-06, and 16 SB 19-08. 2-Methylnaphthalene and/or naphthalene were detected at levels greater than 3,000 ug/kg in samples 16 SB 10-00, 16 SB 12-06, 16 SB 17-04, 16 SB 18-06, 16 SB 20-02, and 16 SB 20-06.

Aroclor 1254 was detected in one site-related subsurface soil sample (16 SB 09-06) at a concentration of 10 ug/kg. VOCs were detected in subsurface soils, including 1,2-DCE (17 ug/kg to 96 ug/kg), 2-butanone (5 ug/kg to 8 ug/kg), benzene (300 ug/kg to 1,300 ug/kg), carbon disulfide (2 ug/kg), ethylbenzene (13 ug/kg to 16,000 ug/kg), methylene chloride (2 ug/kg to 150 ug/kg), PCE (6 ug/kg to 45 ug/kg), TCE (3 ug/kg), and xylene (8 ug/kg to 92,000 ug/kg). The halogenated VOCs detected in multiple samples include PCE (detected in six samples) and 1,2-DCE (two samples). The highest concentration of 1,2-DCE (96 ug/kg) was detected in sample 16 SB 14-04; the highest concentration of PCE (45 ug/kg) was observed in sample 16 SB 18-02. Most of the samples containing chlorinated ethenes were located approximately along a line beginning at the southeastern corner of Building C-16 and extending east/northeast past the shed north of Building C-50. Toluene was detected in 16 SB 04-08, 16 SB 04-10, 16 SB 05-08, and 16 SB 19-08 (benzene was detected in three out of four of these samples).

Phthalates including bis(2-ethylhexyl)- (67 ug/kg to 4,100 ug/kg) and diethyl- (38 ug/kg to 73 ug/kg) were detected in subsurface soil samples collected at Site 16.

Pesticides were detected in site-related subsurface soil samples collected at Site 16 from 6 ug/kg to 20 ug/kg (4,4'-DDT) and 1.8 ug/kg to 11 ug/kg (4,4'-DDE). Other pesticides, including 4',4'-DDD (2.1 ug/kg to 26 ug/kg), endosulfan I (9.9 ug/kg), endosulfan II (41 ug/kg), alpha-chlordane (3.7 ug/kg), heptachlor epoxide (0.49 ug/kg to 7.8 ug/kg), heptachlor (0.27 u/kg), and gamma-chlordane (1.7 ug/kg to 35 ug/kg), were also detected in subsurface soil samples.

Due to the relatively high concentrations of aromatic hydrocarbons present in many samples, the pesticide results at Site 16 should be qualified. Concentrations of aromatic hydrocarbons can interfere to produce a GC trace that can overlap the ranges for pesticides during analysis. Such interferences are normally removed by mandatory clean-up procedures in the laboratory; however, pesticide sensitivity ranges are four to five orders of magnitude less than the levels of hydrocarbons in many of the Site 16 samples, which, in some samples, might produce biased or artifactual results for one or more pesticides. Hence, data for pesticides at Site 16 might be viewed more as screening information or for a worst-case evaluation.

8.5.2.3 Miscellaneous Parameters

Thirty-two subsurface soil samples collected at Site 16 were analyzed for moisture (5.4 percent to 16.8 percent), pH (4.9 to 8.3), and TPH (11.0 mg/kg to 33,000 mg/kg). Nineteen samples contained TPH concentrations greater than maximum background. Samples containing the highest concentrations of TPH (over 3,000 mg/kg) were obtained in the area bounded by Buildings C-16, C-18, and C-19. Eight samples had pH levels exceeding 6.9 or maximum background.

8.5.3 Sediment

Three site-related sediment samples (16 SD 01 through 16 SD 03) were collected at Site 16 (Figure 8-1). Tables 8-9 and 8-10 present the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compare them to background. Table 8-6 presents a comparison of detected compounds to ARARs and TBCs. Figure 8-4 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

8.5.3.1 Inorganics

Concentrations of most metals in site-related samples were similar to background levels. In all samples, lead and zinc were detected at low levels but at levels slightly greater than the levels found in background samples. Antimony, cadmium, silver, and thallium were detected in site-related sediment samples at concentrations near the instrument detection limit but were not detected in background samples.

8.5.3.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k) fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, phenanthrene, and pyrene were detected in all background sediment samples at a range from 140 ug/kg to 1,900 ug/kg. The pesticide 4,4'-DDD (4.9 ug/kg to 21.0 ug/kg) was detected in two samples and pesticide compounds gamma-chlordane (0.095 ug/kg), 4,4'-DDE (1.7 ug/kg), and 4,4'-DDT (19 ug/kg) were each detected in only one background sediment sample.

Background PAHs, plus naphthalene (72.5 ug/kg), acenaphthene (145 ug/kg), and anthracene (215.0 ug/kg), were detected in the site-related sediment samples at comparable or slightly lower concentrations (concentration range of 63.0 ug/kg to 1,250 ug/kg). The pesticides 4,4'-DDE (4.9 ug/kg to 16.5 ug/kg), 4,4'-

TABLE 8-9
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5460	3 / 3	1400 - 4295	2838.33	NO	NO	4295
ANTIMONY*	NOT DETECTED	-	-	-	1 / 3	1.5	0.76	YES	-	1.50
ARSENIC*	5 / 6	2.4 - 9.9	2.9E+02	11.23	3 / 3	2.5 - 7.45	5.22	NO	NO	7.45
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	3 / 3	16.5 - 22.35	19.87	YES	NO	22.35
BERYLLIUM	4 / 6	0.34 0.57	3.3E-01	0.72	3 / 3	0.125 - 0.36	0.24	NO	NO	0.36
CADMIUM*	2 / 6	0.44 - 0.46	1.1E+00	0.93	3 / 3	1.9 - 2.4	2.17	YES	YES	2.40
CALCIUM	6 / 6	179 - 518	6.7E+05	691	3 / 3	450.5 - 1850	1153.50	YES	NO	1850
CHROMIUM	6 / 6	4.3 - 56	2.6E+03	40.42	3 / 3	18.45 - 58.7	44.48	YES	NO	58.70
COBALT	4 / 6	0.51 2.1	6.4E+00	2.85	3 / 3	0.86 - 2.25	1.64	NO	NO	2.25
COPPER*	6 / 6	1 - 13	1.9E+01	9.08	3 / 3	19.45 - 26.7	23.92	YES	YES	26.70
IRON	6 / 6	228 - 21400	7.2E+09	23589	3 / 3	11000 - 13900	12016.67	NO	NO	13900
LEAD*	6 / 6	4 - 34.3	4.8E+01	21.07	3 / 3	44.9 - 57.9	51.65	YES	YES	57.90
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	810	3 / 3	181.5 - 1540	947.17	YES	NO	1540
MANGANESE	6 / 6	3.9 - 63.1	8.9E+01	36.22	3 / 3	38.7 - 93.05	63.05	YES	NO	93.05
MERCURY	1 / 6	0.068 0.068	8.5E-03	0.09	3 / 3	0.021 - 0.06	0.05	NO	YES	0.06
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	3 / 3	3.55 - 5.5	4.55	NO	NO	5.50
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892	3 / 3	128.5 - 942	529.83	NO	NO	942
SILVER	2 / 6	0.1125 0.15	1.9E+00	1.13	3 / 3	0.37 - 0.63	0.50	NO	NO	0.63
SODIUM	4 / 6	26.6 - 2280	2.8E+00	877	3 / 3	39.85 - 135.5	95.12	NO	YES	136
THALLIUM	NOT DETECTED	-	2.9E+03	-	2 / 3	1.3 - 1.6	1.13	YES	NO	1.60
VANADIUM	6 / 6	5.9 - 42.7	-	39.42	3 / 3	8.85 - 40.75	28.93	NO	-	40.75
ZINC	6 / 6	12.5 - 34.7	2.1E+03	41.23	3 / 3	106.55 - 132	122.35	YES	NO	132

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 8-10
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND**			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE*	NOT DETECTED	-	-	1 / 3	119.5	119.5
4,4'-DDD*	2 / 6	4.9 - 21	11.98	1 / 3	66.5	66.5
4,4'-DDE*	1 / 6	1.7	1.70	3 / 3	4.9 - 16.5	16.5
4,4'-DDT*	1 / 6	19	10.64	3 / 3	8.1 - 41	41
ACENAPHTHENE*	NOT DETECTED	-	-	1 / 3	145	145
ALPHA-BHC*	NOT DETECTED	-	-	1 / 3	0.045	0.045
ANTHRACENE*	NOT DETECTED	-	-	1 / 3	215	215
BENZ(A)ANTHRACENE*	3 / 6	85 - 560	560	3 / 3	63 - 660	660
BENZO(A)PYRENE*	3 / 6	110 - 590	394	3 / 3	75 - 590	590
BENZO(B)FLUORANTHENE*	3 / 6	150 - 490	347	3 / 3	150 - 750	750
BENZO(G,H,I)PERYLENE*	3 / 6	51 - 380	380	3 / 3	71 - 350	350
BENZO(K)FLUORANTHENE*	3 / 6	63 - 470	470	2 / 3	96 - 250	250
BIS(2-ETHYLHEXYL)PHTHALATE*	NOT DETECTED	-	-	3 / 3	235 - 460	460
BUTYLBENZYLPHTHALATE*	NOT DETECTED	-	-	1 / 3	65	65
CARBAZOLE*	NOT DETECTED	-	-	1 / 3	165	165
CHRYSENE*	3 / 6	130 - 940	578	3 / 3	120 - 690	690
DIBENZ(A,H)ANTHRACENE*	NOT DETECTED	-	-	1 / 3	90	90
DIBENZOFURAN*	NOT DETECTED	-	-	1 / 3	79.5	79.5
FLUORANTHENE*	3 / 6	240 - 1800	1024	3 / 3	110 - 1250	1250
FLUORENE*	1 / 6	190	190	1 / 3	130	130
GAMMA-CHLORDANE*	1 / 6	0.095	0.095	3 / 3	2.85 - 3.1	3.1
INDENO(1,2,3-CD)PYRENE*	3 / 6	55 - 310	310	3 / 3	71 - 290	290
METHOXYCHLOR*	NOT DETECTED	-	-	1 / 3	9.6	9.6
NAPHTHALENE*	NOT DETECTED	-	-	1 / 3	72.5	72.5
PHENANTHRENE*	3 / 6	110 - 1900	1052	3 / 3	59 - 965	965
PYRENE*	3 / 6	200 - 1900	1077	3 / 3	220 - 1800	1800

* - Selected as a COPC

** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

DDT (8.1 ug/kg to 41.0 ug/kg), and gamma-chlordane (2.85 ug/kg to 3.1 ug/kg) were detected in all site-related sediment samples. The pesticide compounds 4,4'-DDE (66.5 ug/kg) and methoxychlor (9.6 ug/kg) were detected in only one site-related sediment sample. The following compounds were found in site-related samples but not detected in the associated background sediments: 2-methylnaphthalene (119.5 ug/kg), alpha-BHC (0.045 ug/kg), carbazole (165 ug/kg), dibenzofuran (79.5 ug/kg), and phthalates (concentration range of 65 ug/kg to 460 ug/kg).

8.5.3.3 Miscellaneous Parameters

The three sediment samples collected for Site 16 were analyzed for moisture, pH, TOC, and TPH. All samples contained TPH concentrations from 50.0 mg/kg to 660 mg/kg. Moisture content and TOC levels were within the range found in background samples.

8.5.4 Groundwater

Five site-related groundwater samples (16 GW 01 through 16 GW 03, 16 GW 06, and 16 MW 01) were collected at Site 16 (Figure 8-1) during the 1995 RI. These samples were obtained from wells MW16-01 through MW16-03, MW16-06, and MW-01 , respectively. Wells MW16-07 through MW16-10 were installed and sampled (samples 16GW07 through 16GW10) during the 1996 RI Addendum field activities. Sample identifiers vary from the well identifiers for this site. Table 8-11 presents the well identifiers and corresponding sample identifier. Tables 8-12 and 8-13 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples and compare them to background. Table 8-6 presents a comparison of detected compounds to ARARs and TBCs. Figure 8-5 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

8.5.4.1 Inorganics

Concentrations of metals in most site-related samples were similar to background. Downgradient sample 16 GW 06 contained high levels of aluminum (85,200 ug/L) and elevated or high levels of several other metals (arsenic, beryllium, cadmium, chromium, iron, thallium, vanadium, and zinc). Filtered sample results from the same location (16 GW 06-F) did not exhibit elevated levels of any metals except arsenic (3.6 ug/L) and iron (53,500 ug/L). Upgradient sample 16 GW 03 displayed concentrations of iron (15,300 ug/L) and arsenic (5.3 ug/L) similar to 16 GW 06-F.

TABLE 8-11
SITE 16 SAMPLE IDENTICATION
GROUNDWATER

MONITORING WELL IDENTIFIER	SAMPLE IDENTIFIER
MW-01	16MW01
MW16-01	16GW01
MW16-02	16GW02
MW16-03	16GW03
MW16-04	16GW04
MW16-05	16GW05
MW16-06	16GW06
MW16-07	16GW07
MW16-08	16GW08
MW16-09	16GW09
MW16-10	16GW10

TABLE 8-12
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND***				SITE-RELATED					
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	9.6E+06	5097.82	5 / 5	2110 - 85200	20360.00	YES	NO	54942
ARSENIC*	1 / 11	5.8	6.6E+00	4.05	4 / 5	5.3 - 156	34.87	YES	YES	99.4
BARIUM	11 / 11	2.6 - 518	5.8E+02	229.60	5 / 5	133 - 432	330	YES	NO	432
BERYLLIUM*	4 / 11	0.21 - 1.6	1.3E+00	0.49	4 / 5	0.18 - 9.8	2.147	YES	YES	6.23
CADMIUM	5 / 11	0.6 - 1.9	2.3E+00	1.21	2 / 5	0.41 - 4.9	1.176	NO	NO	3.16
CALCIUM	11 / 11	506 - 17200	1.7E+04	8306.55	5 / 5	2530 - 14200	6658	NO	NO	14200
CHROMIUM*	9 / 11	1.3 - 43.5	6.0E+01	29.36	5 / 5	34 - 2070	483.3	YES	YES	1330
COBALT	6 / 11	0.7 - 10.1	9.6E+00	4.06	5 / 5	1.3 - 8.8	3.14	NO	NO	6.20
COPPER*	9 / 11	0.79 - 13.5	1.4E+01	6.53	5 / 5	5.1 - 41.9	17.62	YES	YES	41.90
IRON*	11 / 11	153 - 7690	8.5E+03	4197.09	5 / 5	1240 - 379000	84188	YES	YES	241400
LEAD*	3 / 11	2.1 - 3	3.1E+00	2.44	5 / 5	2 - 46.5	11.36	YES	YES	30.10
MAGNESIUM	11 / 11	273 - 27400	2.3E+04	8449.64	5 / 5	1410 - 17700	5340	NO	NO	11949
MANGANESE	11 / 11	3.3 - 65	1.2E+03	46.18	5 / 5	10.8 - 79.6	52.82	YES	NO	79.6
MERCURY	11 / 11	0.005 - 0.12	2.0E-01	0.12	5 / 5	0.084 - 0.18	0.1044	NO	NO	0.14
NICKEL*	10 / 11	0.81 - 25.5	2.6E+01	11.98	2 / 5	20 - 184	41.025	YES	YES	118
POTASSIUM	11 / 11	350 - 3245	2.5E+06	2810.55	5 / 5	2510 - 54900	13650	YES	NO	35647
SELENIUM	1 / 11	5.3	8.6E+00	4.96	1 / 5	17 17	5.16	YES	NO	17.0
SODIUM	11 / 11	1850 - 11650	1.3E+04	8449.09	5 / 5	16100 - 69300	48100	YES	YES	69300
THALLIUM	3 / 11	4 - 5.1	1.1E+01	5.15	2 / 5	13 - 15.6	6.8	YES	NO	15.6
VANADIUM*	10 / 11	0.69 - 42.25	4.0E+01	16.48	5 / 5	1 - 874	203.08	YES	YES	561
ZINC	6 / 9	3.7 - 348	4.4E+02	178.61	5 / 5	2 - 360	204.2	YES	NO	360

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 8-13
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND FREQUENCY OF DETECTION	BACKGROUND RANGE OF POSITIVE DETECTION	BACKGROUND REPRESENTATIVE CONCENTRATION	SITE-RELATED FREQUENCY OF DETECTION	SITE-RELATED RANGE OF POSITIVE DETECTION	SITE-RELATED REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE*	NOT DETECTED	-	-	1 / 9	3	3
4-METHYLPHENOL*	NOT DETECTED	-	-	1 / 9	1	1
BIS(2-ETHYLHEXYL)PHTHALATE*	NOT DETECTED	-	-	2 / 9	1 - 3	3
FLUORENE*	NOT DETECTED	-	-	1 / 9	1	1
NAPHTHALENE*	NOT DETECTED	-	-	4 / 9	1 - 3	3
PHENOL*	NOT DETECTED	-	-	2 / 9	11 - 12	8.45
VOLATILE HYDROCARBONS*	NOT DETECTED	-	-	5 / 5	6 - 150	150
1,1-DICHLOROETHENE*	NOT DETECTED	-	-	3 / 16	0.01 - 0.5	0.5
1,2-DICHLOROETHANE*	NOT DETECTED	-	-	3 / 16	0.7 - 4	4
1,2-DICHLOROETHENE (TOTAL)*	NOT DETECTED	-	-	6 / 16	0.09 - 38	10.81
BENZENE*	NOT DETECTED	-	-	4 / 16	28 - 200	43.56
BROMODICHLOROMETHANE*	NOT DETECTED	-	-	1 / 11	1	1
CARBON TETRACHLORIDE*	NOT DETECTED	-	-	1 / 16	0 - 0.0003	0.0003
CHLOROFORM*	1 / 11	2	2	4 / 16	4 - 14	14.00
ETHYLBENZENE*	NOT DETECTED	-	-	1 / 16	2	2
TETRACHLOROETHENE*	NOT DETECTED	-	-	2 / 16	1 - 2	2
TOLUENE*	NOT DETECTED	-	-	1 / 16	7	7.00
TRICHLOROETHENE*	NOT DETECTED	-	-	1 / 16	0.475	0.475
VINYL CHLORIDE*	NOT DETECTED	-	-	1 / 11	4	4.00
XYLENE (TOTAL)*	NOT DETECTED	-	-	1 / 16	26	7.67

* - Selected as a COPC

8.5.4.2 Organics

Monitoring Wells

Semivolatile compounds were detected in several monitoring well samples with the highest levels generally observed in 16 GW 04 and 16 GW 05. SVOCs detected include naphthalene (1 ug/L to 690 ug/L) in six samples, 2-methylnaphthalene (3 ug/L to 1,900 ug/L) and fluorene (1 ug/L to 140 ug/L) in three samples, acenaphthene (11 ug/L to 91 ug/L), bis(2-ethylhexyl)phthalate (3 ug/L to 190 ug/L), dibenzofuran (7 ug/L to 73 ug/L), and phenol (12 ug/L to 15 ug/L) in two samples each, and 2,4-dimethylphenol (52 ug/L), 4-methylphenol (1 ug/L), carbazole (16 ug/L), phenanthrene (240 ug/L), and pyrene (27 ug/L) in one sample each.

Significant levels of VOCs were also detected in monitoring well samples, with the highest levels primarily in wells 16 GW 04, 16 GW 05, and 16 GW 06, and to a lesser degree, in 16 GW 03. Well 16 GW 09 also showed a significant level of benzene, but not other VOCs. VOCs detected include benzene (40 ug/L to 1,900 ug/L) and chloroform (4 ug/L to 14 ug/L) in four samples each, ethylbenzene (2 ug/L to 330 ug/L), toluene (7 ug/L to 160 ug/L), and xylene (26 ug/L to 1,700 ug/L) in three samples (16 GW 04, 16 GW 05, and 16 GW 06) each, and PCE (1 ug/L) in one sample.

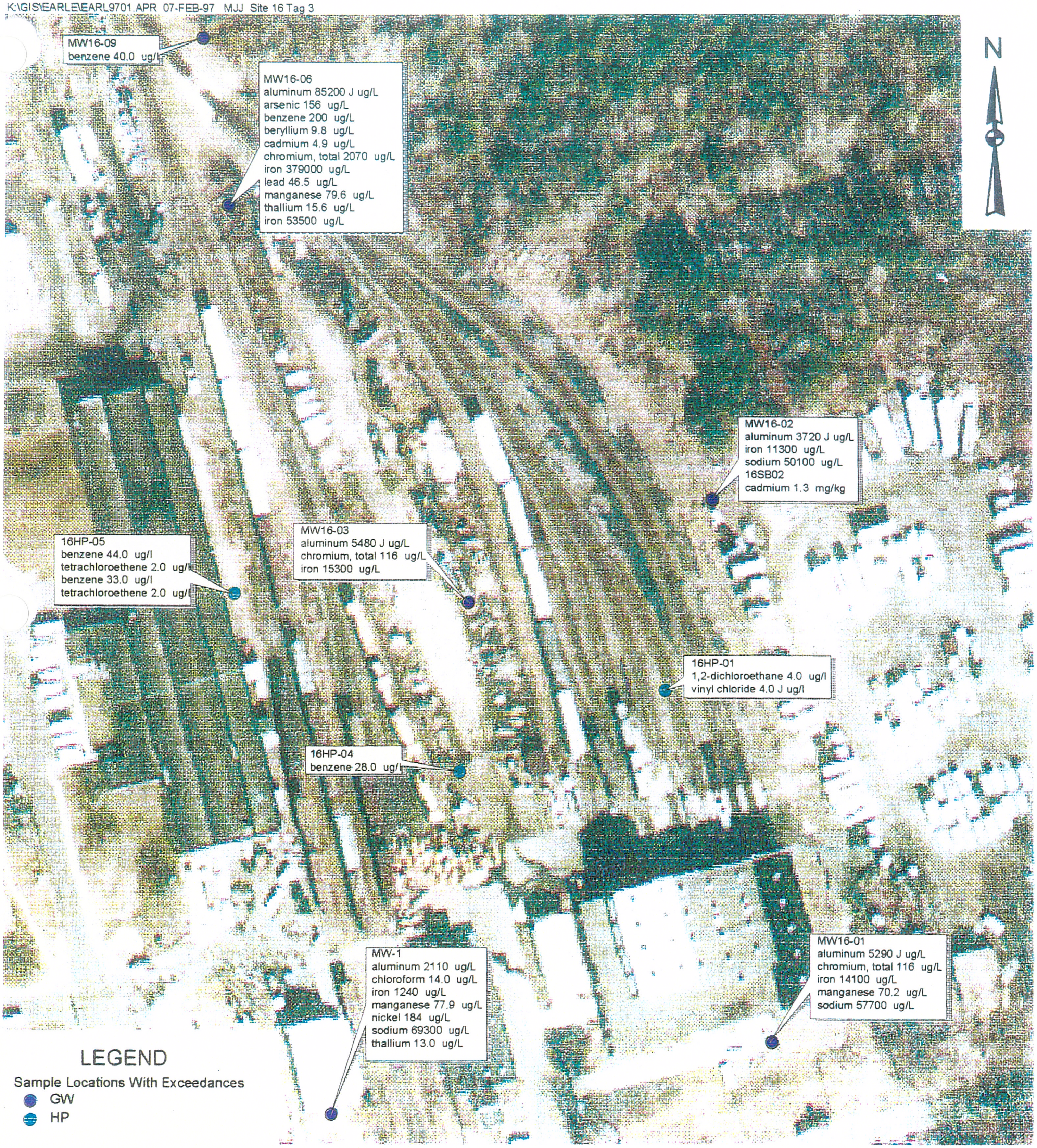
Direct Push Samples

1,2-DCE (0.09 ug/L to 14 ug/L) was detected in four of the five samples. 1,1-DCE (0.01 ug/L to 0.5 ug/L) and 1,2-dichloroethane (0.7 ug/L to 4 ug/L) were each detected in three samples. Benzene (28 ug/L to 44 ug/L) was detected in two samples. PCE (2 ug/L) and TCE (0.9 ug/L) were each detected in one sample. Vinyl chloride was a parameter for one sample (16 HP 01) only and was detected at 4 ug/L. The highest levels of chlorinated aliphatics were generally at sample location 16 HP 01, although PCE was detected at a level exceeding ARARs at 16 HP 05. Benzene was detected at locations 16 HP 04 and 16 HP 05.

8.5.4.3 Miscellaneous Parameters

Two groundwater samples, 16 GW 06 and 16 MW 01, were found with TPH (0.200 mg/L and 0.100 mg/L, respectively). This is less than the required detection limit for TPH in aqueous samples of 0.300 mg/L.

K:\GIS\EARLE\EARL9701.APR 07-FEB-97 MJJ Site 16 Tag 3



NCENTRATIONS IN GROUNDWATER ABOVE SCREENING LEVELS
SITE 16 AND EPIC SITE F

FIGURE 8-5

100 0 100 200 Feet

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8.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 16 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 8.6.1. Persistence of detected chemicals in the environment is discussed in Section 8.6.2. Section 8.6.3 presents a brief discussion of contaminant trends.

8.6.1 Detected Chemicals and Transport Potential

Groundwater investigation results at Site 16 indicate the presence of a floating layer of free product (LNAPL) in contact with groundwater. At two monitoring wells, MW16-04 and MW16-05, GC fingerprint analysis of the free product indicated primarily diesel No. 2 fuel is present. Aromatic volatiles (BTEX) and semivolatiles (naphthalene and other PAHs) associated with petroleum fuels were also detected in other groundwater samples that did not contain free product. This LNAPL layer is a source of hydrocarbons into groundwater.

Subsurface soil samples revealed notable concentrations of BTEX compounds (in seven samples), TPH (greater than 3,000 mg/kg in seven samples), and the lighter PAHs (greater than 30,000 ug/kg in seven samples and greater than 3,000 ug/kg in six samples). Because of the significant concentration ranges present, there is also a probability for leaching of aromatic volatiles and the lighter PAHs (naphthalene and 2-methylnaphthalene) from subsurface soils into groundwater. 2-Methylnapthalene was detected in one groundwater sample, 16 GW 10, at 3 ug/L.

In surface soil samples, individual PAHs were less than 4,400 ug/kg, with TPH levels of up to 20,000 mg/kg. The highest level of TPH was detected in sample 16 SS 03, which is located near the northwestern corner of the former (and current) wash area next to Building C-19. All three sediment samples revealed several PAHs at levels similar to background. In site-related sediment sample 16 SD 01 (located at the catch basin in the northern end of the site), low levels of 2-methylnaphthalene were detected, although this compound was not found in background sediments. 2-Methylnaphthalene is associated with diesel range fuels, which suggests that at least a portion of the observed sediment PAH distribution is related to surface water runoff for erosional transport migration from the site. Slightly elevated TPH levels were also noted in all three sediment samples.

Groundwater concentrations of several metals were generally greater than levels in the corresponding filtered sample collected at the same location. With the exception of arsenic and iron, elevated levels of metals were not present in the filtered samples, which indicates the presence of suspended solids. Metals in suspension are expected to have a greatly diminished potential for in-situ transport compared to metals in solution. Given a geologic formation that does not include conditions conducive to solution channeling or fracture-based flow, samples from wells with high turbidity would show higher metal concentrations than actually mobile in the subsurface. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, at several wells, low-turbidity samples could not be collected. Samples obtained from wells where turbidity could not be reduced displayed metals concentrations higher than representative for the formation and, in the case of 16 GW 02 and 16 GW 05, filtered results were lower.

Elevated levels of metals were found in the three surface soil samples taken in the C-19, former wash runoff area. Slightly elevated levels of antimony, lead, and chromium in subsurface soil and lead and zinc in sediment were observed. Most metals are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. The transport and fate of metals in the environment are primarily controlled by sorption to soil/sediment material. The metal-organic relationships, both in soil and water, increase in importance as the organic carbon content increases. Soils in contact with high levels of petroleum hydrocarbons could increase the sorptive capacity of soil and, in the case of surface soil, could decrease the tendency for fugitive dust emissions.

Groundwater samples showed the presence of site-related SVOCs and VOCs. VOCs included TCE and PCE and their degradation products. Other VOCs detected included BTEX compounds, typically associated with petroleum products. All detected volatile organic groundwater contaminants are volatile and characteristically mobile in the environment (either through soil gas migration or groundwater transport).

PCBs, which were detected at a low level in one subsurface soil, are typically strongly bound to organic matter and are not expected to migrate significantly. Pesticides, which were detected at low levels in sediment, are also considered to exhibit low mobility except in conjunction with surface water erosional patterns.

Several phthalates were detected at low levels in groundwater, surface soil, subsurface soil, and sediment. These compounds exhibit a tendency to bind to soil containing organic carbon and are considered common in the environment due to their presence in plastics.

The physical transport data for detected compounds are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

8.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

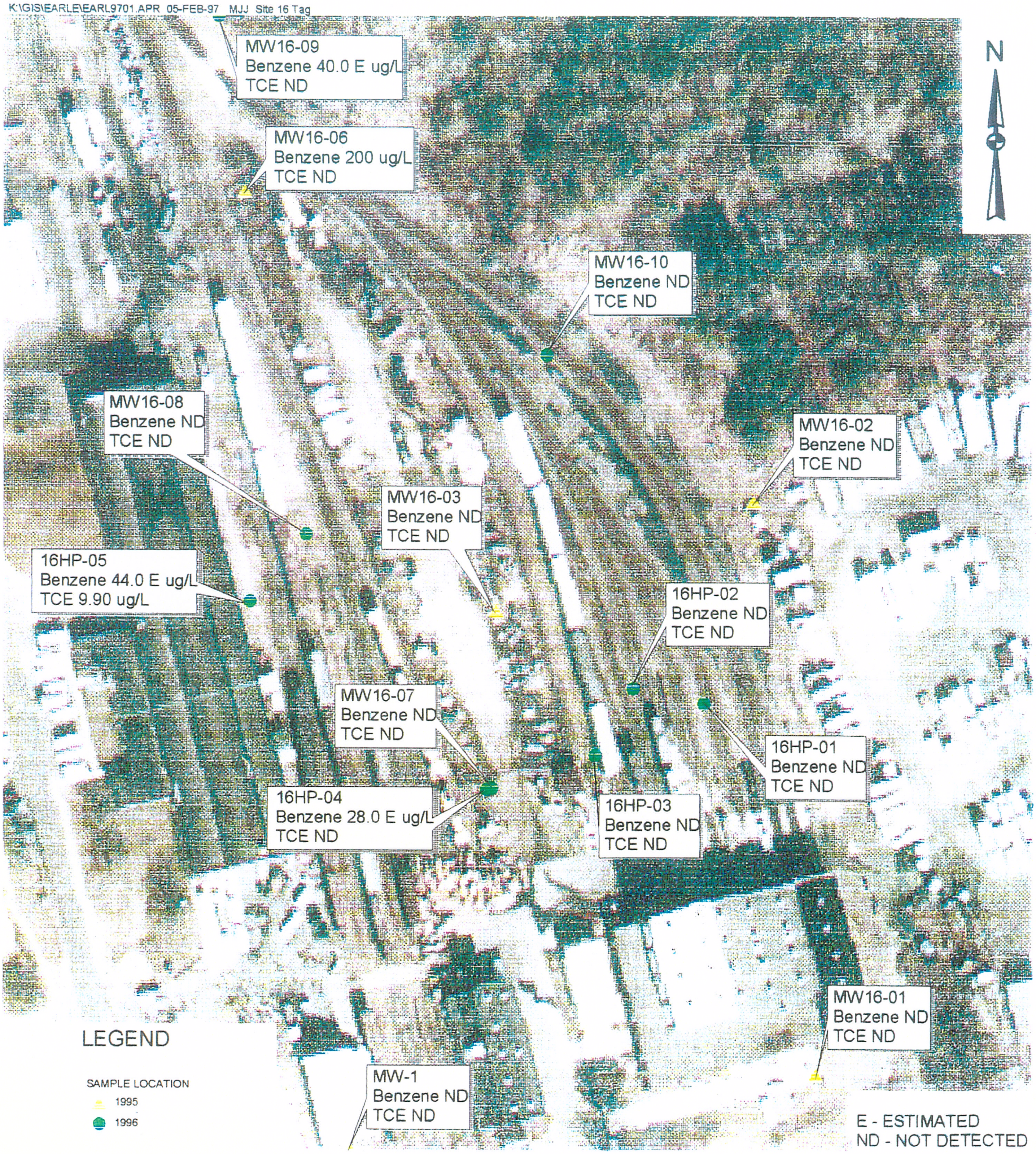
Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation. In the case of high levels of hydrocarbons present in groundwater, the heavier molecular weight PAHs may be transported along with the lighter PAHs to a point where contaminant concentrations are somewhat lower. Volatile organics and the lightest PAHs (naphthalene and 2-methyl naphthalene) are highly mobile in groundwater.

Biodegradation of fuel-related substances (BTEX, PAHs, and TPH) is an important fate process for the volatile and semivolatile fuel-related impacts. However, the near impact of reduction through this mechanism may be ineffective when a source exists from free product. The free-product layer can introduce compounds into groundwater, resulting in a biotoxic zone for microorganisms in the immediate proximity of the LNAPL boundary.

The chlorinated ethenes detected in groundwater have been associated with degradation of TCE and PCE (Cline and Viste, 1983). PCBs are considered highly persistent, typically exhibiting biodegradation patterns that proceed slowly and to varying degrees, depending upon the individual isomer chlorination pattern of the PCB congeners that make up the Aroclor mixtures.

8.6.3 Observed Chemical Contaminant Trends

A variety of fuel-related substances, including the BTEX compounds and the lighter PAHs, originate in a free-product layer in groundwater and were detected in multiple subsurface soil and groundwater samples. The source area appears to be located near the former diesel line between Buildings C-16, C-18, and C-19. The areal extent of groundwater contaminated with the fuel appears to be limited to a zone bounded by the area of floating product and the monitoring wells MW16-08 and MW16-10 (Figure 8-6). The presence of benzene in MW16-06 and MW16-09 is not explained by the RI, but the source of benzene does not appear to be the floating product in the vicinity of Building C-50. No significant subsurface soil or groundwater impacts were



COMPOUNDS DETECTED IN GROUNDWATER
SITE 16 AND EPIC SITE F

FIGURE 8-6

Brown & Root Environmental

detected near MW16-01, which is located south of Building C-50, or near MW16-02, which is located northeast of Building C-50. BTEX compounds were not detected in the surface soils collected near the current wash area north of Building C-19.

The CPT subsurface investigation showed the area with the highest probable petroleum-related contamination in the area north of Building C-50 and at several locations east of Building C-16. Groundwater samples collected in these areas show BTEX, PAHs and TPH, indications of petroleum products.

Monitoring well MW16-06, which is located more than 600 feet downgradient of the area of highest contamination, MW16-09, which is 150 feet downgradient of MW16-06, and the wells containing free product, all revealed BTEX compounds. Another monitoring well, MW16-03, located downgradient and slightly cross-gradient (to the northeast) of the area of highest concentration, did not indicate BTEX contamination; however, MW16-03 did exhibit the presence of naphthalene, a component of diesel range fuels.

PCE, TCE, and related degradation by-products were observed at low or trace levels in subsurface soil and groundwater. 1,2-DCE was detected in the sample from monitoring well 16 GW 06, a finding that could be related to detections of 1,2-DCE, TCE, and PCE in several subsurface soil samples located in an upgradient direction. Most of the soil samples displaying chlorinated ethenes were located approximately along a line beginning at the southeastern corner of Building C-16 and extending east/northeast past the shed north of Building C-50. Since soil gas results and soil samples did not identify any locations of high concentrations, this suggests the possibility that source areas for halogenated VOCs have been largely depleted. Low levels of pesticides were reported in surface and subsurface soils and sediment but were not detected in groundwater. The reported data for pesticides in subsurface soils that also contain high levels of hydrocarbons should be treated more as screening information because of possible analytical bias associated with potential interferences.

The presence of suspended solids in groundwater samples 16 GW 02, 16 GW 03, and 16 GW 06 is indicated by high turbidity readings and elevated levels of metals, such as aluminum, that are normally relatively insoluble in most common forms. Unfiltered sample results were used in calculations for the groundwater risk assessment in accordance with the recommended conservative approach to this evaluation. However, filtered sample results of two wells at Site 16 appear to be more representative of dissolved-phase concentrations.

8.6.4 Conclusions

Hydrocarbons detected in the subsurface soils at Site 16 have impacted the groundwater. The groundwater contamination (primarily volatile organics and fuel constituents) is associated with a free-product LNAPL layer. The floating product is a source of organics to groundwater. In addition, there is a potential for residual leaching of aromatic volatiles and the lighter PAHs from subsurface soils into groundwater because of the significant concentrations present. TPH and PAH detections in sediment indicate that a limited degree of transport via surface water runoff and erosional dispersion has occurred.

Low levels of PCE, TCE, and degradation products were detected in subsurface soil and groundwater at Site 16. The low levels detected may be attributable to residual material present from past spills and may indicate that sources have been depleted over time.

Other substances detected at low levels in surface soils, subsurface soils, and sediment, such as metals, heavier PAHs, pesticides, and PCBs, are not expected to transport quickly from the source areas.

Except in the two wells containing free product, only one PAH compound and one phthalate compound were detected in groundwater.

With the exception of iron, groundwater data do not suggest migration of dissolved inorganic contaminants from the site.

8.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 16. The risk assessment was performed using the approach outlined in Section 2.4. Tables 8-14 through 8-17 provide the selected COPCs and representative concentrations of inorganics and organics in site-related groundwater, sediment, subsurface soil and surface soil, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

TABLE 8-14
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
GROUNDWATER - SITE 16 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ARSENIC	99.4
BERYLLIUM	6.23
CHROMIUM	1330
COPPER	41.9
IRON	241400
LEAD	30.1
NICKEL	117.65
VANADIUM	561
ZINC	360
1,1-DICHLOROETHENE	3.00
1,2-DICHLOROETHANE	0.50
1,2-DICHLOROETHENE (TOTAL)	4.00
2-METHYLNAPHTHALENE	10.81
4-METHYLPHENOL	1.00
BENZENE	43.6
BIS(2-ETHYLHEXYL)PHTHALATE	3.00
BROMODICHLOROMETHANE	1.00
CARBON TETRACHLORIDE	0.0003
CHLOROFORM	14.00
ETHYLBENZENE	2.00
FLUORENE	1.00
NAPHTHALENE	3.00
PHENOL	8.45
TETRACHLOROETHENE	2.00
TOLUENE	7.00
TRICHLOROETHENE	0.475
VINYL CHLORIDE	4.00
XYLENE (TOTAL)	7.67

TABLE 8-15
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	1.50
ARSENIC	7.45
CADMIUM	2.40
COPPER	26.7
LEAD	57.9
2-METHYLNAPHTHALENE*	119.5
4,4'-DDD*	66.5
4,4'-DDE*	16.5
4,4'-DDT*	41.0
ACENAPHTHENE*	145
ALPHA-BHC*	0.045
ANTHRACENE*	215
BENZO(A)ANTHRACENE*	660
BENZO(A)PYRENE*	590
BENZO(B)FLUORANTHENE*	750
BENZO(G,H,I)PERYLENE*	350
BENZO(K)FLUORANTHENE*	250
BIS(2-ETHYLHEXYL)PHTHALATE*	460
BUTYLBENZYLPHTHALATE*	65.0
CARBAZOLE*	165
CHRYSENE*	690
DIBENZ(A,H)ANTHRACENE*	90.0
DIBENZOFURAN*	79.5
FLUORANTHENE*	1250
FLUORENE*	130
GAMMA-CHLORDANE*	3.10
INDENO(1,2,3-CD)PYRENE*	290
METHOXYCHLOR*	9.60
NAPHTHALENE*	72.5
PHENANTHRENE*	965
PYRENE*	1800

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 8-16
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SUBSURFACE SOIL - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ARSENIC	7.10
1,2-DICHLOROETHENE (TOTAL)*	96.0
2-BUTANONE*	8.00
BENZENE*	226
CARBON DISULFIDE*	2.00
ETHYLBENZENE*	2524
METHYLENE CHLORIDE*	150
TETRACHLOROETHENE*	45.0
TOLUENE*	181
TRICHLOROETHENE*	3.00
XYLENE (TOTAL)*	12067
2-METHYLNAPHTHALENE*	45515
ACENAPHTHENE*	2774
ANTHRACENE*	2016
BENZO(A)ANTHRACENE*	43.0
BENZO(A)PYRENE*	43.0
BENZO(K)FLUORANTHENE*	46.0
BIS(2-ETHYLHEXYL)PHTHALATE*	1400
CHRYSENE*	57.0
DIBENZOFURAN*	4548
DIETHYLPHTHALATE*	73.0
FLUORANTHENE*	140
FLUORENE*	4161
NAPHTHALENE*	11993
PHENANTHRENE*	7208
PYRENE*	2415
4,4'-DDD*	9.54
4,4'-DDE*	6.61
4,4'-DDT*	20.0
ALPHA-CHLORDANE*	1.82
AROCLOR-1254*	10.0
ENDOSULFAN I*	4.18
ENDOSULFAN II*	14.28
GAMMA-CHLORDANE*	1.94
HEPTACHLOR*	0.27
HEPTACHLOR EPOXIDE*	3.39

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 8-17
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE SOIL - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	28.0
ARSENIC	10.5
BARIUM	133
CADMIUM	10.2
CHROMIUM	171
COPPER	231
LEAD	1030
NICKEL	16.5
SILVER	25.3
ZINC	1180
4,4'-DDD*	360
4,4'-DDE*	120
4,4'-DDT*	230
4-METHYLPHENOL*	110
ACENAPHTHYLENE*	100
ALPHA-BHC*	0.13
ALPHA-CHLORDANE*	33
ANTHRACENE*	170
BENZO(A)ANTHRACENE*	450
BENZO(A)PYRENE*	1200
BENZO(B)FLUORANTHENE*	1000
BENZO(G,H,I)PERYLENE*	340
BENZO(K)FLUORANTHENE*	86
BIS(2-ETHYLHEXYL)PHTHALATE*	12000
BUTYLBENZYLPHTHALATE*	160
CARBAZOLE*	54
CHRYSENE*	810
DI-N-BUTYLPHTHALATE*	100
FLUORANTHENE*	510
GAMMA-CHLORDANE*	35
HEPTACHLOR EPOXIDE*	0.39
INDENO(1,2,3-CD)PYRENE*	200
N-NITROSODIPHENYLAMINE*	63
PHENANTHRENE*	370
PYRENE*	4400

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

8.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, industrial, and recreational receptors).

8.7.1.1 Current Industrial Employee

Surface Soil Exposure

RME

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 16 are 5.9E-05 (ingestion), 1.8E-05 (dermal contact), and 1.1E-07 (inhalation of fugitive dust). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 93 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 16 is less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 16 in Tables 8-18 and 8-19, respectively.

CTE

No CTE analysis is required for surface soil exposure.

TABLE 8-18
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	3.0E-08	N/A	5.6E-12
4,4'-DDE	1.4E-08	N/A	2.6E-12
4,4'-DDT	2.7E-08	N/A	6.1E-12
4-METHYLPHENOL	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	2.9E-10	N/A	6.4E-14
ALPHA-CHLORDANE	1.5E-08	N/A	3.3E-12
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-07	N/A	2.5E-11
BENZO(A)PYRENE	3.1E-06	N/A	6.6E-10
BENZO(B)FLUORANTHENE	2.6E-07	N/A	5.5E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	2.2E-09	N/A	4.7E-13
BIS(2-ETHYLHEXYL)PHTHALATE	5.9E-08	N/A	1.1E-11
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	3.8E-10	N/A	7.0E-14
CHRYSENE	2.1E-09	N/A	4.5E-13
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
GAMMA-CHLORDANE	1.6E-08	N/A	3.5E-12
HEPTACHLOR EPOXIDE	1.2E-09	N/A	2.8E-13
INDENO(1,2,3-CD)PYRENE	5.1E-08	N/A	1.1E-11
N-NITROSODIPHENYLAMINE (1)	1.1E-10	N/A	2.0E-14
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.5E-05	1.8E-05	1.2E-08
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	8.3E-10
CHROMIUM	N/A	N/A	9.3E-08
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	8.6E-10
TOTAL RISK	5.9E-05	1.8E-05	1.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 8-19
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	4.5E-04	N/A	8.3E-08
4-METHYLPHENOL	2.2E-05	N/A	4.0E-09
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	5.4E-04	N/A	1.0E-07
ANTHRACENE	5.5E-07	N/A	1.0E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	5.9E-04	N/A	1.1E-07
BUTYLBENZYLPHTHALATE	7.8E-07	N/A	1.4E-10
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	9.8E-07	N/A	1.8E-10
FLUORANTHENE	1.2E-05	N/A	2.3E-09
GAMMA-CHLORDANE	5.7E-04	N/A	1.1E-07
HEPTACHLOR EPOXIDE	2.9E-05	N/A	5.4E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
N-NITROSODIPHENYLAMINE (1)	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.4E-04	N/A	2.7E-08
ANTIMONY	6.8E-02	N/A	1.3E-05
ARSENIC	3.4E-02	1.1E-02	6.3E-06
BARIUM	1.9E-03	N/A	3.4E-05
CADMIUM	2.0E-02	1.2E-01	1.0E-05
CHROMIUM	3.3E-02	N/A	6.2E-06
COPPER	5.7E-03	N/A	1.0E-06
LEAD	N/A	N/A	2.6E-03
NICKEL	8.1E-04	N/A	1.5E-07
SILVER	5.0E-03	N/A	9.2E-07
ZINC	3.8E-03	N/A	7.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

8.7.1.2 Future Industrial Employee

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 16 are 3.7E-05 (ingestion), 1.2E-05 (dermal contact), and 8.3E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 99 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 16 are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 16 in Tables 8-20 and 8-21, respectively.

CTE

No CTE analysis is required for subsurface soil exposure.

Groundwater Exposure

RME

The estimated total cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 16 are 6.5E-04 (ingestion) and 1.7E-07 (dermal contact). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway) and beryllium (ingestion, 14 percent of the cancer risk for this exposure pathway).

TABLE 8-20
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	3.6E-14
2-BUTANONE	N/A	N/A	N/A
BENZENE	2.3E-09	N/A	5.1E-13
CARBON DISULFIDE	N/A	N/A	2.1E-15
ETHYLBENZENE	N/A	N/A	6.6E-14
METHYLENE CHLORIDE	3.9E-10	N/A	7.6E-14
TETRACHLOROETHENE	8.2E-10	N/A	1.5E-13
TOLUENE	N/A	N/A	N/A
TRICHLOROETHENE	1.2E-11	N/A	2.4E-15
XYLENE (TOTAL)	N/A	N/A	N/A
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-08	N/A	2.4E-12
BENZO(A)PYRENE	1.1E-07	N/A	2.4E-11
BENZO(K)FLUORANTHENE	1.2E-09	N/A	2.5E-13
BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-09	N/A	1.3E-12
CHRYSENE	1.5E-10	N/A	3.1E-14
DIBENZOFURAN	N/A	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
4,4'-DDD	8.0E-10	N/A	1.5E-13
4,4'-DDE	7.9E-10	N/A	1.5E-13
4,4'-DDT	2.4E-09	N/A	5.3E-13
ALPHA-CHLORDANE	8.3E-10	N/A	1.8E-13
AROCLOR-1254	2.7E-08	5.9E-08	5.0E-12
ENDOSULFAN I	N/A	N/A	N/A
ENDOSULFAN II	N/A	N/A	N/A
GAMMA-CHLORDANE	8.8E-10	N/A	2.0E-13
HEPTACHLOR	4.2E-10	N/A	9.5E-14
HEPTACHLOR EPOXIDE	1.1E-08	N/A	2.4E-12
ARSENIC	3.7E-05	1.2E-05	8.3E-09
TOTAL RISK	3.7E-05	1.2E-05	8.3E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-21
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	1.0E-05	N/A	4.0E-09
2-BUTANONE	1.3E-08	N/A	3.4E-12
BENZENE	N/A	N/A	4.8E-09
CARBON DISULFIDE	2.0E-08	N/A	4.0E-12
ETHYLBENZENE	2.5E-05	N/A	4.9E-09
METHYLENE CHLORIDE	2.4E-06	N/A	4.6E-10
TETRACHLOROETHENE	4.4E-06	N/A	8.2E-10
TOLUENE	8.9E-07	N/A	2.2E-10
TRICHLOROETHENE	4.9E-07	N/A	9.1E-11
XYLENE (TOTAL)	5.9E-06	N/A	6.2E-09
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	4.5E-05	N/A	8.4E-09
ANTHRACENE	6.6E-06	N/A	1.2E-09
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-05	N/A	1.3E-08
CHRYSENE	N/A	N/A	N/A
DIBENZOFURAN	1.1E-03	N/A	2.1E-07
DIETHYLPHTHALATE	8.9E-08	N/A	1.7E-11
FLUORANTHENE	3.4E-06	N/A	6.3E-10
FLUORENE	1.0E-04	N/A	1.9E-08
NAPHTHALENE	2.9E-04	N/A	5.4E-08
PHENANTHRENE	N/A	N/A	N/A
PYRENE	7.9E-05	N/A	1.5E-08
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	3.9E-05	N/A	7.2E-09
ALPHA-CHLORDANE	3.0E-05	N/A	5.5E-09
AROCLOR-1254	N/A	N/A	N/A
ENDOSULFAN I	6.8E-07	N/A	1.3E-10
ENDOSULFAN II	2.3E-06	N/A	4.3E-10
GAMMA-CHLORDANE	3.2E-05	N/A	5.9E-09
HEPTACHLOR	5.3E-07	N/A	9.8E-11
HEPTACHLOR EPOXIDE	2.6E-04	N/A	4.7E-08
ARSENIC	2.3E-02	7.6E-03	4.3E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 16 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future industrial employee, the target organs, corresponding HIs, and principal COPCs are as follows: skin (2.0 - arsenic) and kidney (4.8 - iron). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 16 in Tables 8-22 and 8-23, respectively.

CTE

The estimated total cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 16 are 7.2E-05 (ingestion) and 8.5E-08 (dermal contact). The total groundwater cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway) and beryllium (ingestion, 14 percent of the cancer risk for this exposure pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 16 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future industrial employee, the target organs, corresponding HIs, and principal COPCs are as follows: skin (1.1 - arsenic) and kidney (2.4 - iron). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 16 in Tables 8-24 and 8-25, respectively.

TABLE 8-22
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	1.1E-06	N/A
1,2-DICHLOROETHANE	1.3E-06	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
2-METHYLENAPHTHALENE	N/A	N/A
4-METHYLPHENOL	N/A	N/A
BENZENE	4.4E-06	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.5E-07	N/A
BROMODICHLOROMETHANE	2.2E-07	N/A
CARBON TETRACHLORIDE	1.4E-10	N/A
CHLOROFORM	3.0E-07	N/A
ETHYLBENZENE	N/A	N/A
FLUORENE	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENOL	N/A	N/A
TETRACHLOROETHENE	3.6E-07	N/A
TRICHLOROETHENE	1.8E-08	N/A
TOLUENE	N/A	N/A
VINYL CHLORIDE	2.7E-05	N/A
XYLENE (TOTAL)	N/A	N/A
ARSENIC	5.2E-04	1.7E-07
BERYLLIUM	9.4E-05	N/A
CHROMIUM	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
NICKEL	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	6.5E-04	1.7E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-23
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	3.3E-04			3.3E-04		3.3E-04				N/A
1,2-DICHLOROETHANE	N/A									N/A
1,2-DICHLOROETHENE (TOTAL)	7.2E-03	7.2E-03				7.2E-03				N/A
2-METHYLENAPHTHALENE	N/A									N/A
4-METHYLPHENOL	1.2E-03			1.2E-03	1.2E-03	1.2E-03		1.2E-03		N/A
BENZENE	N/A									N/A
BIS(2-ETHYLHEXYL)PHTHALATE	9.0E-04					9.0E-04			9.0E-04	N/A
BROMODICHLOROMETHANE	3.0E-04			3.0E-04		3.0E-04				N/A
CARBON TETRACHLORIDE	2.6E-06									N/A
CHLOROFORM	8.4E-03			8.4E-03		8.4E-03				N/A
ETHYLBENZENE	1.2E-04			1.2E-04		1.2E-04			1.2E-04	N/A
FLUORENE	1.5E-04	1.5E-04						1.5E-04		N/A
NAPHTHALENE	4.5E-04									N/A
PHENOL	8.5E-05	8.5E-05		8.5E-05						N/A
TETRACHLOROETHENE	1.7E-03			1.7E-03					1.7E-03	N/A
TRICHLOROETHENE	4.8E-04					4.8E-04				N/A
TOLUENE	2.1E-04	2.1E-04						2.1E-04		N/A
VINYL CHLORIDE	N/A									N/A
XYLENE (TOTAL)	1.3E-04									N/A
ARSENIC	2.0E+00		2.0E+00							5.4E-01
BERYLLIUM	7.5E-03							7.5E-03		N/A
CHROMIUM	8.0E-03		8.0E-03							N/A
COPPER	6.3E-03									N/A
IRON	4.8E+00			4.8E+00						N/A
LEAD	N/A									N/A
NICKEL	3.5E-02					3.5E-02	3.5E-02			N/A
VANADIUM	4.8E-01	4.8E-01						4.8E-01		N/A
	HI BY TARGET ORGAN	4.9E-01	2.0E+00	4.8E+00	1.2E-03	5.4E-02	3.5E-02	4.9E-01	2.7E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-24
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	1.2E-07	N/A
1,2-DICHLOROETHANE	1.4E-07	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
2-METHYLENAPHTHALENE	N/A	N/A
4-METHYLPHENOL	N/A	N/A
BENZENE	4.9E-07	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.6E-08	N/A
BROMODICHLOROMETHANE	2.4E-08	N/A
CARBON TETRACHLORIDE	1.5E-11	N/A
CHLOROFORM	3.3E-08	N/A
ETHYLBENZENE	N/A	N/A
FLUORENE	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENOL	N/A	N/A
TETRACHLOROETHENE	4.0E-08	N/A
TRICHLOROETHENE	2.0E-09	N/A
TOLUENE	N/A	N/A
VINYL CHLORIDE	2.9E-06	N/A
XYLENE (TOTAL)	N/A	N/A
ARSENIC	5.8E-05	8.5E-08
BERYLLIUM	1.0E-05	N/A
CHROMIUM	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
NICKEL	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	7.2E-05	8.5E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-25
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	5.4E-04			5.4E-04		5.4E-04				N/A
1,2-DICHLOROETHANE	N/A									N/A
1,2-DICHLOROETHENE (TOTAL)	1.2E-02	1.2E-02				1.2E-02				N/A
2-METHYLENAPHTHALENE	N/A									N/A
4-METHYLPHENOL	2.0E-03			2.0E-03	2.0E-03	2.0E-03		2.0E-03		N/A
BENZENE	N/A									N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.5E-03					1.5E-03			1.5E-03	N/A
BROMODICHLOROMETHANE	4.9E-04			4.9E-04		4.9E-04				N/A
CARBON TETRACHLORIDE	4.2E-06									N/A
CHLOROFORM	1.4E-02			1.4E-02		1.4E-02				N/A
ETHYLBENZENE	2.0E-04			2.0E-04		2.0E-04			2.0E-04	N/A
FLUORENE	2.5E-04	2.5E-04						2.5E-04		N/A
NAPHTHALENE	7.3E-04									N/A
PHENOL	1.4E-04	1.4E-04		1.4E-04						N/A
TETRACHLOROETHENE	2.0E-03			2.0E-03					2.0E-03	N/A
TRICHLOROETHENE	7.8E-04					7.8E-04				N/A
TOLUENE	3.4E-04	3.4E-04						3.4E-04		N/A
VINYL CHLORIDE	N/A									N/A
XYLENE (TOTAL)	1.3E-04									N/A
ARSENIC	1.1E+00		1.1E+00							2.7E-01
BERYLLIUM	1.2E-02							1.2E-02		N/A
CHROMIUM	1.3E-02		1.3E-02							N/A
COPPER	1.0E-02									N/A
IRON	2.4E+00			2.4E+00						N/A
LEAD	N/A									N/A
NICKEL	5.8E-02					5.8E-02	5.8E-02			N/A
VANADIUM	7.8E-01	7.8E-01						7.8E-01		N/A
	HI BY TARGET ORGAN	8.0E-01	1.1E+00	2.4E+00	2.0E-03	8.9E-02	5.8E-02	8.0E-01	3.7E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

8.7.1.3 Future Residential Receptor

Surface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 16 are 2.6E-04 (ingestion), 6.0E-05 (dermal contact), and 6.6E-08 (inhalation of fugitive dust). The total surface soil cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 96 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in surface soil at Site 16 is greater than 1.0 for the dermal contact exposure pathway. For surface soil ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (1.1 - arsenic). The estimated noncarcinogenic HIs for the future residential receptor for the ingestion exposure pathway is less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 16 in Tables 8-26 and 8-27, respectively.

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 16 are 4.3E-05 (ingestion), 9.9E-06 (dermal contact), and 1.1E-08 (inhalation of fugitive dust). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 96 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in surface soil at Site 16 are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

TABLE 8-26
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	1.4E-07	N/A	3.4E-12
4,4'-DDE	6.4E-08	N/A	1.6E-12
4,4'-DDT	1.2E-07	N/A	3.7E-12
4-METHYLPHENOL	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	1.3E-09	N/A	3.9E-14
ALPHA-CHLORDANE	6.7E-08	N/A	2.0E-12
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	5.1E-07	N/A	1.5E-11
BENZO(A)PYRENE	1.4E-05	N/A	4.1E-10
BENZO(B)FLUORANTHENE	1.1E-06	N/A	3.4E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	9.8E-09	N/A	2.9E-13
BIS(2-ETHYLHEXYL)PHTHALATE	2.6E-07	N/A	6.7E-12
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	1.7E-09	N/A	4.3E-14
CHRYSENE	9.3E-09	N/A	2.7E-13
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
GAMMA-CHLORDANE	7.1E-08	N/A	2.2E-12
HEPTACHLOR EPOXIDE	5.6E-09	N/A	1.7E-13
INDENO(1,2,3-CD)PYRENE	2.3E-07	N/A	6.8E-12
N-NITROSODIPHENYLAMINE (1)	4.8E-10	N/A	1.2E-14
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	2.5E-04	6.0E-05	7.5E-09
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	5.1E-10
CHROMIUM	N/A	N/A	5.7E-08
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	5.3E-10
TOTAL RISK	2.6E-04	6.0E-05	6.6E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 8-27
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.9E-03	N/A	8.8E-08
4-METHYLPHENOL	2.8E-04	N/A	4.2E-09
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	7.0E-03	N/A	1.1E-07
ANTHRACENE	7.2E-06	N/A	1.1E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	7.7E-03	N/A	1.1E-07
BUTYLBENZYLPHTHALATE	7.8E-07	N/A	1.4E-10
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	1.3E-05	N/A	1.9E-10
FLUORANTHENE	1.6E-04	N/A	2.4E-09
GAMMA-CHLORDANE	7.5E-03	N/A	1.1E-07
HEPTACHLOR EPOXIDE	3.8E-04	N/A	5.7E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
N-NITROSODIPHENYLAMINE (1)	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.9E-03	N/A	2.8E-08
ANTIMONY	8.9E-01	N/A	1.3E-05
ARSENIC	4.5E-01	9.2E-02	6.7E-06
BARIUM	2.4E-02	N/A	3.6E-05
CADMIUM	2.6E-01	1.0E+00	1.1E-05
CHROMIUM	4.4E-01	N/A	6.5E-06
COPPER	7.4E-02	N/A	1.1E-06
LEAD	N/A	N/A	2.8E-03
NICKEL	1.1E-02	N/A	1.6E-07
SILVER	6.5E-02	N/A	9.7E-07
ZINC	5.0E-02	N/A	7.5E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 16 in Tables 8-28 and 8-29, respectively.

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 16 are 1.7E-04 (ingestion), 4.1E-05 (dermal contact), and 5.1E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 99 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 16 are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil at Site 16 in Tables 8-30 and 8-31, respectively.

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 16 are 2.8E-05 (ingestion), 6.7E-06 (dermal contact), and 8.4E-10 (inhalation of fugitive dust). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil at Site 16 in Table 8-32.

TABLE 8-28
CENTRAL TENDENCY EXPOSURE CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	2.2E-08	N/A	5.7E-13
4,4'-DDE	1.1E-08	N/A	2.7E-13
4,4'-DDT	2.0E-08	N/A	6.2E-13
4-METHYLPHENOL	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	2.1E-10	N/A	6.5E-15
ALPHA-CHLORDANE	1.1E-08	N/A	3.4E-13
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	8.5E-08	N/A	2.5E-12
BENZO(A)PYRENE	2.3E-06	N/A	6.7E-11
BENZO(B)FLUORANTHENE	1.9E-07	N/A	5.6E-12
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	1.6E-09	N/A	4.8E-14
BIS(2-ETHYLHEXYL)PHTHALATE	4.3E-08	N/A	1.1E-12
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	2.8E-10	N/A	7.1E-15
CHRYSENE	1.5E-09	N/A	4.5E-14
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
GAMMA-CHLORDANE	1.2E-08	N/A	3.6E-13
HEPTACHLOR EPOXIDE	9.2E-10	N/A	2.8E-14
INDENO(1,2,3-CD)PYRENE	3.8E-08	N/A	1.1E-12
N-NITROSODIPHENYLAMINE (1)	8.0E-11	N/A	2.0E-15
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	4.1E-05	9.9E-06	1.2E-09
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	8.4E-11
CHROMIUM	N/A	N/A	9.4E-09
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	8.7E-11
TOTAL RISK	4.3E-05	9.9E-06	1.1E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 8-29
CENTRAL TENDENCY EXPOSURE NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	2.9E-03	N/A	4.4E-08
4-METHYLPHENOL	1.4E-04	N/A	2.1E-09
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	3.5E-03	N/A	5.2E-08
ANTHRACENE	3.6E-06	N/A	5.4E-11
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	3.8E-03	N/A	5.7E-08
BUTYLBENZYLPHTHALATE	5.1E-06	N/A	7.6E-11
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	6.3E-06	N/A	9.5E-11
FLUORANTHENE	8.1E-05	N/A	1.2E-09
GAMMA-CHLORDANE	3.7E-03	N/A	5.5E-08
HEPTACHLOR EPOXIDE	1.9E-04	N/A	2.8E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
N-NITROSODIPHENYLAMINE (1)	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	9.3E-04	N/A	1.4E-08
ANTIMONY	4.4E-01	N/A	6.6E-06
ARSENIC	2.2E-01	4.6E-02	3.3E-06
BARIUM	1.2E-02	N/A	1.8E-05
CADMIUM	1.3E-01	5.0E-01	5.3E-06
CHROMIUM	2.2E-01	N/A	3.2E-06
COPPER	3.7E-02	N/A	5.5E-07
LEAD	N/A	N/A	1.4E-03
NICKEL	5.2E-03	N/A	7.8E-08
SILVER	3.2E-02	N/A	4.8E-07
ZINC	2.5E-02	N/A	3.7E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 8-30
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	2.2E-14
2-BUTANONE	N/A	N/A	N/A
BENZENE	1.0E-08	N/A	3.1E-13
CARBON DISULFIDE	N/A	N/A	1.3E-15
ETHYLBENZENE	N/A	N/A	4.1E-14
METHYLENE CHLORIDE	1.8E-09	N/A	4.7E-14
TETRACHLOROETHENE	3.7E-09	N/A	9.4E-14
TOLUENE	N/A	N/A	N/A
TRICHLOROETHENE	5.2E-11	N/A	1.5E-15
XYLENE (TOTAL)	N/A	N/A	N/A
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	4.9E-08	N/A	1.5E-12
BENZO(A)PYRENE	4.9E-07	N/A	1.5E-11
BENZO(K)FLUORANTHENE	5.3E-09	N/A	1.6E-13
BIS(2-ETHYLHEXYL)PHTHALATE	3.1E-08	N/A	7.8E-13
CHRYSENE	6.5E-10	N/A	1.9E-14
DIBENZOFURAN	N/A	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
4,4'-DDD	3.6E-09	N/A	9.1E-14
4,4'-DDE	3.5E-09	N/A	8.9E-14
4,4'-DDT	1.1E-08	N/A	3.2E-13
ALPHA-CHLORDANE	3.7E-09	N/A	1.1E-13
AROCLOR-1254	1.2E-07	2.0E-07	3.1E-12
ENDOSULFAN I	N/A	N/A	N/A
ENDOSULFAN II	N/A	N/A	N/A
GAMMA-CHLORDANE	4.0E-09	N/A	1.2E-13
HEPTACHLOR	1.9E-09	N/A	5.8E-14
HEPTACHLOR EPOXIDE	4.8E-08	N/A	1.5E-12
ARSENIC	1.7E-04	4.0E-05	5.1E-09
TOTAL RISK	1.7E-04	4.1E-05	5.1E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-31
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
1,2-DICHLOROETHENE (TOTAL)	1.4E-04	N/A	4.2E-09
2-BUTANONE	1.7E-07	N/A	3.6E-12
BENZENE	N/A	N/A	5.1E-09
CARBON DISULFIDE	2.6E-07	N/A	4.2E-12
ETHYLBENZENE	3.2E-04	N/A	5.2E-09
METHYLENE CHLORIDE	3.2E-05	N/A	4.9E-10
TETRACHLOROETHENE	5.8E-05	N/A	8.6E-10
TOLUENE	1.2E-05	N/A	2.3E-10
TRICHLOROETHENE	6.4E-06	N/A	9.6E-11
XYLENE (TOTAL)	7.7E-05	N/A	6.5E-09
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	5.9E-04	N/A	8.8E-09
ANTHRACENE	8.6E-05	N/A	1.3E-09
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	8.9E-04	N/A	1.3E-08
CHRYSENE	N/A	N/A	N/A
DIBENZOFURAN	1.5E-02	N/A	2.2E-07
DIETHYLPHTHALATE	1.2E-06	N/A	1.7E-11
FLUORANTHENE	4.5E-05	N/A	6.7E-10
FLUORENE	1.3E-03	N/A	2.0E-08
NAPHTHALENE	3.8E-03	N/A	5.7E-08
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.0E-03	N/A	1.5E-08
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.1E-04	N/A	7.7E-09
ALPHA-CHLORDANE	3.9E-04	N/A	5.8E-09
AROCLOR-1254	N/A	N/A	N/A
ENDOSULFAN I	8.9E-06	N/A	1.3E-10
ENDOSULFAN II	3.0E-05	N/A	4.6E-10
GAMMA-CHLORDANE	4.1E-04	N/A	6.2E-09
HEPTACHLOR	6.9E-06	N/A	1.0E-10
HEPTACHLOR EPOXIDE	3.3E-03	N/A	5.0E-08
ARSENIC	3.0E-01	6.2E-02	4.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-32
CENTRAL TENDENCY EXPOSURE CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	3.7E-15
2-BUTANONE	N/A	N/A	N/A
BENZENE	1.7E-09	N/A	5.2E-14
CARBON DISULFIDE	N/A	N/A	2.1E-16
ETHYLBENZENE	N/A	N/A	6.7E-15
METHYLENE CHLORIDE	2.9E-10	N/A	7.7E-15
TETRACHLOROETHENE	6.1E-10	N/A	1.5E-14
TOLUENE	N/A	N/A	N/A
TRICHLOROETHENE	8.5E-12	N/A	2.4E-16
XYLENE (TOTAL)	N/A	N/A	N/A
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	8.1E-09	N/A	2.4E-13
BENZO(A)PYRENE	8.1E-08	N/A	2.4E-12
BENZO(K)FLUORANTHENE	8.7E-10	N/A	2.6E-14
BIS(2-ETHYLHEXYL)PHTHALATE	5.1E-09	N/A	1.3E-13
CHRYSENE	1.1E-10	N/A	3.2E-15
DIBENZOFURAN	N/A	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
4,4'-DDD	5.9E-10	N/A	1.5E-14
4,4'-DDE	5.8E-10	N/A	1.5E-14
4,4'-DDT	1.8E-09	N/A	5.4E-14
ALPHA-CHLORDANE	6.1E-10	N/A	1.9E-14
AROCLOR-1254	2.0E-08	3.3E-08	5.1E-13
ENDOSULFAN I	N/A	N/A	N/A
ENDOSULFAN II	N/A	N/A	N/A
GAMMA-CHLORDANE	6.5E-10	N/A	2.0E-14
HEPTACHLOR	3.1E-10	N/A	9.6E-15
HEPTACHLOR EPOXIDE	8.0E-09	N/A	2.4E-13
ARSENIC	2.8E-05	6.7E-06	8.4E-10
TOTAL RISK	2.8E-05	6.7E-06	8.4E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Groundwater Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in groundwater at Site 16 are 2.8E-03 (ingestion), 2.7E-05 (dermal contact), and 6.6E-05 (inhalation of VOAs). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway) and beryllium (ingestion, 14 percent of the cancer risk for this exposure pathway). Vinyl chloride ingestion cancer risk exceeded 1E-04; however, it contributed less than 10 percent of the total cancer risk for the exposure scenario.

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 16 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: skin (9.9 - arsenic), kidney (54 - iron), and various organ effects (2.4 - vanadium). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 16 in Tables 8-33 and 8-34, respectively.

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in groundwater at Site 16 are 1.2E-03 (ingestion), 1.4E-07 (dermal contact), and 1.3E-05 (inhalation of fugitive dust). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 80 percent of the cancer risk for this pathway) and beryllium (ingestion, 14 percent of the cancer risk for this exposure pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 16 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: skin (4.9 - arsenic), kidney (26 - iron), and various organ effects (1.3 - vanadium). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

TABLE 8-33
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	4.5E-06	N/A	9.6E-07
1,2-DICHLOROETHANE	5.4E-06	N/A	3.4E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	1.8E-05
2-METHYLENAPHTHALENE	N/A	N/A	N/A
4-METHYLPHENOL	N/A	N/A	N/A
BENZENE	1.9E-05	N/A	1.5E-05
BIS(2-ETHYLHEXYL)PHTHALATE	6.2E-07	N/A	N/A
BROMODICHLOROMETHANE	9.2E-07	N/A	N/A
CARBON TETRACHLORIDE	5.8E-10	N/A	1.4E-10
CHLOROFORM	1.3E-06	N/A	1.2E-05
ETHYLBENZENE	N/A	N/A	6.4E-08
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
TETRACHLOROETHENE	1.6E-06	N/A	3.6E-08
TRICHLOROETHENE	7.8E-08	N/A	2.7E-08
TOLUENE	N/A	N/A	N/A
VINYL CHLORIDE	1.3E-04	N/A	1.6E-05
XYLENE (TOTAL)	N/A	N/A	N/A
ARSENIC	2.2E-03	2.7E-05	N/A
BERYLLIUM	4.0E-04	N/A	N/A
CHROMIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	2.8E-03	2.7E-05	6.6E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-34
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	GROUNDWATER INGESTION BY TARGET ORGAN: CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	1.7E-03			1.7E-03		1.7E-03			N/A	N/A
1,2-DICHLOROETHANE	N/A								N/A	1.1E-02
1,2-DICHLOROETHENE (TOTAL)	3.6E-02	3.6E-02				3.6E-02			N/A	N/A
2-METHYLENAPHTHALENE	N/A								N/A	N/A
4-METHYLPHENOL	6.0E-03			6.0E-03	6.0E-03	6.0E-03	6.0E-03		N/A	N/A
BENZENE	N/A								N/A	2.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	4.5E-03					4.5E-03		4.5E-03	N/A	N/A
BROMODICHLOROMETHANE	1.5E-03			1.5E-03		1.5E-03			N/A	2.4E-08
CARBON TETRACHLORIDE	1.3E-05								N/A	4.1E-06
CHLOROFORM	4.2E-02			4.2E-02		4.2E-02			N/A	3.3E-08
ETHYLBENZENE	6.0E-04			6.0E-04		6.0E-04		6.0E-04	N/A	6.2E-05
FLUORENE	7.5E-04	7.5E-04					7.5E-04		N/A	N/A
NAPHTHALENE	2.2E-03								N/A	N/A
PHENOL	4.2E-04	4.2E-04		4.2E-04					N/A	N/A
TETRACHLOROETHENE	6.0E-03			6.0E-03				6.0E-03	N/A	N/A
TRICHLOROETHENE	2.4E-03					2.4E-03			N/A	N/A
TOLUENE	1.0E-03	1.0E-03					1.0E-03		N/A	5.8E-04
VINYL CHLORIDE	N/A								N/A	N/A
XYLENE (TOTAL)	8.3E-04								N/A	1.4E-02
ARSENIC	9.9E+00		9.9E+00						5.4E-01	N/A
BERYLLIUM	3.7E-02						3.7E-02		N/A	N/A
CHROMIUM	4.0E-02		4.0E-02						N/A	N/A
COPPER	3.1E-02								N/A	N/A
IRON	5.4E+01			5.4E+01					N/A	N/A
LEAD	N/A								N/A	N/A
NICKEL	1.8E-01								N/A	N/A
VANADIUM	2.4E+00								N/A	N/A
	HI BY TARGET ORGAN	3.8E-02	9.9E+00	5.4E+01	6.0E-03	9.5E-02	4.5E-02	1.1E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater soil at Site 16 in Tables 8-35 and 8-36, respectively.

8.7.1.4 Future Recreational Receptor

Sediment

RME

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 16 are 1.9E-07 (ingestion) and 5.1E-09 (dermal contact). This sediment cancer risk is below the 10^{-4} to 10^{-6} target acceptable risk range.

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 16 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 16 in Tables 8-37 and 8-38, respectively.

CTE

No CTE analysis is required for sediment and surface water exposure.

8.7.1.5 Lead Results

The IEUBK Lead Model (v. 0.99) was used to characterize risks from lead in soil, dust, and water for the hypothetical future residential children (ages 0 through 6), who are considered the most sensitive receptor group at Site 16. The simulated range of blood-lead values that might occur in a population as a result of exposures to lead was compared to a guideline level of 10 micrograms per deciliter (µg/dL). Based on model results, 64.0 percent of residential children exposed under similar conditions might have blood-lead levels exceeding 10 µg/dL. This exceeds a protective guideline of 5 percent for the maximum proportion of individuals with blood levels exceeding 10 µg/dL (EPA, 1994). The model inputs assumed were default parameter values, 1,030 mg/kg lead in site-related soils, and 30.1 µg/L lead in groundwater. The IEUBK population histograms for Site 16 exposures are presented in Appendix D.

TABLE 8-35
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	2.0E-06	N/A	2.8E-07
1,2-DICHLOROETHANE	2.5E-06	N/A	1.0E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
2-METHYLENAPHTHALENE	N/A	N/A	N/A
4-METHYLPHENOL	N/A	N/A	N/A
BENZENE	8.5E-06	N/A	4.3E-06
BIS(2-ETHYLHEXYL)PHTHALATE	2.8E-07	N/A	N/A
BROMODICHLOROMETHANE	4.2E-07	N/A	N/A
CARBON TETRACHLORIDE	2.6E-10	N/A	4.2E-11
CHLOROFORM	5.8E-07	N/A	3.2E-06
ETHYLBENZENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
TETRACHLOROETHENE	7.0E-07	N/A	1.1E-08
TRICHLOROETHENE	3.5E-08	N/A	8.0E-09
TOLUENE	N/A	N/A	N/A
VINYL CHLORIDE	5.1E-05	N/A	4.7E-06
XYLENE (TOTAL)	N/A	N/A	N/A
ARSENIC	1.0E-03	1.4E-07	N/A
BERYLLIUM	1.8E-04	N/A	N/A
CHROMIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	1.2E-03	1.4E-07	1.3E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-36
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	GROUNDWATER INGESTION BY TARGET ORGAN							GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
		CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	RESPIRA-TORY SYSTEM	LIVER	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM		
1,1-DICHLOROETHENE	3.6E-03			3.6E-03		3.6E-03			N/A	N/A
1,2-DICHLOROETHANE	N/A								N/A	3.8E-02
1,2-DICHLOROETHENE (TOTAL)	7.7E-02	7.7E-02				7.7E-02			N/A	N/A
2-METHYLENAPHTHALENE	N/A								N/A	N/A
4-METHYLPHENOL	1.3E-02			1.3E-02	1.3E-02	1.3E-02	1.3E-02		N/A	N/A
BENZENE	N/A								N/A	8.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	9.6E-03					9.6E-03		9.6E-03	N/A	N/A
BROMODICHLOROMETHANE	3.2E-03			3.2E-03		3.2E-03			N/A	6.5E-03
CARBON TETRACHLORIDE	2.7E-05								N/A	1.4E-05
CHLOROFORM	9.0E-02			9.0E-02		9.0E-02			N/A	5.3E-04
ETHYLBENZENE	1.3E-03			1.3E-03		1.3E-03		1.3E-03	N/A	2.1E-03
FLUORENE	1.6E-03	1.6E-03					1.6E-03		N/A	N/A
NAPHTHALENE	4.8E-03								N/A	N/A
PHENOL	9.0E-04	9.0E-04		9.0E-04					N/A	N/A
TETRACHLOROETHENE	1.3E-02			1.3E-02				1.3E-02	N/A	N/A
TRICHLOROETHENE	5.1E-03					5.1E-03			N/A	N/A
TOLUENE	2.2E-03	2.2E-03					2.2E-03		N/A	2.0E-03
VINYL CHLORIDE	N/A								N/A	N/A
XYLENE (TOTAL)	8.3E-04								N/A	1.4E-02
ARSENIC	1.2E+01		1.2E+01						2.7E-01	N/A
BERYLLIUM	8.0E-02						8.0E-02		N/A	N/A
CHROMIUM	8.5E-02		8.5E-02						N/A	N/A
COPPER	6.7E-02								N/A	N/A
IRON	2.6E+01			2.6E+01					N/A	N/A
LEAD	N/A								N/A	N/A
NICKEL	3.8E-01								N/A	N/A
VANADIUM	1.3E+00								N/A	N/A
	HI BY TARGET ORGAN	8.2E-02	1.2E+01	2.6E+01	1.3E-02	2.0E-01	9.6E-02	2.4E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-37
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 16
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	N/A	N/A
4,4'-DDD	1.7E-10	N/A
4,4'-DDE	6.1E-11	N/A
4,4'-DDT	1.5E-10	N/A
ACENAPHTHENE	N/A	N/A
ALPHA-BHC	3.1E-12	N/A
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	5.3E-09	N/A
BENZO(A)PYRENE	4.7E-08	N/A
BENZO(B)FLUORANTHENE	6.0E-09	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	2.0E-10	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	7.1E-11	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A
CARBAZOLE	3.6E-11	N/A
CHRYSENE	5.5E-11	N/A
DIBENZ(A,H)ANTHRACENE	7.2E-09	N/A
DIBENZOFURAN	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	4.4E-11	N/A
INDENO(1,2,3-CD)PYRENE	2.3E-09	N/A
METHOXYCHLOR	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	1.2E-07	5.1E-09
CADMIUM	N/A	N/A
COPPER	N/A	N/A
LEAD	N/A	N/A
TOTAL RISK	1.9E-07	5.1E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 8-38
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 16
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	NA	NA
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	1.0E-05	N/A
ACENAPHTHENE	3.1E-07	N/A
ALPHA-BHC	NA	N/A
ANTHRACENE	9.2E-08	N/A
BENZO(A)ANTHRACENE	NA	N/A
BENZO(A)PYRENE	NA	N/A
BENZO(B)FLUORANTHENE	NA	N/A
BENZO(G,H,I)PERYLENE	NA	N/A
BENZO(K)FLUORANTHENE	NA	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	2.9E-06	N/A
BUTYLBENZYLPHTHALATE	4.2E-08	N/A
CARBAZOLE	NA	N/A
CHRYSENE	NA	N/A
DIBENZ(A,H)ANTHRACENE	NA	N/A
DIBENZOFURAN	2.5E-06	N/A
FLUORANTHENE	4.0E-06	N/A
FLUORENE	4.2E-07	N/A
GAMMA-CHLORDANE	6.6E-06	N/A
INDENO(1,2,3-CD)PYRENE	NA	N/A
METHOXYCHLOR	2.5E-07	N/A
NAPHTHALENE	2.3E-07	N/A
PHENANTHRENE	NA	N/A
PYRENE	7.7E-06	N/A
ANTIMONY	4.8E-04	N/A
ARSENIC	3.2E-03	1.3E-04
CADMIUM	6.1E-04	4.9E-04
COPPER	8.5E-05	N/A
LEAD	NA	NA

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The maximum groundwater concentration of 30.1 ug/l exceeded the Office of Water Action Level of 15 ug/l. No other groundwater lead detection exceeded the 15 ug/l standard. The soil concentration of 1,030 mg/kg exceeded the soil screening level of 400 mg/kg. Lead in surface soil ranged from 359 mg/kg to 1,030 mg/kg with two of the three detections exceeding the soil screening level of 400 mg/kg.

8.7.2 Conclusions

Surface soil, subsurface soil, groundwater, and sediment were sampled at Site 16. The potential receptors considered for this site were future industrial, residential, and recreational receptors.

The RME cancer risk associated with the future residential (surface and subsurface soil) exposure scenario was at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range. Arsenic (via ingestion of and dermal contact with surface soil and subsurface soil) was the major COPC that contributed to the cancer risk for these exposure scenarios. The RME noncarcinogenic HIs associated with the future residential (surface soil) exposure scenarios exceeded 1.0, the cutoff point below which adverse effects are not expected to occur. Arsenic (via ingestion of surface soil) was the principal COPC that contributed to the HI exceeding 1.0 for these exposure scenario.

The RME cancer risk associated with the future industrial and residential (groundwater) exposure scenario exceeded the upper end of the 10^{-4} to 10^{-6} target acceptable risk range. Arsenic (via ingestion) and beryllium (via ingestion) were the major COPCs that contributed to the cancer risk for these exposure scenarios. The RME noncarcinogenic HIs associated with the future industrial and residential (groundwater) exposure scenarios exceeded 1.0, the cutoff point below which adverse effects are not expected to occur. Arsenic (via ingestion), iron (via ingestion), and vanadium (via ingestion) were the principal COPCs that contributed to the HI exceeding 1.0 for these exposure scenario. Affected target organs are skin and kidney.

The CTE cancer risk associated with the future residential (groundwater) exposure scenario exceeded the upper end of the 10^{-4} to 10^{-6} target acceptable risk range. Arsenic (via ingestion) and beryllium (via ingestion) were the major COPCs that contributed to the cancer risk for this exposure scenario. The CTE noncarcinogenic HIs associated with the future industrial and residential (groundwater) exposure scenarios exceeded 1.0, the cutoff point below which adverse effects are not expected to occur. Arsenic (via ingestion), iron (via ingestion), and vanadium (via ingestion) were the principal COPCs that contributed to the HI exceeding 1.0 for these exposure scenario. Affected target organs are skin and kidney.

The RME cancer risks associated with future residential and future industrial (groundwater) exposure scenarios exceeded the upper end of the 10^{-4} to 10^{-6} target acceptable risk range. In addition, CTE cancer risks also for the future residential receptor also exceeded the 10^{-4} to 10^{-6} target acceptable risk range. Arsenic (via ingestion of and dermal contact with groundwater) is the principal COPC that contributed to the cancer risks for these exposure scenarios. Vinyl chloride also contributed to this total cancer risk, but it contributed less than 10 percent of the total risk.

RME estimates for noncarcinogenic HIs associated with future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenarios. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

RME risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 16 in Table 8-39 for subsurface soil and groundwater. Table 8-40 presents the relevant CTE risk estimates associated with potential receptors for groundwater, sediment, and surface water.

The estimated RME cancer risk for the future industrial employee and the future residential receptor exceeds the target acceptable risk range, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds the target acceptable risk range, based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

Lead concentrations detected at the site during this RI were above the EPA guidelines and may be expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

Arsenic was found at elevated concentrations from only one monitoring well (MW16-06) and this was a turbid sample. In the associated filtered groundwater sample from MW16-06, arsenic was not detected. In surface soil samples, arsenic was detected in three out of three samples at a range of 5.2 mg/kg to 10.5 mg/kg. This was within the range of background samples (4/4 detections, range = 1.35 mg/kg to 14.4 mg/kg). In subsurface soil samples, arsenic was detected in 31 out of 32 samples at a range of 1.2 mg/kg to 20.3 mg/kg. The 20.3 mg/kg subsurface soil result was elevated compared to background concentrations (8/8 detections, range = 1.35 mg/kg to 14.4 mg/kg), but the average concentrations for on-site and background arsenic are very close suggesting that site-related subsurface soil arsenic may be within the range of background.

TABLE 8-39
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

		Estimated Incremental Cancer Risk				Estimated Hazard Index**				
Medium	Exposure Routes	Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	5.9E-05	N/A	2.6E-04	N/A	1.8E-01	N/A	2.3E+00	N/A	N/A
	Dermal Contact	1.8E-05	N/A	6.0E-05	N/A	1.3E-01	N/A	1.1E+00@	N/A	N/A
	Inhalation of Fugitive Dust	1.1E-07	N/A	6.6E-08	N/A	2.7E-03	N/A	2.8E-03	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	3.7E-05	1.7E-04	N/A	N/A	2.5E-02	3.3E-01	N/A	N/A
	Dermal Contact	N/A	1.2E-05	4.1E-05	N/A	N/A	7.6E-03	6.2E-02	N/A	N/A
	Inhalation of Fugitive Dust	N/A	8.3E-09	5.1E-09	N/A	N/A	4.7E-06	5.0E-06	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	1.9E-07	N/A	N/A	N/A	N/A	2.8E-02
	Dermal Contact	N/A	N/A	N/A	5.1E-09	N/A	N/A	N/A	N/A	7.5E-05
Groundwater	Ingestion	N/A	6.2E-04	2.8E-03	N/A	N/A	4.8E+00@	5.4E+01@	N/A	N/A
	Dermal Contact	N/A	1.7E-07	2.7E-05	N/A	N/A	5.4E-01	5.4E-01	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	6.6E-05	N/A	N/A	N/A	N/A	2.9E-01	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	-	N/A	N/A	N/A	N/A	N/A
TOTAL		7.7E-05	6.7E-04	3.4E-03	2.0E-07	3.1E-01	5.4E+00	5.8E+01	2.9E-01	2.8E-02

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 8-40
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	4.3E-05	N/A	N/R	N/A	1.1E+00	N/A	N/A
	Dermal Contact	N/R	N/A	9.9E-06	N/A	N/R	N/A	5.4E-01	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	1.1E-08	N/A	N/R	N/A	1.4E-03	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	2.8E-05	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	6.7E-06	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	8.4E-10	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	7.2E-05	1.2E-03	N/A	N/A	2.4E+00@	2.6E+01@	N/A	N/A
	Dermal Contact	N/A	8.5E-08	1.4E-07	N/A	N/A	2.7E-01	2.7E-01	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	1.3E-05	N/A	N/A	N/A	N/A	1.5E-01	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	7.2E-05	1.3E-03	-	-	2.7E+00	2.8E+01	1.5E-01	-

N/A = Not applicable because this media is not associated with this potential receptor

N/R - Central Tendency calculation not required

N/S = Not sampled

* = During Showering, Adult Residents Only

** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

Benzene was detected in four out of 16 samples in groundwater at a range of 28 ug/l to 200 ug/l. The concentration of 200 ug/l of benzene found in groundwater does not, by itself, result in an elevated cancer risk to hypothetical future groundwater receptors. However, due to the presence of other compounds, such as vinyl chloride and metals, the aggregate potential impact on future shallow groundwater consumers (assuming drinking water supplies were to be drawn from a zone no deeper than approximately 75 feet below this industrial area) would result in an elevated risk (for residential receptor only) as compared to the acceptable risk range defined by EPA.

8.8 EVALUATION SUMMARY

Using CPT and induced fluorescence, the Navy was able to delineate the extent of the petroleum "floating product" layer. By agreement among Navy, EPA, and NJDEP, free-product capture is underway at Site 16. At the time of completion of the removal action, an FS of potential follow-up remedial activities will be planned.

The results of the groundwater investigation indicate that significant levels of semivolatile and volatile organic compounds are associated with the fuel spill. The areal extent of groundwater contaminated with the fuel appears to be limited to a zone bounded by the area of floating product and the monitoring wells MW16-08 and MW16-10. A feasibility study for the floating-product layer and associated contaminated soil should be considered.

The presence of benzene in MW16-06 and MW16-09 is not explained by the RI, but the source of benzene may not be the floating product in the vicinity of Building C-50. Since MW16-08 does not contain VOC contaminants, additional subsurface investigation may be justified in the area bounded by MW16-08, MW16-06 and MW16-09. Additional investigation in the northern section of the site is needed to determine the extent of benzene contamination.

Lead was found in one shallow groundwater sample at a concentration above the EPA Office of Water Action Level. Two of the three surface soil samples were above the EPA soil level of 400 ppm. Lead was also detected at levels above sediment ecological toxicity thresholds in three sediment samples. Although lead was not widely spread or found to result in elevated risks to human health or the environment at Site 16, the IEUBK model indicated that blood levels of lead could exceed protective guidelines as a result from contact with site media. Lead concentrations should be considered in any future FS.

The human health risk assessment concluded that cancer and non-cancer risks above guideline ranges result under several scenarios, based on compounds found in local groundwater, surface soil, and subsurface soil.

9.0 SITE 17: LANDFILL

9.1 SITE BACKGROUND AND PHYSICAL SETTING

The Site 17 Landfill occupies 3 acres in the Waterfront area, adjacent to a tidal marsh in the Ware Creek drainage basin. The site was used for the disposal of wood, forklifts, empty paint cans, and construction debris. The landfill surface is covered with a parking area that is currently utilized by Waterfront personnel. The face of the landfill is 10 to 15 feet higher in elevation than the marsh area and is heavily vegetated. Infiltration is limited to some degree by the nature of the surface cover, and overland flow drains toward the salt marsh north and west of the site. The groundwater flow direction is north-northwest toward the marsh, based upon measured groundwater elevations.

Geo-rectified digital imagery was utilized to interpret the probable extent of disposal areas with respect to the placement of fill material during the early 1940s. The Waterfront facilities were originally constructed upon this fill material. Figure 9-1 is a map of the site.

9.2 PREVIOUS INVESTIGATIONS

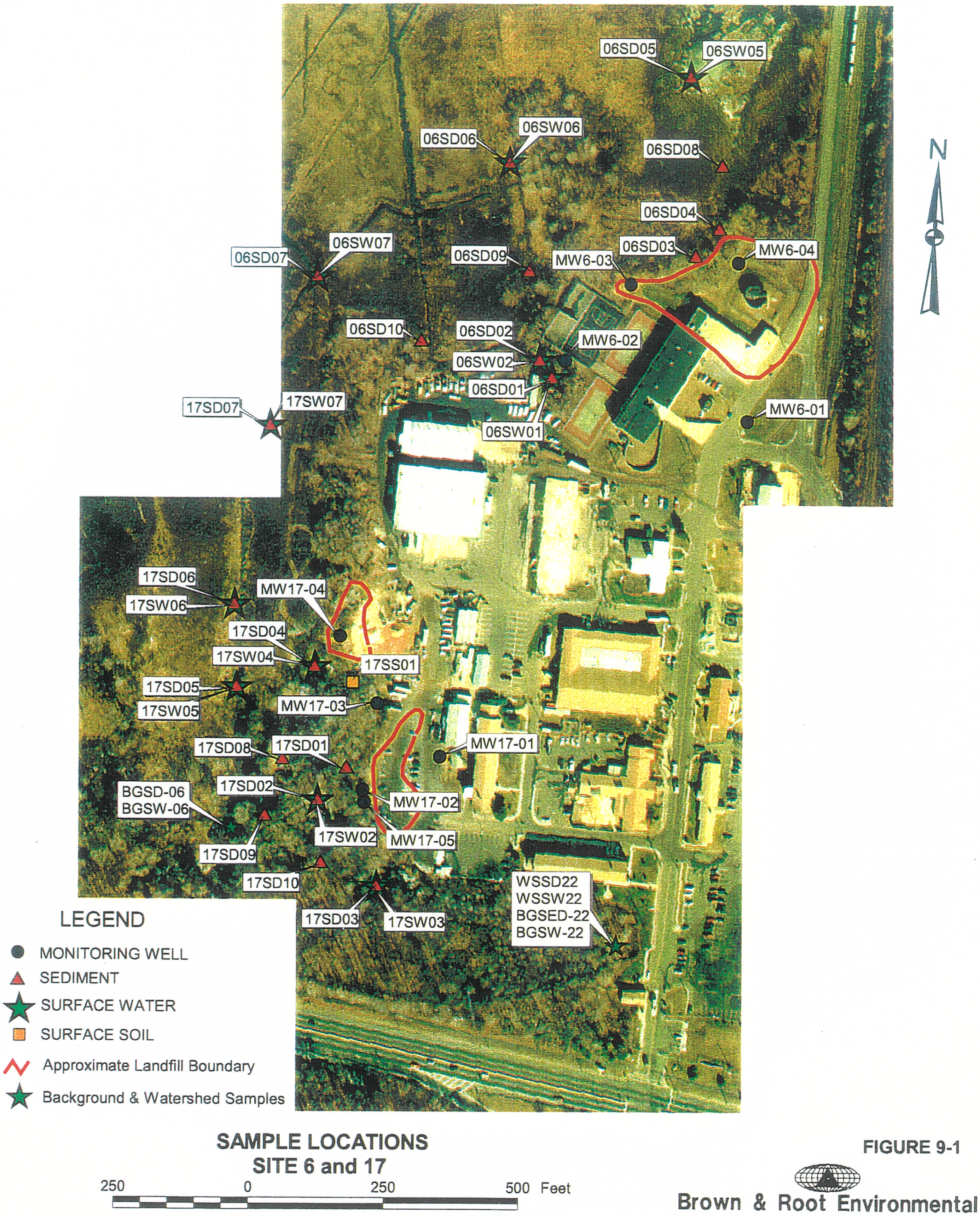
9.2.1 IAS and SI

IAS

The 1983 IAS, consisting of interviews and visual inspection, concluded minimal impact. The site was not recommended for a confirmation study because of the presence of largely inert and immobile materials.

SI

During the 1993 SI, soil samples were collected from three soil borings and two of the four monitoring well borings. Soil borings were completed to the water table, and subsurface soil samples were taken from between 5 and 11 feet bgs. Four monitoring wells were installed and screened in the upper water-bearing zone. In addition, four sediment samples were collected from the marsh area downgradient of the site. Soil samples were analyzed for metals and cyanide, and analytical results indicated that no significant concentrations of metals or cyanide were present. Elevated levels of volatiles, semivolatiles, and pesticides were detected in sediment samples. Groundwater samples were analyzed for TAL metals, full scan of TCL



SAMPLE LOCATIONS
SITE 6 and 17

FIGURE 9-1

Brown & Root Environmental

compounds, and landfill parameters. Elevated levels of metals and landfill parameter indicators were present in groundwater.

9.2.2 1995 RI

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 17:

- Sampling and analysis of surface water
- Sampling and analysis of sediment
- Drilling and installation of one shallow permanent monitoring well
- Sampling and analysis of groundwater from the newly installed well and existing wells
- Measurement of static-water levels in the wells
- Sampling and analysis of surface soil

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the surface water and sediment samples, the surface soil sample, and the newly installed monitoring well and selected existing wells.

9.2.3 Summary of Conclusions

Results of the RI revealed slightly elevated levels of PAHs and pesticides in drainage pathway sediments and elevated levels of metals, possibly due to suspended sediment, in drainage pathway surface water samples.

9.2.4 Data Gaps (Objectives of RI Addendum)

Evaluation of the RI data indicated that further data were needed to evaluate the potential ecological impacts on the wetlands adjacent to the site; therefore, additional surface water and sediment sampling in the marsh northeast of the landfill was required.

9.3 RI ADDENDUM FIELD INVESTIGATION

On October 28 and 30, 1996 B&R Environmental conducted the following field activities at Site 17:

- Sampling and analysis of surface water (Section 9.3.1)
- Sampling and analysis of sediment (Section 9.3.2)

9.3.1 Surface Water Sampling

As specified in the RI Addendum work plan, six sample locations in the wetlands area northeast of the site were selected for sampling surface water and associated sediment. Three locations either had no surface water flow or minimal flow inadequate to obtain aqueous samples; therefore, only three surface water samples (17 SW 05 through 17 SW 07) were collected. Samples were obtained from a ponded area that discharges westward to the creek (17 SW 07) and from the creek itself (17 SW 05 and 17 SW 06). Figure 9-1 shows the sample locations. Samples were collected by placing the sample container directly into the surface water. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TSS, alkalinity, hardness, BOD, COD, and TDS analysis. B&R Environmental also analyzed for temperature, turbidity, specific conductivity, pH, salinity, and dissolved oxygen in the field.

9.3.2 Sediment Sampling

Six sediment samples (17 SD 05 through 17 SD 10) were collected at various locations in the marsh northeast of the landfill. Samples 17 SD 05 through 17 SD 07 correspond to the surface water locations described in Section 9.3.1. Samples 17 SD 08 and 17 SD 09 were collected from drainage pathways leading to the creek, and 17 SD 10 was collected from the creek. Figure 9-1 presents the sample locations. All samples were obtained at depths from approximately 2 to 6 inches by stainless-steel trowel and transferred into the sample container. Samples were submitted to IEA Laboratories for TAL metals, TCL semivolatiles, TCL pesticides/PCBs, TOC, grain size, and percent moisture. B&R Environmental also recorded pH, conductivity, and moisture in the field.

9.4 SITE CHARACTERISTICS

9.4.1 Geology

Regional mapping places Site 17 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness, and the soil borings are no more than 20 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Englishtown Formation. In general, the borings encountered fill material and yellowish-brown, olive brown, and gray silty sand, clayey sand and sand, olive brown silt, and gray clay. Based upon the boring log descriptions, the wells and borings penetrated fill material and the Englishtown Formation.

9.4.2 Hydrogeology

Groundwater in the fill material and the Englishtown aquifer beneath the site occurs under unconfined conditions and the fill material and formation are interpreted to be hydraulically interconnected. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October 1995 groundwater elevation measurements, is toward the northwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based upon the boring log descriptions, the wells are screened across the contact between the fill material and the Englishtown Formation.

9.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates the occurrence and distribution of samples from the 1995 RI and 1996 RI Addendum field activities.

9.5.1 Surface Soils

One site-related surface soil sample (17 SS 01) was collected at Site 17 (Figure 9-1). Tables 9-1 and 9-2 present the occurrence and distribution of inorganic chemicals detected in site-related surface soil samples and compares them to background. Table 9-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 9-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

TABLE 9-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	BACKGROUND***					SITE-RELATED					
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	EPRESENTATIV ONCENTRATIO	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > X BKGD	MEAN > ACK UTL	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	7.5E+03	6153	5310	1 / 1	525 - 525	525	NO	NO	525
ARSENIC *	4 / 4	1.35 - 14.4	2.3E+01	13.43	14.4	1 / 1	2.3 - 2.3	2.30	NO	NO	2.3
BARIUM	4 / 4	1.85 - 31	4.7E+01	22.53	31	1 / 1	3.2 - 3.2	3.20	NO	NO	3.2
BERYLLIUM	1 / 4	0.28 - 0.28	5.6E+00	0.39	0.28	1 / 1	0.049 - 0.049	0.05	NO	NO	0.049
CADMIUM	1 / 4	0.57 - 0.57	7.5E-01	0.67	0.52	1 / 1	0.098 - 0.098	0.10	NO	NO	0.098
CALCIUM	4 / 4	40.1 - 519	6.8E+03	551.80	519	1 / 1	129 - 129	129	NO	NO	129
CHROMIUM	4 / 4	7.8 - 59.5	1.1E+02	69.05	59.5	1 / 1	5.4 - 5.4	5.40	NO	NO	5.4
COBALT	2 / 4	0.75 - 5	7.6E+00	3.15	4.27	1 / 1	0.27 - 0.27	0.27	NO	NO	0.27
COPPER	4 / 4	0.97 - 8.4	1.5E+01	10.06	8.4	1 / 1	2.2 - 2.2	2.20	NO	NO	2.2
IRON	4 / 4	3745 - 62500	9.6E+04	52403	62500	1 / 1	3060 - 3060	3060	NO	NO	3060
LEAD	4 / 4	1.8 - 39.4	4.0E+02	37.30	39.4	1 / 1	7.5 - 7.5	7.50	NO	NO	7.5
MAGNESIUM	4 / 4	71.7 - 619	9.0E+02	578.85	619	1 / 1	95.5 - 95.5	95.50	NO	NO	95.5
MANGANESE	4 / 4	3.45 - 214	3.3E+02	128.33	182.62	1 / 1	9.9 - 9.9	9.90	NO	NO	9.9
MERCURY	4 / 4	0.035 - 0.17	5.9E-01	0.18	0.17	1 / 1	0.019 - 0.019	0.02	NO	NO	0.019
NICKEL	2 / 4	1.8 - 7.2	1.1E+01	5.18	7.2	1 / 1	1.3 - 1.3	1.30	NO	NO	1.3
POTASSIUM	4 / 4	95 - 792	4.1E+03	912.50	792	1 / 1	104 - 104	104	NO	NO	104
SODIUM	4 / 4	17.5 - 86.2	1.2E+02	78.30	86.2	1 / 1	444 - 444	444	YES	YES	444
VANADIUM	4 / 4	11.05 - 64	2.0E+02	70.13	64	1 / 1	6 - 6	6.00	NO	NO	6
ZINC	3 / 4	1.1 - 27.6	4.6E+02	22.80	27.6	1 / 1	10.4 - 10.4	10.40	NO	NO	10.4

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400

TABLE 9-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT*	2 / 4	43 - 420	355.71	1 / 1	1.2	1.2

* - Selected as a COPC

02/05/97

TABLE 9-3a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17GW01	17GW03	17GW04	17GW05	---	---	ARARS & TBCs		
LOCATION:	17GW01	17GW03	17GW04	17GW05	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
SAMPLE DATE:	08/02/95	07/27/95	07/27/95	08/09/95					
INORGANICS	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
aluminum	2090 E	1360 E	96.8	1500 E J			-	-	200
arsenic	3.3 U	4.2	19.7 E	7.0			50.0	-	8.00
barium	49.7	118	590	16.0			2000	2000 a	2000
beryllium	4.5 E	1.4	0.11 U	0.11 U			4.00	4000 e	20.0
cadmium	0.43	0.87	8.3 E	0.38 U			5.00	5.00 e	4.00
calcium	11000	7290	517000	1700			-	-	-
chromium, total	1.1	1.0 U	1.0 U	4.6			100	100 a	100
cobalt	24.7	14.0	0.72	2.2			-	-	-
copper	0.77 U	0.83	1.0	2.5			1300	-	1000
iron	1400 E	10800 E	54300 E	11300 E			-	-	300
lead	1.5 UJ	5.7 J	1.5 UJ	3.8 J			15.0	-	10.0
magnesium	14500	6990	89900	1440			-	-	-
manganese	3040 E	732 E	864 E	79.9 E			-	-	50.0
mercury	0.0040 UJ	0.0040 UJ	0.0040 UJ	0.054			2.00	2.00 b	2.00
nickel	43.2	15.8	0.75 U	3.2			100	100 a	100
potassium	3000	3040	92700	2460			-	-	-
sodium	15800	28900	15700000 E	4780			-	-	50000
vanadium	1.1	10.2	0.61 U	18.1			-	-	-
zinc	253 R	68.9 R	3.8	10.5			-	2000 a	5000

TABLE 9-3a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

PAGE 2 of 2

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 9-3b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

							ARARS & TBCs		
SAMPLE NUMBER:		17GW01	17GW03	17GW04	17GW05	- - -	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
LOCATION:		17GW01	17GW03	17GW04	17GW05	- - -			
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI				
SAMPLE DATE:		08/02/95	07/27/95	07/27/95	08/09/95				
MISCELLANEOUS									
ammonia nitrogen	mg/L	1.0 U	1.0 U	5.0	1.0 U		-	30.0	0.500
biochemical oxygen demand	mg/L	1.3 J	1.4 J	4.0	4.0		-	-	-
chemical oxygen demand	mg/L	7.0 U	4.0 J	150	18.0		-	-	-
chloride	mg/L	120	80.0	31000	9.0		-	-	250
sulfate	mg/L	180	41.0	550	16.0		500	-	250
total organic carbon	mg/L	0.50 J	0.90 J	14.0	2.0		-	-	-
total phosphorus as PO4	mg/L	0.20 U	0.20 U	1.2	0.20		-	-	-
turbidity	ntu	n/a	14.4	645	n/a		-	-	-

TABLE 9-3b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

PAGE 2 of 2

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 9-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01 08/24/95	17SD02 06/15/95	17SD03 06/15/95	17SD04 06/15/95	17SD05 10/30/96	17SD06 10/28/96	17SD07 10/28/96	SELECTED ARARS
LOCATION:	17SD01	17SD02	17SD03	17SD04	17SD05	17SD06	17SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	08/24/95	06/15/95	06/15/95	06/15/95	10/30/96	10/28/96	10/28/96	
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1410	19300 J	7770 J	745	4430	2660	15800 J	-
antimony	0.58 U	25.6 UJ	9.4 UJ	5.2 U	0.49 U	0.45 U	2.3 E J	2.00 M
arsenic	11.4 E J	36.3 E J	13.2 E J	4.0	12.0 E	9.7 E J	41.9 E J	8.20 L
barium	3.3	71.8 E J	32.2 J	2.4	15.5	5.8	40.8 E J	40.0 B
beryllium	0.11	1.2 J	0.72 J	0.17 U	0.70	0.55	1.9 J	-
cadmium	0.23	3.1 E J	1.1 UJ	0.62 U	0.66	0.058 U	0.24 UJ	1.20 L
calcium	336	4660 J	1260 J	125	516	109	3300 J	-
chromium, total	10.8 J	53.5 J	20.2 J	6.8	27.4 J	11.9 J	49.0 J	81.0 L
cobalt	0.58	6.4 J	2.8 J	1.2 U	2.3	1.3	21.1 J	50.0 T
copper	4.0	99.1 E J	26.1 J	2.0	11.9	3.4 J	83.2 E J	34.0 L
iron	7790	49700 J	20500 J	5640	30700	23800	66400 J	-
lead	10.9	126 E J	75.9 E J	5.2 J	12.4	8.7 J	236 E J	47.0 L
magnesium	241	3120 J	898 J	117	1090	390	4800 J	-
manganese	15.7	74.8 J	33.8 J	4.0	44.6	27.0 J	218 J	460 O
mercury	0.020	0.32 E J	0.16 E J	0.0080 U	0.14 U	0.13 U	0.54 UJ	0.150 L
nickel	2.9	27.6 E J	7.2 J	1.9 U	5.7	3.1	29.3 E J	21.0 L
potassium	606	3350 J	1320 J	235	2830 J	1120 J	4000 J	-
selenium	1.1 J	7.4 J	2.2 J	0.93 J	1.0 U	1.0 UJ	5.0 J	-
silver	0.20 U	5.0 UJ	1.8 UJ	1.0 U	0.14 U	0.13 U	0.54 UJ	1.00 M
sodium	50.2	695 J	165 J	870	241	263	10800 J	-
thallium	1.5	3.6 UJ	1.3 UJ	0.74 U	0.89 U	0.82 UJ	3.4 UJ	-
vanadium	16.9	101 J	42.7 J	9.4	26.2	23.0 J	96.[illegible] J	-
zinc	12.0 J	242 E J	57.4 J	7.3 J	44.4	28.0 J	[illegible] E J	150
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	360 U	2100 UJ	170 J	410 U	480 UJ	440 U	1800 UJ	330 F
4-methylphenol	360 U	420 J	820 J	410 U	480 UJ	440 U	1800 UJ	-
acenaphthene	360 U	2100 UJ	340 J	410 U	480 UJ	440 U	1800 UJ	620 Q
acenaphthylene	360 U	2100 UJ	89.0 E J	410 U	480 UJ	440 U	1800 UJ	44.0 L

TABLE 9-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01 08/24/95	17SD02 06/15/95	17SD03 06/15/95	17SD04 06/15/95	17SD05 10/30/96	17SD06 10/28/96	17SD07 10/28/96	SELECTED ARARS
LOCATION:	17SD01	17SD02	17SD03	17SD04	17SD05	17SD06	17SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	08/24/95	06/15/95	06/15/95	06/15/95	10/30/96	10/28/96	10/28/96	
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
anthracene	360 U	2100 UJ	1000 E J	410 U	480 UJ	440 U	1800 UJ	330 F
benzo(a)anthracene	360 U	500 E J	2600 E J	410 U	120 J	440 U	1800 UJ	330 F
benzo(a)pyrene	360 U	490 E J	2600 E J	41.0 J	140 J	440 U	1800 UJ	430 L
benzo(b)fluoranthene	360 U	1000 E J	5000 E J	62.0 J	200 J	64.0 J	240 J	330 F
benzo(g,h,i)perylene	360 U	530 E J	3100 E J	410 U	66.0 J	440 U	1800 UJ	330 F
benzo(k)fluoranthene	360 U	260 J	1300 E J	410 U	92.0 J	440 UJ	1800 UJ	330 F
bis(2-ethylhexyl)phthalate	360 U	4400 J	9400 J	410 U	480 UJ	54.0 J	1800 UJ	890000000 S
butylbenzylphthalate	360 U	2100 UJ	610 J	410 U	480 UJ	440 U	1800 UJ	11000 Q
carbazole	360 U	2100 UJ	630 E J	410 U	480 UJ	440 U	1800 UJ	330 F
chrysene	68.0 J	690 E J	3100 E J	52.0 J	180 J	50.0 J	180 J	330 F
di-n-butylphthalate	360 U	2100 UJ	140 J	410 U	480 UJ	440 U	1800 UJ	11000 P
dibenz(a,h)anthracene	360 U	2100 UJ	820 E J	410 U	480 UJ	440 U	1800 UJ	330 F
dibenzofuran	360 U	2100 UJ	220 J	410 U	480 UJ	440 U	1800 UJ	2000 P
diethylphthalate	360 U	2100 UJ	100 J	43.0 J	480 UJ	440 U	1800 UJ	630000 P
fluoranthene	130 J	930 J	4700 E J	96.0 J	310 J	93.0 J	400 J	2900 Q
fluorene	360 U	2100 UJ	590 E J	410 U	480 UJ	440 U	1800 UJ	540 P
indeno(1,2,3-cd)pyrene	360 U	420 E J	2200 E J	410 U	68.0 J	440 U	1800 UJ	330 F
isophorone	360 U	2100 UJ	75.0 J	410 U	480 UJ	440 U	1800 UJ	-
naphthalene	360 U	2100 UJ	160 J	410 U	480 UJ	440 U	1800 UJ	480 P
phenanthrene	360 U	510 J	4200 E J	410 U	120 J	440 U	200 J	850 Q
pyrene	120 J	1100 E J	7000 E J	80.0 J	250 J	75.0 J	360 J	660 L
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
toluene	11.0 U	62.0 UJ	4.0 J	12.0 U	n/a	n/a	n/a	670 P
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	1.6 R	58.0 E J	26.0 E J	4.1 U	4.8 U	4.4 U	42.0 E J	1.60 L
4,4'-DDE	27.0 E	98.0 E J	98.0 E J	0.36 R	4.8 U	4.4 U	110 E J	2.20 L
4,4'-DDT	59.0 E	30.0 E J	13.0 E J	4.1 U	4.8 U	4.4 U	39.0 E J	1.60 L
Aroclor-1248	n/a	210 UJ	73.0 UJ	41.0 U	48.0 U	44.0 U	180 UJ	22.7 L

TABLE 9-3c

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01 08/24/95	17SD02 06/15/95	17SD03 06/15/95	17SD04 06/15/95	17SD05 10/30/96	17SD06 10/28/96	17SD07 10/28/96	SELECTED ARARS
LOCATION:	17SD01	17SD02	17SD03	17SD04	17SD05	17SD06	17SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:	08/24/95	06/15/95	06/15/95	06/15/95	10/30/96	10/28/96	10/28/96	
PESTICIDES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Aroclor-1254	n/a	210 UJ	73.0 UJ	41.0 U	48.0 U	44.0 U	180 UJ	-
Aroclor-1260	n/a	80.0 J	31.0 J	41.0 U	48.0 U	44.0 U	180 UJ	-
alpha-chlordane	1.8 U	8.1 E JN	2.2 R	4.5 J	2.5 U	2.3 U	9.4 UJ	7.00 O
delta-BHC	1.8 U	11.0 UJ	3.8 UJ	0.094 R	2.5 U	2.3 U	9.4 UJ	-
dieldrin	3.6 U	21.0 UJ	7.3 UJ	0.026 R	4.8 U	4.4 U	18.0 UJ	52.0 Q
endosulfan II	3.6 U	21.0 UJ	7.3 UJ	0.21 JN	4.8 U	4.4 U	18.0 UJ	5.40 P
endrin	3.6 U	21.0 UJ	7.3 UJ	4.1 U	4.8 U	4.4 U	18.0 UJ	20.0 Q
gamma-BHC (Lindane)	0.037 R	11.0 UJ	3.8 UJ	2.1 U	2.5 U	2.3 U	9.4 UJ	-
gamma-chlordane	1.8 U	7.8 E JN	2.0 R	5.0	2.5 U	2.3 U	9.4 UJ	7.00 O
heptachlor epoxide	1.8 U	0.63 R	3.8 UJ	2.1 U	2.5 U	2.3 U	9.4 UJ	5.00 O
methoxychlor	18.0 U	3.9 J	1.6 J	21.0 U	25.0 U	23.0 U	94.0 UJ	19.0 P

TABLE 9-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD08 10/30/96	17SD09 10/30/96	17SD10 10/30/96	---	---	---	---	SELECTED ARARS
LOCATION:	17SD08	17SD09	17SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI					
SAMPLE DATE:	10/30/96	10/30/96	10/30/96					
INORGANICS	mg/kg	mg/kg	mg/kg					mg/kg
aluminum	8180	7070	3550					-
antimony	0.44 U	0.54 U	0.50 U					2.00 M
arsenic	9.4 E	11.9 E	6.9					8.20 L
barium	26.6	50.4 E	15.0					40.0 B
beryllium	0.57	0.58	0.33					-
cadmium	0.36	0.28	0.29					1.20 L
calcium	177	527	236					-
chromium, total	69.0	24.1	9.6 R					81.0 L
cobalt	1.1	0.69	1.1					50.0 T
copper	7.6 J	9.9 J	10.0 J					34.0 L
iron	17600	28000	7660					-
lead	18.0	15.2	31.3					47.0 L
magnesium	715	442	355					-
manganese	14.8 J	27.2 J	12.8 J					460 O
mercury	0.13 U	0.16 U	0.31 E					0.150 L
nickel	4.4	2.7	3.0					21.0 L
potassium	1510	865	720					-
selenium	0.93 UJ	1.1 UJ	1.0 UJ					-
silver	0.13	0.16	0.17					1.00 M
sodium	168 U	207 U	191 U					-
thallium	0.80 UJ	1.0 UJ	0.91 UJ					-
vanadium	73.6	35.2	16.2					-
zinc	52.4	14.9	28.9					150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
2-methylnaphthalene	430 UJ	n/a	n/a					330 F
4-methylphenol	430 UJ	n/a	n/a					-
acenaphthene	430 UJ	n/a	n/a					620 Q
acenaphthylene	430 UJ	n/a	n/a					44.0 L

TABLE 9-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD08 10/30/96	17SD09 10/30/96	17SD10 10/30/96	---	---	---	---	SELECTED ARARS
LOCATION:	17SD08	17SD09	17SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1996 RI	1996 RI	1996 RI					
SAMPLE DATE:	10/30/96	10/30/96	10/30/96					
SEMIVOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
anthracene	430 UJ	n/a	n/a					330 F
benzo(a)anthracene	430 UJ	n/a	n/a					330 F
benzo(a)pyrene	43.0 J	n/a	n/a					430 L
benzo(b)fluoranthene	81.0 J	n/a	n/a					330 F
benzo(g,h,i)perylene	430 UJ	n/a	n/a					330 F
benzo(k)fluoranthene	430 UJ	n/a	n/a					330 F
bis(2-ethylhexyl)phthalate	430 UJ	n/a	n/a					890000000 S
butylbenzylphthalate	430 UJ	n/a	n/a					11000 Q
carbazole	430 UJ	n/a	n/a					330 F
chrysene	76.0 J	n/a	n/a					330 F
di-n-butylphthalate	430 UJ	n/a	n/a					11000 P
dibenz(a,h)anthracene	430 UJ	n/a	n/a					330 F
dibenzofuran	430 UJ	n/a	n/a					2000 P
diethylphthalate	430 UJ	n/a	n/a					630000 P
fluoranthene	110 J	n/a	n/a					2900 Q
fluorene	430 UJ	n/a	n/a					540 P
indeno(1,2,3-cd)pyrene	430 UJ	n/a	n/a					330 F
isophorone	430 UJ	n/a	n/a					-
naphthalene	430 UJ	n/a	n/a					480 P
phenanthrene	63.0 J	n/a	n/a					850 Q
pyrene	110 J	n/a	n/a					660 L
VOLATILES	ug/kg	ug/kg	ug/kg					ug/kg
toluene	n/a	n/a	n/a					670 P
PESTICIDES	ug/kg	ug/kg	ug/kg					ug/kg
4,4'-DDD	4.3 U	5.2 U	23.0 E JN					1.60 L
4,4'-DDE	4.8 E	5.2 U	7.6 E					2.20 L
4,4'-DDT	4.3 U	5.2 U	4.8 U					1.60 L
Aroclor-1248	43.0 U	52.0 U	57.0 E					22.7 L

TABLE 9-3c
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD08 10/30/96		17SD09 10/30/96		17SD10 10/30/96		---	---	---	---	SELECTED ARARS	
LOCATION:	17SD08		17SD09		17SD10		---	---	---	---	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1996 RI		1996 RI		1996 RI							
SAMPLE DATE:	10/30/96		10/30/96		10/30/96							
PESTICIDES	ug/kg		ug/kg		ug/kg						ug/kg	
Aroclor-1254	43.0	U	52.0	U	120						-	
Aroclor-1260	43.0	U	52.0	U	48.0	U					-	
alpha-chlordane	2.2	U	2.7	U	14.0	E					7.00	O
delta-BHC	2.2	U	2.7	U	2.5	U					-	
dieldrin	4.3	U	5.2	U	4.8	U					52.0	Q
endosulfan II	4.3	U	5.2	U	4.8	U					5.40	P
endrin	4.3	U	5.2	U	10.0						20.0	Q
gamma-BHC (Lindane)	2.2	U	2.7	U	2.5	U					-	
gamma-chlordane	2.2	U	2.7	U	10.0	E					7.00	O
heptachlor epoxide	2.2	U	2.7	U	2.5	U					5.00	O
methoxychlor	22.0	U	27.0	U	25.0	U					19.0	P

TABLE 9-[illegible]
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).
UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.
No Value - Constituent was not analyzed for in this sample.
UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.
J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.
R - Positive result is considered rejected based on exceedance of data validation quality control criteria.
N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.
E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.
B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.
F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.
L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.
M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.
O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.
P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.
Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.
S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.
T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.
W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 9-3d
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SD01 08/24/95	17SD02 06/15/95	17SD03 06/15/95	17SD04 06/15/95	17SD05 10/30/96	17SD06 10/28/96	17SD07 10/28/96	ARARS & TBCs
LOCATION:		17SD01	17SD02	17SD03	17SD04	17SD05	17SD06	17SD07	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1996 RI	1996 RI	1996 RI	
SAMPLE DATE:		08/24/95	06/15/95	06/15/95	06/15/95	10/30/96	10/28/96	10/28/96	
MISCELLANEOUS									
% solids	%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
moisture	%	7.5	83.5	54.9	18.7	n/a	n/a	n/a	-
pH		7.0	5.7 J	6.0 J	6.6	n/a	n/a	n/a	-
total organic carbon	mg/kg	740	110000 J	30000 J	680	3640	3560	149000 J	-

TABLE 9-3d

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SD08 10/30/96	17SD09 10/30/96	17SD10 10/30/96	---	---	---	---	ARARS & TBCs
LOCATION:		17SD08	17SD09	17SD10	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1996 RI	1996 RI	1996 RI					
SAMPLE DATE:		10/30/96	10/30/96	10/30/96					
MISCELLANEOUS									
% solids	%	77.2	62.6	68.0					-
moisture	%	n/a	n/a	n/a					-
pH		n/a	n/a	n/a					-
total organic carbon	mg/kg	9400	42200	26800					-

TABLE 9-3d
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

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No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

\- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, P.IBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 9-3e

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	**17SS01 08/24/95**	---	---	---	---	---	ARARS & TBCs		
LOCATION:	**17SS01**	---	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	**1995 RI**								
SAMPLE DATE:	**08/24/95**								
INORGANICS	**mg/kg**						**mg/kg**	**mg/kg**	**mg/kg**
aluminum	525						-	-	-
arsenic	2.3						20.0	20.0	-
barium	3.2						700	47000	-
beryllium	0.049						1.00	1.00	-
cadmium	0.10						1.00	100	-
calcium	129						-	-	-
chromium, total	5.4 J						-	500	-
cobalt	0.27						-	-	-
copper	2.2						600	600	-
iron	3060						-	-	-
lead	7.5						400	600	-
magnesium	95.5						-	-	-
manganese	9.9						-	-	-
mercury	0.019						14.0	270	-
nickel	1.3						250	2400	-
potassium	104						-	-	-
sodium	444						-	-	-
vanadium	6.0						370	7100	-
zinc	10.4 J						1500	1500	
PESTICIDES	**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDT	1.2 J						2000	9000	500000
dieldrin	0.085 R						42.0	180	50000

TABLE 9-3e
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

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J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 9-3f

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SW02 06/15/95	17SW03 06/15/95	17SW04 06/15/95	17SW05 10/30/96	ARARS & TBCs				
LOCATION:	17SW02	17SW03	17SW04	17SW05	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1996 RI					
SAMPLE DATE:	06/15/95	06/15/95	06/15/95	10/30/96					
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	9680	6350	1510	124	-	-	-	-	-
arsenic	88.6 E	20.0 E	6.8 E	3.2 U	189	0.0180	0.140	-	0.0170
barium	331 J	274 J	303 J	37.9	-	-	-	-	2000
beryllium	1.3	0.14 U	0.14 U	0.28 U	-	-	-	-	-
cadmium	3.2 E J	2.2 U	2.2 U	0.22 U	1.10 +	-	-	-	-
calcium	21600	16500	52600	12200	-	-	-	-	-
chromium, total	20.4	13.9	8.5 U	0.40 U	209 +	-	-	-	160
cobalt	6.2	2.7 U	3.6	2.5	-	-	-	-	-
copper	65.1 E	24.5 E	16.9 E	3.5	11.0 +	-	-	-	-
iron	170000	32200	42100	2480	-	-	-	-	-
lead	77.1 E	52.2 E	11.8 E	0.80 U	3.20 +	-	-	-	5.00
magnesium	6430	6770	19400	5920	-	-	-	-	-
manganese	176	646	391	231	-	-	-	-	-
mercury	0.20 E	0.20 E	0.050 E	0.20 U	0.0120	0.140	0.150	-	-
nickel	11.0	10.2	8.5	8.1	160 +	610	4600	-	516
potassium	4020	5740	11300	3190	-	-	-	-	-
selenium	15.7 E J	6.1 E J	2.5 U	3.6 U	5.00	-	-	-	10.0
sodium	50600	56000	3000000	26500 J	-	-	-	-	-
thallium	12.5 E	5.1 E	3.3 E	3.7 E	-	1.70	6.30	-	1.70
vanadium	73.6	24.1	7.4	0.30 U	-	-	-	-	-
zinc	290 E J	202 E J	221 E J	19.8	101 +	-	-	-	
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	10.0 U	1.0 J	10.0 U	10.0 U	3.00	1.80	5.90	-	
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
methoxychlor	n/a	n/a	n/a	0.52 U	30.0	100	-	0.0300	40.0

TABLE 9-3f

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SW06 10/28/96	17SW07 10/28/96	---	---	ARARS & TBCs				
LOCATION:	17SW06	17SW07	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1996 RI	1996 RI							
SAMPLE DATE:	10/28/96	10/28/96							
INORGANICS	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	245	251			-	-	-	-	-
arsenic	3.2 U	3.2 U			189	0.0180	0.140	-	0.0170
barium	30.8	17.2			-	-	-	-	2000
beryllium	0.28 U	0.28 U			-	-	-	-	-
cadmium	0.22 U	0.22 U			1.10 +	-	-	-	-
calcium	10200	48900			-	-	-	-	-
chromium, total	3.4 R	4.6 R			209 +	-	-	-	160
cobalt	2.4	0.67			-	-	-	-	-
copper	7.0	7.3			11.0 +	-	-	-	-
iron	4270	4370			-	-	-	-	-
lead	1.6 J	2.0 J			3.20 +	-	-	-	5.00
magnesium	4930	118000			-	-	-	-	-
manganese	272	81.2			-	-	-	-	-
mercury	0.20 U	0.20 U			0.0120	0.140	0.150	-	-
nickel	7.0	3.3			160 +	610	4600	-	516
potassium	3780	54700 J			-	-	-	-	-
selenium	3.6 UJ	4.6 J			5.00	-	-	-	10.0
sodium	26600	1050000			-	-	-	-	-
thallium	3.1 UJ	3.1 UJ			-	1.70	6.30	-	1.70
vanadium	1.1	1.6			-	-	-	-	-
zinc	29.7 J	20.8 J			101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	1.0 J	10.0 U			3.00	1.80	5.90	-	1.76
PESTICIDES	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
methoxychlor	0.50 U	0.30 E R			30.0	100	-	0.0300	40.0

TABLE 9-3f
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

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No Value - Constituent was not analyzed for in this sample.

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J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

\- - No standard is available for this chemical in this classification.

\+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 9-3g

COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SW02 06/15/95	17SW03 06/15/95	17SW04 06/15/95	ARARS & TBCs				
LOCATION:		17SW02	17SW03	17SW04	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI	1995 RI	1995 RI					
SAMPLE DATE:		06/15/95	06/15/95	06/15/95					
MISCELLANEOUS									
alkalinity as CaCO3	mg/L	n/a	n/a	n/a	-	-	-	-	-
ammonia nitrogen	mg/L	2.0 E	2.0 E	3.0 E	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	15.0	12.0	14.0	-	-	-	-	-
chemical oxygen demand	mg/L	250	80.0	130	-	-	-	-	-
chloride	mg/L	70.0	112	4200	-	-	-	230	230
nitrate nitrogen	mg/L	0.50 U	0.19 J	1.9	-	10.0	-	-	10.0
total dissolved solids	mg/L	n/a	n/a	n/a	-	-	-	-	-
total hardness	mg/L	46.0	54.0	193	-	-	-	-	-
total organic carbon	mg/L	39.0	13.0	39.0	-	-	-	-	-
total phosphorus as PO4	mg/L	3.1	1.4	0.90	-	-	-	-	-
total suspended solids	mg/L	n/a	n/a	n/a	-	-	-	-	-
turbidity	ntu	146	90.0	74.0	-	-	-	-	-

TABLE 9-3g

COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SW05 10/30/96		17SW06 10/28/96		17SW07 10/28/96		ARARS & TBCs				
LOCATION:		17SW05		17SW06		17SW07		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1996 RI		1996 RI		1996 RI						
SAMPLE DATE:		10/30/96		10/28/96		10/28/96						
MISCELLANEOUS												
alkalinity as CaCO3	mg/L	17.6		14.0		70.0		-	-	-	-	-
ammonia nitrogen	mg/L	n/a		n/a		n/a		-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	2.0	U	7.0		2.0	U	-	-	-	-	-
chemical oxygen demand	mg/L	15.6	R	34.3	R	104	R	-	-	-	-	-
chloride	mg/L	n/a		n/a		n/a		-	-	-	230	230
nitrate nitrogen	mg/L	n/a		n/a		n/a		-	10.0	-	-	10.0
total dissolved solids	mg/L	170		34.0		3600		-	-	-	-	-
total hardness	mg/L	54.2		52.8		676		-	-	-	-	-
total organic carbon	mg/L	n/a		n/a		n/a		-	-	-	-	-
total phosphorus as PO4	mg/L	n/a		n/a		n/a		-	-	-	-	-
total suspended solids	mg/L	11.0		19.0		20.0		-	-	-	-	-
turbidity	ntu	n/a		n/a		n/a		-	-	-	-	-

TABLE 9-3g
COMPARISON OF SURFACE WATER EXPLOSIVES AND MISC. DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

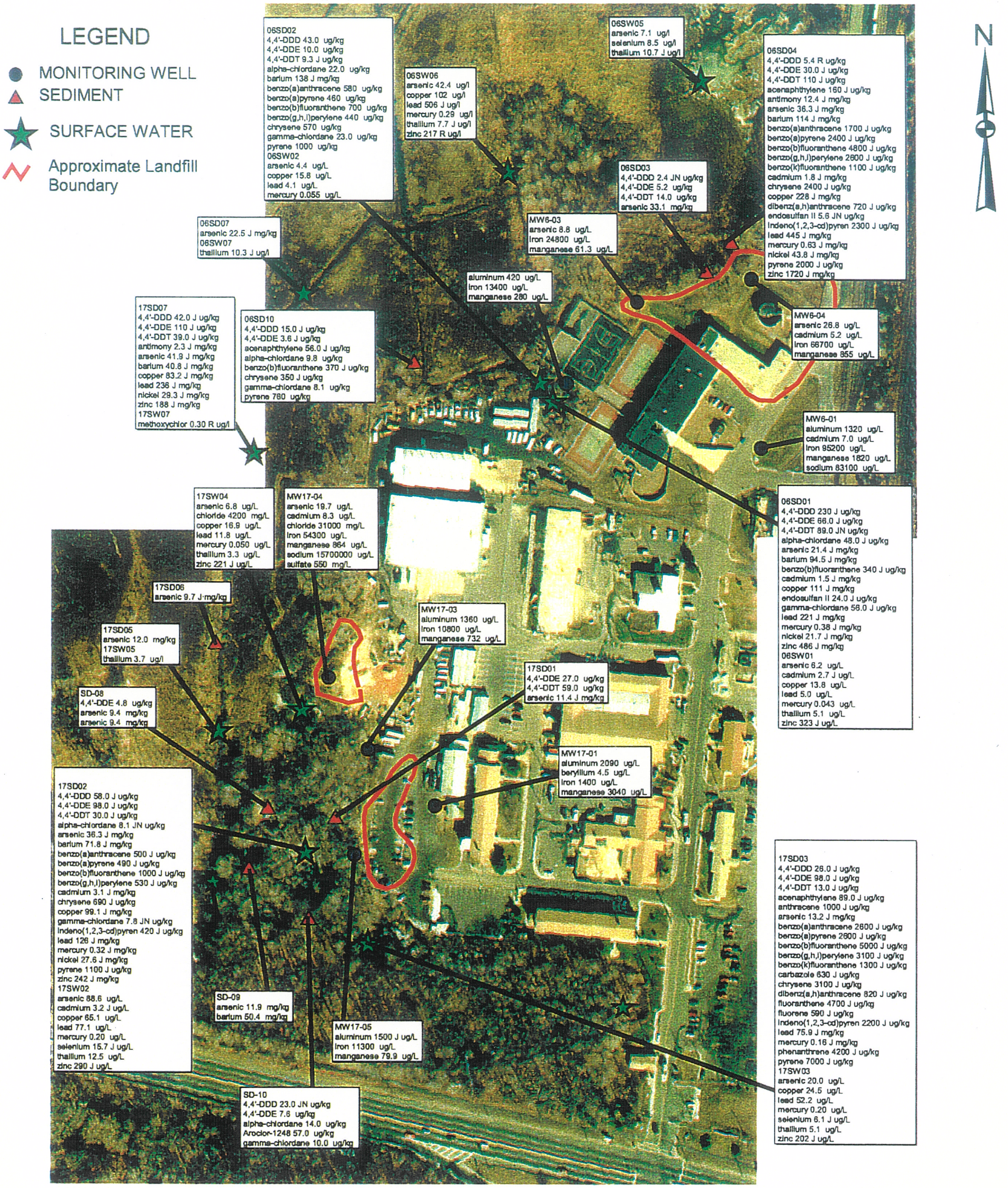
Footnotes to Ambient Water Quality Criteria:

- - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L

& - Value represents the more stringent of criteria for freshwaters classified as FW2-NT, FW2-TP, and FW2-TM

P:\GIS\EARLE\APR\EARL9708.APR 11-September-97 MJJ Site 6/17 Tags Layout



CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 6 and 17

250 0 250 500 Feet

FIGURE 9-2

Brown & Root Environmental

9.5.1.1 Inorganics

Concentrations of metals in 17 SS 01 were within the ranges found in background samples.

9.5.1.2 Organics

4,4'-DDT was detected in background surface soil samples in the concentration range of 43 ug/kg to 420 ug/kg. The pesticide compound was detected in the surface soil sample at Site 17 at a much lower concentration of 1.2 ug/kg.

9.5.2 Sediment

Four site-related sediment samples (17 SD 01 through 17 SD 04) were collected during the 1995 RI and an additional six sediment samples (17 SD 05 through 17 SD 10) were collected during the 1996 RI Addendum field work (Figure 9-1). Tables 9-4 and 9-5 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to facility-wide background. Facility-wide background (BGSD01, BGSD02, and BGSD04 through BGSD07) samples are used for COPC selection for the human health risk assessment. Only those background samples obtained form this watershed (BGSD05 through BGSD07), however, are used for the ecological risk assessment. Table 9-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 9-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

9.5.2.1 Inorganics

Elevated levels of metals were detected in several site samples, notably sample locations 17 SD 02 and 17 SD 07. Metals detected at levels at least two times background include aluminum (up to 19,300 mg/kg), arsenic (up to 41.9 mg/kg), barium (up to 71.9 mg/kg), beryllium (up to 1.9 mg/kg), cadmium (up to 3.1 mg/kg), cobalt (up to 21.1 mg/kg), copper (up to 99.1 mg/kg), iron (up to 66,400 mg/kg), lead (up to 236 mg/kg), magnesium (up to 4,800 mg/kg), manganese (up to 218 mg/kg), mercury (up to 0.32 mg/kg), nickel (up to 29.3 mg/kg), vanadium (up to 101 mg/kg), and zinc (up to 242 mg/kg). Sample 17 SD 03 also showed elevated levels of arsenic, cobalt, iron, lead, and mercury but at levels below 17 SD 01 and 17 SD 07. Analytes detected, but not present in background samples, include antimony (17 SD 07), selenium (17 SD 01 through 17 SD 04), and thallium (17 SD 02 and 17 SD 07).

TABLE 9-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5460	10 / 10	745 - 19300	7190	YES	NO	19300
ANTIMONY *	NOT DETECTED	-	-	-	1 / 10	2.3 - 2.3	2.19	YES	-	2.30
ARSENIC *	5 / 6	2.40 - 9.90	2.9E+02	11.23	10 / 10	4 - 41.9	15.10	YES	NO	21.77
BARIUM	6 / 6	3.20 - 15.80	2.9E+02	16.80	10 / 10	2.4 - 71.8	26.40	YES	NO	38.20
BERYLLIUM	4 / 6	0.34 - 0.57	3.3E-01	0.72	10 / 10	0.11 - 1.9	0.67	NO	YES	0.94
CADMIUM	2 / 6	0.44 - 0.46	1.1E+00	0.93	6 / 10	0.23 - 3.1	0.57	NO	NO	1.04
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	10 / 10	109 - 4660	1038	YES	NO	1870
CHROMIUM	6 / 6	4.30 - 56	2.6E+03	40.42	10 / 10	6.8 - 69	34.17	NO	NO	69
COBALT	4 / 6	0.51 - 2.10	6.4E+00	2.85	10 / 10	0.58 - 21.1	3.55	YES	NO	6.86
COPPER *	6 / 6	1 - 13	1.9E+01	9.08	10 / 10	2 - 99.1	24.07	YES	YES	42.63
IRON	6 / 6	228 - 21400	7.2E+09	23589	10 / 10	5640 - 66400	25035	YES	NO	49496
LEAD *	6 / 6	4.00 - 34.30	4.8E+01	21.07	10 / 10	5.2 - 236	50.69	YES	YES	89.83
MAGNESIUM	6 / 6	60.70 - 880	2.0E+06	809.90	10 / 10	117 - 4800	1171.18	YES	NO	1968
MANGANESE	6 / 6	3.90 - 63.10	8.9E+01	36.22	10 / 10	4 - 218	44.32	YES	NO	77.55
MERCURY *	1 / 6	0.07 - 0.07	8.5E-03	0.09	4 / 10	0.02 - 0.32	0.13	YES	YES	0.19
NICKEL	5 / 6	1.60 - 6	3.4E+01	6.90	9 / 10	2.7 - 29.3	8.30	YES	NO	13.82
POTASSIUM	5 / 6	86.10 - 2900	1.4E+07	1892	10 / 10	235 - 4000	1642	NO	NO	3536
SELENIUM *	NOT DETECTED	-	1.9E+00	-	5 / 10	0.93 - 7.4	1.78	YES	-	4.47
SILVER	2 / 6	0.11 - 0.15	2.8E+00	1.13	3 / 10	0.13 - 0.17	0.45	NO	NO	0.17
SODIUM	4 / 6	26.60 - 2280	2.9E+03	876.80	7 / 10	50.2 - 10800	1223	YES	NO	2965
THALLIUM*	NOT DETECTED	-	2.2E+00	-	1 / 10	1.5 - 1.5	0.78	YES	-	1.10
VANADIUM	6 / 6	5.90 - 42.70	2.1E+03	39.42	10 / 10	9.4 - 101	46.73	YES	NO	95.83
ZINC	6 / 6	12.50 - 34.70	1.5E+03	41.23	10 / 10	7.3 - 242	66.15	YES	NO	107.97

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 9-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	2 / 6	4.9 -	11.98	4 / 9	23 - 58	58
4,4'-DDE *	1 / 6	1.7 - 1.7	1.70	6 / 9	4.8 - 110	110
4,4'-DDT *	1 / 6	19 - 19	10.64	4 / 10	13 - 59	59
ALPHA-CHLORDANE *	NOT DETECTED	-	-	3 / 9	4.5 - 14	13.90
AROCLOR-1248 *	1 / 6	5.8 - 5.8	5.80	1 / 9	57 - 57	57
AROCLOR-1254 *	NOT DETECTED	-	-	1 / 9	120 - 120	107.08
AROCLOR-1260 *	NOT DETECTED	-	-	2 / 9	31 - 80	60.54
ENDOSULFAN II *	NOT DETECTED	-	-	1 / 10	0.21 - 0.21	0.21
ENDRIN *	NOT DETECTED	-	-	1 / 10	10 - 10	8.58
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.10	3 / 9	5 - 10	10
METHOXYCHLOR *	NOT DETECTED	-	-	2 / 10	1.6 - 3.9	3.90
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	1 / 8	170 - 170	170
4-METHYLPHENOL *	NOT DETECTED	-	-	2 / 8	420 - 820	766.58
ACENAPHTHENE *	NOT DETECTED	-	-	1 / 8	340 - 340	340
ACENAPHTHYLENE *	NOT DETECTED	-	-	1 / 8	89 - 89	89
ANTHRACENE *	NOT DETECTED	-	-	1 / 8	1000 - 1000	1000
BENZ(A)ANTHRACENE *	3 / 6	85 - 560	560	3 / 8	120 - 2600	2317
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	5 / 8	41 - 2600	2600
BENZO(B)FLUORANTHENE *	3 / 6	150 - 490	346.54	7 / 8	62 - 5000	5000
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380	3 / 8	66 - 3100	3100
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470	3 / 8	92 - 1300	1197
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	3 / 8	54 - 9400	9400
BUTYLBENZYLPHTHALATE *	NOT DETECTED	-	-	1 / 8	610 - 610	610
CARBAZOLE *	NOT DETECTED	-	-	1 / 8	630 - 630	630
CHRYSENE *	3 / 6	130 - 940	577.87	8 / 8	50 - 3100	3100
DI-N-BUTYLPHTHALATE *	1 / 6	97 97	97	1 / 8	140 - 140	140
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	1 / 8	820 - 820	820
DIBENZOFURAN *	NOT DETECTED	-	-	1 / 8	220 - 220	220
DIETHYLPHTHALATE *	1 / 6	44 - 44	44	2 / 8	43 - 100	100
FLUORANTHENE *	3 / 6	240 - 1800	1024.31	8 / 8	93 - 4700	4700
FLUORENE *	1 / 6	190 - 190	190	1 / 8	590 - 590	590
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310	3 / 8	68 - 2200	2200
ISOPHORONE *	NOT DETECTED	-	-	1 / 8	75 - 75	75
NAPHTHALENE *	NOT DETECTED	-	-	1 / 8	160 - 160	160
PHENANTHRENE *	3 / 6	110 - 1900	1052	5 / 8	63 - 4200	4131
PYRENE *	3 / 6	200 - 1900	1077	8 / 8	75 - 7000	7000
TOLUENE *	1 / 3	480 - 480	480	1 / 4	4 - 4	4

* - Selected as a COPC

** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

9.5.2.2 Organics

The PAH compounds dibenz(a,h)anthracene, acenaphthene, acenaphthylene, naphthalene, and anthracene (concentration range 4 ug/kg to 1,000 ug/kg) were found in at least one site-related sediment sample but were not detected in the associated background sediment samples. The maximum concentrations of PAHs were observed in sample 17 SD 03 with levels greater than the range of background samples.

Bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, diethyl phthalate, and butylbenzyl phthalate were detected in site-related sediment samples but were not detected in the associated background sediment samples. Bis(2-ethylhexyl) phthalate was present at the highest concentrations (9,400 ug/kg in sample 17 SD 03 and 4,400 ug/kg in 17 SD 02). Aroclor 1260 was detected in 17 SD 02 at 80 ug/kg and 17 SD 03 at 31 ug/kg but was not detected in background samples. Aroclor 1248 was detected at 17 SD 10 at 57 ug/kg. This level is approximately 10 times the background concentration. Aroclor 1254 was also detected at 17 SD 10 at a concentration of 120 ug/kg. Aroclor 1254 was not detected in background samples. The Aroclor 1260 result for 17 SD 03 was qualified (R), rejected, based on data validation and cannot be used for risk assessment. 4-Methylphenol (420 ug/kg to 820 ug/kg), isophorone (75 ug/kg), endosulfan II, alpha-chlordane (4.5 ug/kg to 14 ug/kg), and methoxychlor (1.6 ug/kg to 3.9 ug/kg) were detected in at least one site-related sediment sample but were not detected in the associated background sediment samples. The following pesticide compounds were detected at concentrations greater than the ranges of background samples in one or more site-related sediment samples: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and gamma chlordane. The highest levels of pesticides were found primarily at sample locations 17 SD 01 through 17 SD 03 and 17 SD 07.

9.5.2.3 Miscellaneous Parameters

The 1995 RI sediment samples collected at Site 17 were analyzed for moisture, pH, and TOC. Two sediment samples (17 SD 01 and 17 SD 04) contained pH levels exceeding maximum sediment background levels. The 1996 RI Addendum samples were analyzed for TOC and percent solids. Sample 17 SD 07 showed TOC (149,000 mg/kg) approximately 1.5 times background.

9.5.3 Groundwater

Four site-related groundwater samples (17 GW 01, 17 GW 03, 17 GW 04, and 017 GW 05) were collected (from monitoring wells MW17-01 and MW17-03 through MW17-05) at Site 17 (Figure 9-1). Table 9-6 presents the occurrence and distribution of inorganic chemicals detected in site-related groundwater samples and compares them to background. No organic compounds were detected in site-related groundwater samples. Table 9-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 9-2 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

TABLE 9-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	1320 - 2090	1.6E+11	3387	4 / 4	96.8 - 2090	1262	NO	NO	2090
ARSENIC *	1 / 3	5.1 - 5.1	1.7E+02	5.60	3 / 4	4.2 - 19.7	8.14	YES	NO	19.70
BARIUM	3 / 3	30.4 - 78.1	2.5E+06	105.47	4 / 4	16 - 590	193.43	YES	NO	590
BERYLLIUM	2 / 3	0.23 - 4.5	7.7E+01	3.19	2 / 4	1.4 - 4.5	1.50	NO	NO	4.50
CADMIUM	3 / 3	0.43 - 7	2.2E+01	5.29	3 / 4	0.43 - 8.3	2.45	NO	NO	7.05
CALCIUM	3 / 3	11000 - 24100	9.4E+14	38067	4 / 4	1700 - 517000	134248	YES	NO	434535
CHROMIUM *	NOT DETECTED	-	1.1E+00	-	2 / 4	1.1 - 4.6	1.67	YES	YES	3.99
COBALT	3 / 3	3.2 - 24.7	4.2E+04	23.67	4 / 4	0.72 - 24.7	10.41	NO	NO	24.70
COPPER *	NOT DETECTED	-	4.0E-02	-	3 / 4	0.83 - 2.5	1.18	YES	YES	2.50
IRON	3 / 3	1400 - 95200	2.4E+16	66847	4 / 4	1400 - 54300	19450	NO	NO	54300
LEAD *	NOT DETECTED	-	3.8E-01	-	2 / 4	3.8 - 5.7	2.75	YES	YES	5.70
MAGNESIUM	3 / 3	8610 - 17300	2.5E+14	26940	4 / 4	1440 - 89900	28208	YES	NO	77011
MANGANESE	3 / 3	720 - 3040	7.3E+11	3720	4 / 4	79.9 - 3040	1179	NO	NO	3040
MERCURY	1 / 3	0.044 - 0.044	1.1E-05	0.03	1 / 4	0.054	0.02	NO	YES	0.05
NICKEL	3 / 3	3.7 - 43.2	2.7E+05	38.33	3 / 4	3.2 - 43.2	15.64	NO	NO	43.20
POTASSIUM	3 / 3	3000 - 3620	1.1E+12	6780	4 / 4	2460 - 92700	25300	YES	NO	78174
SODIUM	3 / 3	15800 - 92500	1.9E+17	127600	4 / 4	4780 - 15700000	3937370	YES	NO	13164690
VANADIUM *	1 / 3	1.1 - 1.1	9.4E-01	1.14	3 / 4	1.1 - 18.1	7.43	YES	YES	18.10
ZINC	2 / 2	18.9 - 30.9	7.3E+11	49.80	2 / 4	3.8 - 10.5	43.81	NO	NO	10.50

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

9.5.3.1 Inorganics

Most metals were present in site-related samples at concentrations similar to background. Arsenic, barium, cadmium, and iron were detected at levels greater than the range of background samples in sample 17 GW 04. This sample contained a very high sodium level (1.6 percent).

9.5.3.2 Miscellaneous Parameters

Miscellaneous parameter analyses of four groundwater samples at Site 17 consisted of ammonia, BOD, COD, chlorides, sulfates, TOC, phosphates, and turbidity. Results are presented in Appendix A. MW17-03 and MW17-01 (downgradient) and MW17-05 (crossgradient and adjacent to the landfill) revealed greater concentrations of indicator parameters than MW17-01 (upgradient). COD, TOC, and phosphates were detected in MW17-04 and MW17-05 at concentrations greater than maximum background levels. MW17-04 also contained ammonia, chloride, and sulfate concentrations above background. Chloride concentrations in MW17-04 were very high (31,000 mg/L). Sulfate was detected at levels exceeding maximum background levels in MW17-01, MW17-03, and MW17-04. With the exception of very high chloride concentrations in MW17-04, none of the other indicator parameters were high enough to be within a range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

9.5.4 Surface Water

Three site-related surface water samples (17 SW 02 through 17 SW 04) were collected at Site 17 in 1995 and three surface water samples (17 SW 05 through 17 SW 07) were collected in 1996 (Figure 9-1). Tables 9-7 and 9-8 present the occurrence and distribution of organic and inorganic chemicals detected in site-related surface water samples and compare them to background. Facility-wide background (BGSW01, BGSW02, and BGSW04 through BGSW07) samples are used for COPC selection for the human health risk assessment. Only those background samples obtained form this watershed (BGSW05 through BGSW07), however, are used for the ecological risk assessment. Table 9-3 presents a comparison of detected compounds to ARARs and TBCs. Figure 9-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

TABLE 9-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND**			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
PYRENE*	0 / 6	-	-	2 / 6	1 - 1	1

* - Selected as a COPC

** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

TABLE 9-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM *	5 / 6	102 - 1540	2.2E+03	904.20	6 / 6	124 - 9680	3027	YES	YES	6348
ARSENIC *	1 / 6	9 - 9	1.3E+01	5.32	3 / 6	6.8 - 88.6	20.03	YES	YES	48.28
BARIUM	6 / 6	16.3 - 36.4	2.4E+03	55.05	6 / 6	17.2 - 331	165.65	YES	NO	290.13
CADMIUM	3 / 6	0.22 - 1.2	1.7E+00	0.70	1 / 6	1.3 - 1.3	0.31	NO	NO	0.71
CALCIUM	1 / 6	0.18 - 0.18	3.2E-01	0.23	1 / 6	3.2 - 3.2	0.96	YES	YES	1.94
CHROMIUM	6 / 6	462 - 177000	2.3E+05	71114	6 / 6	10200 - 52600	27000	NO	NO	52600
COBALT *	3 / 5	0.72 - 2.6	4.4E+00	1.78	2 / 4	13.9 - 20.4	9.69	YES	YES	20.40
COPPER	6 / 6	0.81 - 2	5.2E+00	3.10	5 / 6	0.67 - 6.2	2.79	NO	NO	6.20
IRON	5 / 6	1.1 - 17.8	3.0E+02	11.92	6 / 6	3.5 - 65.1	20.72	YES	NO	39.70
LEAD *	6 / 6	160 - 23100	3.0E+04	9577	6 / 6	2480 - 170000	42570	YES	YES	95730
MAGNESIUM	2 / 6	4.4 - 16	2.2E+01	7.31	5 / 6	1.6 - 77.1	24.18	YES	YES	50.98
MANGANESE	6 / 6	369 - 559000	7.0E+05	190703	6 / 6	4930 - 118000	26908	NO	NO	63886
MERCURY	6 / 6	14 - 203	3.8E+02	172.43	6 / 6	81.2 - 646	299.53	YES	NO	646
NICKEL	2 / 6	0.023 - 0.028	2.3E-01	0.12	3 / 6	0.05 - 0.2	0.13	YES	NO	0.20
POTASSIUM	6 / 6	2.1 - 7.9	8.2E+01	10.23	6 / 6	3.3 - 11	8.02	NO	NO	11
SODIUM	5 / 6	251 - 259000	3.2E+05	88923	6 / 6	3190 - 54700	13788	NO	NO	30456
THALLIUM	2 / 6	3.5 - 9.2	1.4E+01	6.27	3 / 6	4.6 - 15.7	5.21	NO	NO	9.72
VANADIUM	3 / 3	11150 - 4340000	1.3E+07	2912233	6 / 6	26500 - 3000000	701617	NO	NO	1685764
ZINC	3 / 6	3.5 - 5.5	2.8E+01	5.90	4 / 6	3.3 - 12.5	4.62	NO	NO	7.98

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

9.5.4.1 Inorganics

Higher concentrations of most metals were seen in site-related sample 17 SW 02. Metals present in this sample at levels greater than two times background include aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, thallium, vanadium, and zinc. Elevated levels were also observed for aluminum, arsenic, barium, iron, chromium, lead, manganese, mercury, vanadium, and zinc in 17 SW 03 and barium and zinc in 17 SW 03. The presence of elevated levels of aluminum in 17 SW 02 and 17 SW 03 suggests that a significant portion of the metals in these samples may be present in a suspended rather than dissolved form. No elevated levels of metals were detected in the 1996 RI Addendum samples.

9.5.4.2 Organics

The only organic compound detected in surface water samples was bis(2-ethylhexyl) phthalate at a concentration of 1 ug/L at sample location 17 SW 06. This compound was not detected in background samples.

9.5.4.3 Miscellaneous Parameters

Miscellaneous parameter analyses for three surface water samples collected at Site 17 in 1995 consisted of ammonia, BOD, COD, chlorides, nitrates, hardness, TOC, phosphates, and turbidity. Results are presented in Appendix A. All the indicator parameters, except for nitrates, were detected above maximum surface water background concentrations in all samples. Nitrate nitrogen concentrations in sample 17 SW 04 exceeded background levels. None of the indicator parameters detected in the surface water samples were high enough to be within range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

Parameters analyzed for the 1996 samples were alkalinity, BOD, COD, total dissolved solids, hardness, and total suspended solids. Results indicate elevated levels of alkalinity, total dissolved solids, and hardness in sample 17 SW 07 when compared to the other samples; however, no background samples were analyzed for these parameters.

9.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 17 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 9.6.1. Persistence of detected chemicals in the environment is discussed in Section 9.6.2. Section 9.6.3 presents a brief discussion of contaminant trends.

9.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 17 indicate detectable amounts of PAHs, pesticides, and PCB compounds in sediment and several inorganics present in groundwater, sediment, and surface water. The physical transport data for the detected contaminants are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Low levels of PCBs, PAHs, phthalate, and certain pesticides were detected in sediment. The detected PAHs and PCBs are typically strongly bound to organic matter and are not expected to migrate significantly except in conjunction with surface water erosional patterns. Pesticides are also considered of low mobility when absorbed onto high-carbon content substrates such as natural organic material in soil or sediments.

Bis(2-ethylhexyl) phthalate was detected at a maximum concentration in 17 SD 03 and was also detected in the surface water from the same location. This compound possesses a high soil-water distribution constant (K_d) and fairly low solubility. Adsorption onto suspended solids and particulate matter and complexation with natural organic substances are probably the most important environmental transport processes for bis(2-ethylhexyl) phthalate. Phthalate esters are commonly found in freshwater and saltwater sediment samples and readily interact with the fulvic acid present in humic substances in water and soil, forming a complex that is readily soluble in water (Clement Associates, 1985).

Levels of metals were slightly greater than background in one site-related sediment sample and in a corresponding surface water sample. These metals may or may not be present in soluble form because the surface water sample exhibited several minerals that are normally insoluble, which suggests that transport as suspended solids is possible. Organic compounds have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility. Surface water erosional transport may be the principal mechanism for migration of the detected organic compounds and metals in sediment.

One groundwater sample, 17 GW 04, exhibited slightly elevated levels of several metals. In this well and others at Site 17, low turbidity readings were achieved by sampling using dedicated low-flow bladder pumps, so that results should represent the presence of dissolved metals. Very high levels of sodium chloride (approximately five percent by weight) were present in this groundwater sample, which was collected from monitoring well MW17-04.

9.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective. PCBs and pesticides found at the site are considered highly persistent and undergo biodegradation at slow rates that vary according to the chlorinated isomer substitution pattern for each type or PCB congener in Aroclor mixtures.

PAHs can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. The rate of degradation depends on a number of factors including oxygen, carbon sources, nutrients, pH, moisture, and appropriate acclimatized organisms.

A variety of unicellular and multicellular organisms take up and accumulate phthalate esters, and bioaccumulation is considered an important fate process (Clement Associates, 1985). Biodegradation is also considered an important fate process. Because phthalate esters are degraded under most conditions and can be metabolized by multicellular organisms, it is unlikely that long-term bioaccumulation or biomagnification occurs.

9.6.3 Observed Chemical Contaminant Trends

No VOCs were detected in the groundwater, surface soil, surface water, and sediment. Organic contaminant species of low solubility and mobility (PAHs, pesticides, and PCBs) were detected at low levels in sediment but were not found in surface water or surface soil. Phthalates were detected at elevated levels in two sediment samples, with a corresponding phthalate present at a trace level in one of the surface water samples from the same location.

Elevated levels of certain metals were noted in sediment and surface water samples locations within the marsh area that is downslope and west of the edge of the landfill. Overland flow drains toward the salt marsh north of the site.

Most inorganic constituents detected in Site 17 groundwater samples were within concentration ranges similar to background groundwater samples. One monitoring well (MW17-04) showed slightly elevated levels of arsenic, barium, cadmium, and iron, which, given the low turbidity readings observed, may indicate the potential for groundwater transport for one or more of these metals. The same well also exhibited sodium chloride at levels of approximately five percent (a concentration comparable to that of seawater, which is approximately 2.8 percent).

9.6.4 Conclusions

Several classes of organic compounds detected in sediment are considered to be species of low mobility (PAHs, pesticides, and PCBs) that are not expected to transport quickly from source areas. The occurrence of these compounds in sediment may be the result of gradual migration from the landfill through seeps and erosional dispersion; however, surface water did not reveal the presence of these contaminants. Phthalate esters detected in two sediments and one surface water exhibit a tendency to bind to organic matter in soil. These compounds can be rendered mobile in surface water when complexed with soluble forms of humic substances. Phthalate esters are commonly detected in sediments and might be related to migration from the landfill through seeps or overland flow.

Elevated levels of metals were detected at three surface water locations. Several of the same metals were present at elevated levels in sediment samples from the same locations. Elevated levels of aluminum in these surface water locations suggest that metals may be present in association with suspended solids. The presence of these metals might be related to migration from the landfill through seeps or overland flow.

One monitoring well (MW17-04) at the northwestern end of the landfill revealed slightly elevated levels of several metals present in dissolved form. This well was also found to contain concentrations of sodium chloride in the same general range as seawater. Arsenic, barium, and iron were detected at elevated levels in this well (and were also found at elevated levels in two sediment and three surface water samples). Monitoring wells near the western edge of the landfill did not reveal elevated levels of metals.

9.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 17. The risk assessment was performed using the approach outlined in Section 2.4. Tables 9-9 through 9-12 provide the selected COPCs and representative concentrations of inorganics and organics in site-related surface soil, groundwater, sediment, and surface water, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

TABLE 9-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE SOIL - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ARSENIC	2.3
4,4'-DDT*	1.2

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 9-10
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
GROUNDWATER - SITE 17 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ARSENIC	19.7
CHROMIUM	3.99
COPPER	2.5
LEAD	5.7
VANADIUM	18.1

TABLE 9-11
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SEDIMENT - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)
ANTIMONY	2.3
ARSENIC	21.77
COPPER	42.63
LEAD	126
MERCURY	0.19
SELENIUM	4.47
THALLIUM	1.5
2-METHYLNAPHTHALENE*	170
4,4'-DDD*	58
4,4'-DDE*	110
4,4'-DDT*	59
4-METHYLPHENOL*	766.58
ACENAPHTHENE*	340
ACENAPHTHYLENE*	89
ALPHA-CHLORDANE*	13.9
ANTHRACENE*	1000
AROCLOR-1248*	57
AROCLOR-1254*	107.08
AROCLOR-1260*	61
BENZO(A)ANTHRACENE*	2316
BENZO(A)PYRENE*	2600
BENZO(B)FLUORANTHENE*	5000
BENZO(G,H,I)PERYLENE*	3100
BENZO(K)FLUORANTHENE*	1196
BIS(2-ETHYLHEXYL)PHTHALATE*	9400
BUTYLBENZYLPHTHALATE*	610
CARBAZOLE*	630
CHRYSENE*	3100
DI-N-BUTYLPHTHALATE*	140
DIBENZ(A,H)ANTHRACENE*	820
DIBENZOFURAN*	220
DIETHYLPHTHALATE*	100
ENDOSULFAN II*	0.21
ENDRIN*	8.58
FLUORANTHENE*	4700
FLUORENE*	590
GAMMA-CHLORDANE*	10
INDENO(1,2,3-CD)PYRENE*	2200
ISOPHORONE*	75
METHOXYCHLOR*	3.9
NAPHTHALENE*	160
PHENANTHRENE*	4131
PYRENE*	7000
TOLUENE*	4

* = UNITS FOR ORGANICS ARE IN ug/kg

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TABLE 9-12
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCS
SURFACE WATER - SITE 17 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ALUMINUM	6347
ARSENIC	48.28
COBALT	20.4
LEAD	50.98
VANADIUM	41.59
PYRENE	1

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The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site. It should be noted that facility-wide background (BGSD/SW01, BGSD/SW02, and BGSD/SW04 through BGSD/SW07) samples are used for COPC selection for the human health risk assessment.

9.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current (industrial receptors) and hypothetical future land use (residential, industrial, and recreational receptors).

9.7.1.1 Current Industrial Employee

Surface Soil Exposure

RME

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 17 are 1.2E-06 (ingestion), 4.0E-07 (dermal contact), and 6.7E-10 (inhalation of fugitive dust). The total surface soil cancer risk is at the lower end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this exposure pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 17 are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 17 in Tables 9-13 and 9-14, respectively.

CTE

No CTE analysis is required for surface soil exposure.

TABLE 9-13
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDT	1.4E-10	2.8E-10	3.2E-14
ARSENIC	1.2E-06	4.0E-07	6.7E-10
TOTAL RISK	1.2E-06	4.0E-07	6.7E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-14
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDT	2.3E-06	4.6E-06	4.3E-10
ARSENIC	7.5E-03	2.5E-03	1.4E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

9.7.1.2 Future Industrial Employee

Groundwater Exposure

RME

The estimated total cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 17 are 1.0E-04 (ingestion) and 2.1E-07 (dermal contact). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 17 is less than 1.0 for the ingestion exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater soil at Site 17 in Tables 9-15 and 9-16, respectively.

CTE

No CTE analysis is required for groundwater exposure.

9.7.1.3 Future Residential Receptor

Surface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in surface soil at Site 17 are 5.4E-06 (ingestion), 1.3E-06 (dermal contact), and 4.1E-10 (inhalation of fugitive dust). The total surface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

TABLE 9-15
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 17
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ARSENIC	1.0E-04	2.1E-07
CHROMIUM	N/A	N/A
COPPER	N/A	N/A
LEAD	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	1.0E-04	2.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-16
RME NONCARCINOGENIC HQS
FUTURE INDUSTRIAL RECEPTORS - SITE 17
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ARSENIC	6.4E-01	1.3E-03
CHROMIUM	3.9E-05	N/A
COPPER	6.1E-04	N/A
LEAD	N/A	N/A
VANADIUM	2.5E-02	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FO

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site 17 are less than 1.0 for the ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soil at Site 17 in Tables 9-17 and 9-18, respectively.

CTE

No CTE analysis is required for surface soil exposure.

Groundwater Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in groundwater at Site 17 are 4.4E-04 (ingestion) and 5.4E-06 (dermal contact). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 100 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 17 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (4.2 - arsenic). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 17 in Tables 9- 19 and 9-20, respectively.

TABLE 9-17
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDT	6.4E-10	9.2E-10	1.9E-14
ARSENIC	5.4E-06	1.3E-06	4.1E-10
TOTAL RISK	5.4E-06	1.3E-06	4.1E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDT	3.1E-05	3.7E-05	4.6E-10
ARSENIC	9.8E-02	2.0E-02	1.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-19
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ARSENIC	4.4E-04	5.4E-06	N/A
CHROMIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	4.4E-04	5.4E-06	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-20
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN				
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ARSENIC	4.2E+00		4.2E+00		5.3E-02	N/A
CHROMIUM	2.6E-04			2.6E-04	N/A	N/A
COPPER	4.0E-03	4.0E-03			N/A	N/A
LEAD	N/A	N/A			N/A	N/A
VANADIUM	1.7E-01				N/A	N/A
	HI BY TARGET ORGAN	4.0E-03	4.2E+00	2.6E-04	5.3E-02	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in groundwater at Site 17 are 2.0E-04 (ingestion) and 1.7E-06 (dermal contact). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 100 percent of the cancer risk for this pathway and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 17 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organ, corresponding HI, and principal COPC is skin (2.0 - arsenic). The estimated noncarcinogenic HI for the dermal contact exposure pathway was less than 1.0. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 17 in Tables 9-21 and 9-22, respectively.

9.7.1.4 Future Recreational Receptor

Sediment and Surface Water

RME

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 17 are 2.5E-07 (ingestion) and 1.8E-08 (dermal contact). The cancer risks for exposure to COPCs in surface water during wading at Site 17 are 9.5E-07 (ingestion) and 2.9E-07 (dermal contact). This sediment cancer risk is below the 10^{-4} to 10^{-6} target acceptable risk range. The principal COPC contributing to the sediment cancer risk is arsenic (dermal contact, 100 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 17 are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated individual noncarcinogenic HQs for exposure to COPCs in surface water during wading at Site 17 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

TABLE 9-21

CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17

GROUNDWATER, AMENDED RISK

NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ARSENIC	2.0E-04	1.7E-08	N/A
CHROMIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
VANADIUM	N/S	N/A	N/A
TOTAL RISK	2.0E-04	1.7E-08	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 19-22
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ARSENIC	2.0E+00		2.0E+00			2.2E-02	N/A
CHROMIUM	1.2E-04					N/A	N/A
COPPER	1.9E-03	1.9E-03		1.9E-03	1.9E-03	N/A	N/A
LEAD	N/A	N/A				N/A	N/A
VANADIUM	7.7E-02					N/A	N/A
	HI BY TARGET ORGAN	1.9E-03	2.0E+00	1.9E-03	1.9E-03		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 17 in Tables 9-23 and 9-24, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 17 in Tables 9-25 and 9-26, respectively.

CTE

No CTE analysis is required for sediment and surface water exposure.

9.7.1.5 Lead Results

The IEUBK Lead Model (v. 0.99) was used to characterize risks from lead in soil, dust, and water for the hypothetical future residential children (ages 0 through 6), who are considered the most sensitive receptor group at Site 17. The simulated range of blood-lead values that might occur in a population as a result of exposures to lead was compared to a guideline level of 10 micrograms per deciliter (µg/dL). Based on model results, 0.0 percent of residential children exposed under similar conditions might have blood-lead levels exceeding 10 µg/dL. This is less than a protective guideline of five percent for the maximum proportion of individuals with blood levels exceeding 10 µg/dL (EPA, 1994). The model inputs assumed were default parameter values, 7.5 mg/kg lead in site-related soils, and 5.7 µg/L lead in groundwater. The IEUBK population histograms for Site 17 exposures are presented in Appendix D.

9.7.2 Conclusions

Surface soil, groundwater, sediment, and surface water were sampled at Site 17. The potential receptors considered for this site were current industrial and future industrial, residential, and recreational receptors.

The RME cancer risks associated with future residential (groundwater) exposure scenarios were at the upper end of the target acceptable risk range of 10^{-4} to 10^{-6}. The CTE cancer risks for the future residential receptor were also at the upper end of the target acceptable risk range of 10^{-4} to 10^{-6}. Arsenic (via ingestion) is the principal COPC that contributed to the cancer risks for these exposure scenarios. The RME cancer risks associated with future industrial (groundwater) exposure were at the upper end of the target acceptable risk range of 10^{-4} to 10^{-6}. Arsenic (via ingestion) is the principal COPC that contributed to the cancer risks for these exposure scenarios.

TABLE 9-23
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SEDIMENT, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	N/A	N/A
4,4'-DDD	1.8E-10	N/A
4,4'-DDE	3.1E-10	N/A
4,4'-DDT	1.2E-10	N/A
4-METHYLPHENOL	N/A	N/A
ACENAPHTHENE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ALPHA-CHLORDANE	1.2E-10	N/A
ANTHRACENE	N/A	N/A
AROCLOR-1248	5.8E-09	5.5E-08
AROCLOR-1254	7.8E-09	7.4E-08
AROCLOR-1260	5.5E-09	5.2E-08
BENZO(A)ANTHRACENE	1.1E-08	N/A
BENZO(A)PYRENE	1.1E-07	N/A
BENZO(B)FLUORANTHENE	1.9E-08	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	6.8E-10	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	7.7E-10	N/A
BUTYLBENZYLPHTHALATE	N/A	N/A
CARBAZOLE	1.7E-10	N/A
CHRYSENE	1.2E-10	N/A
DI-N-BUTYLPHTHALATE	N/A	N/A
DIBENZ(A,H)ANTHRACENE	7.0E-08	N/A
DIBENZOFURAN	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A
ENDOSULFAN II	N/A	N/A
ENDRIN	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	9.9E-11	N/A
INDENO(1,2,3-CD)PYRENE	9.9E-09	N/A
ISOPHORONE	9.4E-13	N/A
METHOXYCHLOR	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
TOLUENE	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	4.2E-09	1.6E-06
COPPER	N/A	N/A
MERCURY	N/A	N/A
TOTAL RISK	2.5E-07	1.8E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMI

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 9-24
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SEDIMENT, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	N/A	N/A
4,4'-DDD	N/A	N/A
4,4'-DDE	N/A	N/A
4,4'-DDT	N/A	N/A
4-METHYLPHENOL	N/A	N/A
ACENAPHTHENE	1.8E-05	N/A
ACENAPHTHYLENE	N/A	N/A
ALPHA-CHLORDANE	1.7E-05	N/A
ANTHRACENE	3.9E-07	N/A
AROCLOR-1248	N/A	N/A
AROCLOR-1254	5.9E-04	5.6E-03
AROCLOR-1260	N/A	N/A
BENZO(A)ANTHRACENE	N/A	N/A
BENZO(A)PYRENE	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E-05	N/A
BUTYLBENZYLPHTHALATE	3.9E-07	N/A
CARBAZOLE	N/A	N/A
CHRYSENE	N/A	N/A
DI-N-BUTYLPHTHALATE	1.8E-07	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A
DIBENZOFURAN	8.4E-06	N/A
DIETHYLPHTHALATE	1.6E-08	N/A
ENDOSULFAN II	5.4E-09	N/A
ENDRIN	3.5E-06	N/A
FLUORANTHENE	7.3E-06	N/A
FLUORENE	2.3E-06	N/A
GAMMA-CHLORDANE	1.5E-05	N/A
INDENO(1,2,3-CD)PYRENE	N/A	N/A
ISOPHORONE	5.8E-08	N/A
METHOXYCHLOR	6.2E-09	N/A
NAPHTHALENE	6.1E-07	N/A
PHENANTHRENE	N/A	N/A
PYRENE	1.4E-05	N/A
TOLUENE	3.1E-09	N/A
ANTIMONY	8.8E-04	N/A
ARSENIC	1.1E-02	4.2E-02
COPPER	1.6E-04	N/A
MERCURY	9.9E-05	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-25
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
PYRENE	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	9.5E-07	2.9E-07
COBALT	N/A	N/A
LEAD	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	9.5E-07	2.9E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 9-26
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 1
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
PYRENE	1.2E-04	N/A
ALUMINUM	9.7E-04	N/A
ARSENIC	2.5E-02	7.6E-03
COBALT	1.6E-05	N/A
LEAD	N/A	N/A
VANADIUM	9.1E-04	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

RME estimates for noncarcinogenic HIs associated with future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenarios. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

RME risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 17 in Table 9-27 for surface soil, groundwater, sediment, and surface water. Table 9-28 presents the relevant CTE risk estimates associated with potential receptors for surface soil, groundwater, sediment, and surface water. The estimated RME cancer risk for the future industrial employee is at the upper end of the target acceptable risk range, based mainly on ingestion of groundwater. The estimated RME cancer risk for the future residential receptor is at the upper end of the target acceptable risk range, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor is also at the upper end of the target acceptable risk range, based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

Lead concentrations detected at the site during this RI were below the EPA guidelines and are not expected to be associated with a significant increase in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

Arsenic was detected in three out of four site-related groundwater samples at concentrations of 4.2 ug/l, 7.0 ug/l, and 19.7 ug/l. Arsenic was detected in one out of three background groundwater samples at a concentration of 5.1 ug/l. One of the site-related concentrations, 19.7 ug/l, is clearly elevated above background. The other two site-related samples are in the range of background. The site-related average concentration for arsenic is elevated above background average concentration (5.6 ug/l versus 8.14 ug/l).

9.8 ECOLOGICAL RISK ASSESSMENT

9.8.1 <u>Background</u>

Since Sites 6 and 17 are situated in the same area of the Waterfront complex and are part of the same watershed, they were assessed together. As described earlier, Sites 6 and 17 are inactive landfills that are located adjacent to a large tidal marsh that is connected to Sandy Hook Bay. Sites 6 and 17 received a variety of waste materials, including construction debris, paint cans, and solvents. The surface of Site 6 is currently paved or covered with buildings, including athletic courts, an inactive sewage settling tank, and Building R-15. Other portions of Site 6 are covered with turfgrass. Site 17 is located approximately 500

TABLE 9-27
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident Child	Future Resident Adult	Future Recreational Child
Surface Soil	Incidental Ingestion	1.2E-06	N/A	5.4E-06	N/A	7.5E-03	N/A	9.8E-02	N/A	N/A
	Dermal Contact	4.0E-07	N/A	1.3E-06	N/A	2.4E-03	N/A	2.0E-02	N/A	N/A
	Inhalation of Fugitive Dust	6.7E-10	N/A	4.1E-10	N/A	1.0E-06	N/A	1.0E-06	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	2.5E-07	N/A	N/A	N/A	N/A	1.3E-02
	Dermal Contact	N/A	N/A	N/A	1.8E-06	N/A	N/A	N/A	N/A	4.8E-02
Groundwater	Ingestion	N/A	1.0E-04	4.4E-04	N/A	N/A	6.7E-01	4.2E+00@	N/A	N/A
	Dermal Contact	N/A	2.1E-07	5.4E-06	N/A	N/A	1.3E-03	5.3E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	9.5E-07	N/A	N/A	N/A	N/A	2.7E-02
	Dermal Contact	N/A	N/A	N/A	2.9E-07	N/A	N/A	N/A	N/A	7.6E-03
	TOTAL	1.6E-06	1.0E-04	4.5E-04	3.3E-06	9.9E-03	6.7E-01	4.4E+00	-	9.5E-02

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

** = No volatiles were detected in groundwater

*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 9-28
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Dermal Contact	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/R	2.0E-04	N/A	N/A	N/R	2.0E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	1.7E-08	N/A	N/A	N/R	2.2E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	-	2.0E-04	-	-	-	2.0E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendencies calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

feet southwest of Site 6. The majority of the surface of Site 17 is now a paved parking area. A small portion of the middle of the former landfill is covered with dirt and is used as a storage area for small machinery and other materials. The toes of Site 6 and Site 17 extend into the marsh and are slightly higher in elevation than the marsh. Portions of the sites may have been part of the marsh before development at the Waterfront.

A thin strip of trees, predominantly box elder and black locust, is present along most of the northern and western edges of Site 6. Honeysuckle and Japanese bamboo are also present along this area. In addition, a small wooded area, approximately 100 feet wide, protrudes 300 feet into the marsh from the northwestern edge of the former landfill. Forested wetlands are located south and west of Site 17. The forested wetlands are dominated by red maple and sweetgum, with some elderberry and skunk cabbage. The marsh is dominated by a thick monoculture of *Phragmites australis*, also known as common reed. This perennial generally occupies higher marsh elevations and is rarely intermixed (Eleuterius, 1990). It is also commonly found in disturbed wetland areas. For the most part, *Phragmites* provides only fair to marginal habitat. However, the large size of the marsh and the presence of surrounding wooded upland and wetland areas most likely result in extensive use by aquatic, semi-aquatic, and terrestrial receptors. Small fish, wading birds, and small mammals were observed in and around the marsh during 1994 and 1996 site visits by B&R Environmental. No sensitive habitats, other than the wetlands, and no threatened or endangered species are known to occur on or around the marsh.

The marsh has been extensively channelized. The numerous channels provide free flow of water in parts of the marsh, resulting in fluctuating water levels from Sandy Hook Bay tidal influence and inland stream water, although tidal influence near Sites 6 and 17 is usually minimal. Ware Creek and several small tributaries are located in the marsh. Ware Creek is located approximately 1,000 and 1,200 feet northwest of Site 6 and Site 17, respectively. A tributary of Ware Creek that originates on the inland portion of the Waterfront area runs parallel to Site 17, approximately 300 feet to the west. Hence, Site 6 and Site 17 are located in the Ware Creek watershed. Another small drainage depression is located in the forested wetland area southwest of Site 17. Water flow is low and ephemeral in this depression, which originates near RI Site 15 (Site 15 is located 500 feet southeast of Site 17). Due to the topography and the paved and developed nature of Site 17, runoff from the former landfill area enters the marsh and forested wetland. Similar to Site 17, runoff from the former landfill at Site 6 flows toward the marsh. The wooded area along the northern edge of Site 6 contains a large depression that may hold runoff from that portion of the landfill. No seeps are evident on the marsh side of this depression. Also, a small drainageway is located on the western side of the landfill. Water is ephemeral in the drainageway and flows only after periods of moderate or heavy rainfall. The drainageway accepts water from a developed portion of the Waterfront complex to the southeast. It eventually discharges to Ware Creek, which is located about 1,000 feet to the northwest. RI Site 16 is located in the developed area that empties into the drainageway.

Since most of the sites are paved or otherwise developed, inhibiting significant infiltration and leaching of contaminants, runoff from the landfill toes is expected to be the most relevant contaminant migration pathway to the marsh. Most of the landfill toe at Site 6 is vegetated, precluding erosion and significant contaminant migration, but portions of the toe contain some exposed soil and could contribute contaminants to marsh surface water and sediment. The toe of the landfill at Site 17 also contains vegetation, but large portions of bare or only marginally vegetated soil are present. Therefore, erosion and contaminant migration from the landfill toe via runoff from the paved areas was considered possible.

As part of the 1993 SI, four sediment samples at Site 6 were collected in the marsh along the landfill toe (Weston, 1993b). Slightly elevated levels of several metals, including arsenic, chromium, copper, lead, and mercury, were detected in sediment samples. Several organics (mainly PAHs) were also detected at slightly elevated concentrations in sediment samples, and low levels of some pesticides and PCBs were detected. Only low levels of a few contaminants were detected in subsurface soil and groundwater samples collected as part of the SI. Four sediment samples were collected along the landfill toe at Site 17 during the SI. Low levels of several metals and organics, primarily PAHs, were detected in some sediment samples. Subsurface soil and groundwater samples were also collected. Minimal contaminant impacts to those media were observed.

Due to the proximity of Site 6 and Site 17 to the marsh and the potential ecological risks from possible contaminant inputs, surface water and sediment samples were collected as part of 1995 RI sampling activities to confirm the presence of contaminants in the marsh near the landfill toes (B&R Environmental, 1996). At Site 6, two surface water samples were collected in the marsh near the landfill toe (Table 9-29). Originally, surface water samples were to be collected at seeps near the landfill toe, but no seeps were encountered, despite greater than average rainfall over the period prior to sample collection. Four sediment samples were collected along the landfill toe (Table 9-29). Several metals in surface water exceeded ecological screening values (ETs) but the exceedances were generally low; therefore, potential risks from inorganics in Site 6 surface water were determined to be relatively low. In Site 6 sediments, several inorganics exceeded ET values. In particular, lead and zinc exceeded the most conservative ET values available and also less conservative values. A few pesticides and PAHs exceeded the only screening values available, and DDT and analogs and the PAHs benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene exceeded both the most conservative screening values available and less conservative values.

TABLE 9-29

SUMMARY OF WATERFRONT SURFACE WATER AND SEDIMENT SAMPLES
RI AND RI ADDENDUM SAMPLING
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Type	Sample Designation(s)	Sample Location(s)[1]	Rationale for Sample Collection
1995 RI Surface Water and Sediment Samples	06SW/SD01, 06SW/SD02, 06SD03, 06SD04	Along the toe of the Site 6 landfill	Investigate potential contaminant migration from the Site 6 landfill into the marsh near the landfill toe
	17SD01, 17SW/SD02, 17SW/SD03, 17SW/SD04	Along the toe of the Site 17 landfill	Investigate potential contaminant migration from the Site 17 landfill into the marsh near the landfill toe
1995 RI Ware Creek Watershed Surface Water and Sediment Samples	WSSW/SD21	In a Ware Creek tributary where it passes beneath Normandy Road	Investigate potential contaminant migration from the central portion of the Waterfront area into the larger watershed
	WSSW/SD22	In a drainage ditch immediately upgradient of RI Site 15	Investigate potential contaminant migration from the central portion of the Waterfront area into the larger watershed
1996 RI Addendum Surface Water and Sediment Samples	06SD08, 06SD09, 06SD10	Slightly into the marsh in drainage channels that originate near the landfill toe	Investigate the extent of contaminant impacts slightly into the marsh (i.e., contaminant migration from Site 6 landfill past the landfill toe area)
	17SD08, 17SD09, 17SD10	Slightly into the marsh in drainage channels that originate near the landfill toe	Investigate the extent of contaminant impacts slightly into the marsh (i.e., contaminant migration from Site 6 landfill past the landfill toe area)
	06SW/SD05, 06SW/SD06, 06SW/SD07	Deep into the marsh in drainage channels that originate near the landfill toe	Investigate the extent of contaminant impacts deep into the marsh (i.e., contaminant migration from Site 6 landfill)
	17SW/SD05, 17SW/SD06, 17SW/SD07	Deep into the marsh in drainage channels that originate near the landfill toe	Investigate extent of contaminant impacts deep into the marsh (i.e., contaminant migration from Site 17 landfill)
1996 RI Addendum Background Surface Water and Sediment Samples	BGSW/SD05	In a tributary of Ware Creek several hundred feet upgradient of the marsh	Investigate the extent of contaminant migration from inland sources to the marsh and potentially obtain background data for Site 17
	BGSW/SD06	In a tributary of Ware Creek (same as BGSW/SD05) at its point of entry into the marsh	Investigate the extent of contaminant migration from inland sources to the marsh, primarily the highway area, and potentially obtain background data for Site 17
	BGSW/SD07	In the marsh several hundred feet north of the Waterfront complex	Collected to be representative of concentrations of contaminants in the northern portion of the marsh that are unrelated to NWS Earle Waterfront sources (background data for Site 6)

[1] See Figure 9-1

At Site 17, two surface water samples were collected at seeps on the landfill toe as part of 1995 RI sampling activities, and one sample was collected from the wetland adjacent to the western portion of the landfill (Table 9-29). Also, four sediment samples were collected along the landfill toe. Several inorganics in Site 17 surface water exceeded ET values. In particular, aluminum, barium, and lead significantly exceeded ETs. In sediments, several inorganics slightly exceeded ET values, including barium and lead. No ET value was available for aluminum, but the maximum detected concentration significantly exceeded background. Numerous organics exceeded screening values. DDT and analogs and numerous PAH compounds exceeded both the most conservative ET values available and less conservative values.

Groundwater samples were also collected at Site 6 and Site 17 as part of 1995 RI sampling activities. Slightly elevated levels of some metals were detected in a few groundwater samples at each site but were not detected at concentrations high enough to indicate significant potential risks via discharge to the marsh. This concurs with SI groundwater sampling from 1993 (Weston, 1993b) that detected some metals in groundwater at both sites but concluded that only minimal impacts to groundwater had occurred. Previous investigations, as previously discussed, suggested that significant potential risks from Site 6 and Site 17 contaminants in surface water and sediments were possible to aquatic and semi-aquatic receptors that inhabit the marsh and that overland runoff/erosion is the primarily migration pathway. Also, concentrations of PAHs in 1995 RI sediment samples were generally higher than in 1993 SI samples, suggesting possible active migration. However, the nature and extent of contamination in the marsh had not been fully defined. The 1996 RI report concluded that potential ecological risks to marsh-related receptors may not be significant if migration of contaminants is minimal and contaminants are confined to the areas directly adjacent to the landfill.

Additional surface water and sediment sampling was therefore proposed in the marsh near Sites 6 and 17 to more fully assess the zone of contaminant influence from the sites and related potential ecological risks. Sampling sites were selected during a field visit on October 1, 1996. Representatives from B&R Environmental, the Navy, NOAA, and Region II EPA were present. Three surface water and sediment sampling locations at Site 6 were selected at points slightly into the marsh (away from the landfill toe) where the hydrology indicated contaminant migration into the marsh may potentially occur (samples 06SW/SD08, 06SW/SD09, and 06SW/SD10; Table 9-29; Figure 9-1). Three additional surface water and sediment sampling locations were chosen farther into the marsh (a few hundred feet from the landfill) at points where further contaminant migration from the landfill could potentially occur (06SW/SD05, 06SW/SD06, and 06SW/SD07; Table 9-29). These included drainage depressions and channels in the marsh in the general vicinity of the landfill. The same approach was taken during selection of sampling locations for Site 17. Samples 17SW/SD08, 17SW/SD09, and 17SW/SD10 were collected close to the marsh, and samples 17SW/SD05, 17SW/SD06, and 17SW/SD07 were collected farther out into the marsh (Table 9-29; Figure 9-1). This sampling regime was intended to result in six surface water/sediment samples per site. This approach was taken to ascertain whether elevated levels of contaminants detected in samples at the landfill toes were localized near the landfill. Despite relatively wet conditions during sampling, surface water samples at the three sampling locations closest to each site could not be collected, resulting in the collection of three surface water samples per site. All samples were analyzed for full TCL/TAL analytes. However, due to operator error, SVOCs were not analyzed for in sediment samples 17SD09 and 17SD10.

Several other contaminant sources exist adjacent to the marsh. These include developments at the Waterfront area and roadways, as well as off-site residential areas, a non-Navy landfill, and other developed areas on the western side of the marsh. In order to ascertain whether contaminants are being introduced into the marsh area near the landfills from other sources, three surface water and sediment sampling locations were selected in the Ware Creek watershed where contaminant inputs from Site 6 and 17 are unlikely (Table 9-29). One surface water/sediment sample was collected from a tributary of Ware Creek upstream of the marsh to determine if contaminants are entering the marsh from inland sources unrelated to the Waterfront (BGSW/SD05; Figure 9-1). Another sample was collected in the same Ware Creek tributary at the point of entry into the marsh (BGSW/SD06). This sampling site was selected primarily to determine if the highway area is contributing PAHs and other contaminants to the watershed. Finally, an additional surface water/sediment sample was collected in the marsh several hundred feet north of the Waterfront complex (BGSW/SD07). The site is not connected to the Site 6 and Site 17 areas by open waterways and is not located close to any developments; it was selected to represent potential concentrations of contaminants in the marsh that are completely unrelated to NWS Earle sources.

Data from background sample BGSW/SD07 are presented for comparative purposes on Site 6 screening tables. This sampling location was closest to Site 6 and was located approximately 800 feet into the marsh from the site, so background data from this sample were most appropriate for comparison to the Site 6 samples (Figure 9-1). The average contaminant concentrations in background samples BGSW/SD05 and BGSW/SD06 are presented for comparative purposes on Site 17 screening tables. These sampling locations were closest to Site 17 and are located directly upgradient of the site, so background data from these samples were most appropriate for comparison to Site 17 samples. Surface water and sediment data from individual samples BGSW/SD05 and BGSW/SD06 are presented in Appendix Tables A-d (surface water) and A-g (sediment). Surface water contaminant concentrations were similar for those two samples, as were sediment contaminant concentrations. Average concentrations from the two samples were appropriate for use in Site 6 and Site 17 screening tables. Data from the background surface water and sediment samples are presented and discussed in Section 9.8.3.

No background surface water or sediment samples were collected at the Waterfront as part of 1995 RI sampling activities. Surface water and sediment background data from the Mainside area were used as surrogate background data for the RI Waterfront ERAs (B&R Environmental, 1996). Since background surface water and sediment data were available from the Waterfront area from RI Addendum sampling activities, the RI Mainside background data were not used in this assessment. Two background surface soil samples (BGSB03 and BGSB04) were collected in the Waterfront area as part of 1995 RI sampling activities. Since surface soil was not investigated quantitatively at Sites 6 and 17 as part of this RI Addendum ERA, the 1995 background surface soil data were not used quantitatively in this ERA. Those data, however, are discussed qualitatively in Section 9.8.3. In particular, surface soil data from BGSB04, which was collected near WSSW/SD22 (mentioned below), are discussed.

Two surface water and sediment samples that were collected as part of the 1996 RI Ware Creek watershed sampling program (WSSW/SD21 and WSSW/SD22; Table 9-29; Figure 11-1) are discussed in Section 9.8.2. Sample WSSW/SD21 was collected in a Ware Creek tributary where it passes beneath Normandy Road (approximately 1,000 feet upgradient of BGSW/SD05) and sample WSSW/SD22 was collected in a drainage ditch immediately southeast (upgradient) of Site 15. These samples were collected to investigate potential contaminant inputs from the central section of the Waterfront area into the larger watershed (primarily the marsh). Surface water and sediment data from these samples are presented in Tables 30-4a and 30-2a of the 1996 RI report, respectively, and are discussed in Section 9.8.3.

9.8.2 Sites 6 and 17 - Results

The results of Sites 6 and 17 surface water and sediment screening are presented below.

9.8.2.1 Surface Water

The maximum detected concentrations of the inorganics aluminum, barium, cobalt, copper, iron, lead, manganese, selenium, silver, thallium, and vanadium exceeded surface water ETs at Site 6 (Table 9-30). The average concentrations of aluminum, barium, cobalt, copper, iron, lead, manganese, silver, and thallium exceeded surface water ETs at Site 6 (Table 9-31). No organics were detected in Site 6 surface water samples (Table 9-30). The maximum detected concentrations of aluminum, barium, iron, and manganese exceeded surface water ETs at Site 17 (Table 9-32). The average concentrations of those four metals in Site 17 surface water also exceeded ET values (Table 9-33). Only one organic, bis(2-ethylhexyl) phthalate, was detected in Site 17 surface water, but its maximum concentration did not exceed its ET (Table 9-32).

TABLE 9-30
SELECTION OF SURFACE WATER CONTAMINANTS OF CONCERN - SITE 6
MAXIMUM CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Surface Water Threshold[2]	N.J. Water Quality Standard	Hazard Quotient	Retained as COC?
Inorganics (µg/L)								
Aluminum	3/3	213-15100	1540	15100	87	NA	173.6	Yes
Antimony	1/3	3.3	ND	3.3	160	NA	0.0	No
Arsenic	2/3	7.1-42.4	9	42.4	190	190	0.2	No
Barium	3/3	30.1-65	21.6	65	3.9	NA	16.7	Yes
Beryllium	3/3	0.45-2.4	1.2	2.4	5.1	NA	0.5	No
Cobalt	3/3	0.79-6.6	1.8	6.6	3	NA	2.2	Yes
Copper	3/3	6.6-102	17.8	102	37.11	11	2.7	Yes
Iron	3/3	2060-3.5E+5	23,100	349,000	1000	NA	349.0	Yes
Lead	3/3	1.2-506	16	506	14.7	2.5	34.4	Yes
Manganese	3/3	170-257	36.9	257	80	NA	3.2	Yes
Mercury	1/3	0.29	ND	0.29	1.3	NA	0.2	No
Nickel	3/3	1.8-27.2	4.6	27.2	507.9	160	0.0	No
Selenium	1/3	8.5	9.2	8.5	5	5	1.7	Yes
Silver	1/3	0.74	ND	0.74	0.012	NA	61.7	Yes
Thallium	3/3	7.7-10.7	4.1	10.7	4	NA	2.7	Yes
Vanadium	3/3	0.92-40.5	9	40.5	19	NA	2.1	Yes

1 Sample BGSW07

2 See Table 2-24

ND = Not detected

NA = No value available

TABLE 9-31
SELECTION OF SURFACE WATER CONTAMINANTS OF CONCERN - SITE 6
AVERAGE CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Surface Water Threshold[2]	N.J. Water Quality Standard	Hazard Quotient	Retained as COC?
Inorganics (µg/L)								
Aluminum	3/3	213-15100	1540	5249	87	NA	60.3	Yes
Antimony	1/3	3.3	ND	1.67	160	NA	0.0	No
Arsenic	2/3	7.1-42.4	9	17.03	190	190	0.0	No
Barium	3/3	30.1-65	21.6	41.9	3.9	NA	10.7	Yes
Beryllium	3/3	0.45-2.4	1.2	1.28	5.1	NA	0.3	No
Cobalt	3/3	0.79-6.6	1.8	3.13	3	NA	1.0	Yes
Copper	3/3	6.6-102	17.8	38.13	37.11	11	1.0	Yes
Iron	3/3	2060-3.5E+5	23,100	118,156	1000	NA	118.2	Yes
Lead	3/3	1.2-506	16	170	14.7	2.5	11.6	Yes
Manganese	3/3	170-257	36.9	211	80	NA	2.6	Yes
Mercury	1/3	0.29	ND	0.16	1.3	NA	0.1	No
Nickel	3/3	1.8-27.2	4.6	34.7	507.9	160	0.0	No
Selenium	1/3	8.5	9.2	4.03	5	5	0.8	No
Silver	1/3	0.74	ND	0.413	0.012	NA	34.4	Yes
Thallium	3/3	7.7-10.7	4.1	9.57	4	NA	2.4	Yes
Vanadium	3/3	0.92-40.5	9	15.1	19	NA	0.8	No

1 Sample BGSW07

2 See Table 2-24

ND = Not detected

NA = No value available

TABLE 9-32
SELECTION OF SURFACE WATER CONTAMINANTS OF CONCERN - SITE 17
MAXIMUM CONTAMINANT CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Surface Water Threshold[2]	N.J. Water Quality Standard	Hazard Quotient	Retained as COC?
Inorganics (µg/L)								
Aluminum	3/3	124-251	57.3	251	87	NA	2.9	Yes
Barium	3/3	17.2-37.9	31.5	37.9	3.9	NA	9.7	Yes
Cobalt	3/3	0.67-2.5	1.85	2.5	3.01	NA	0.8	No
Copper	3/3	3.5-7.3	3.45	7.3	25.8	11	0.3	No
Iron	3/3	2480-4370	2035	4370	1000	NA	4.4	Yes
Lead	2/3	1.6-2	ND	2	8.5	2.5	0.2	No
Manganese	3/3	81.2-272	195	272	80	NA	3.4	Yes
Nickel	3/3	3.3-8.1	6.6	8.1	353.9	160	0.0	No
Selenium	1/3	4.6	ND	4.6	5	5	0.9	No
Thallium	1/3	3.7	ND	3.7	4	NA	0.9	No
Vanadium	2/3	1.1-1.6	0.3	1.6	19	NA	0.0	No
Zinc	3/3	19.8-29.7	13.75	29.7	235.6	100	0.1	No
Organics (µg/L)								
Bis(2-ethylhexyl)phthalate	1/3	1	ND	1	32	NA	0.0	No

1 Average of samples BGSW05 and BGSW06

2 See Table 2-25

ND = Not detected

NA = No value available

TABLE 9-33

SELECTION OF SURFACE WATER CONTAMINANTS OF CONCERN - SITE 17
AVERAGE CONTAMINANT CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Surface Water Threshold[2]	N.J. Water Quality Standard	Hazard Quotient	Retained as COC?
Inorganics (µg/L)								
Aluminum	3/3	124-251	57.3	206.7	87	NA	2.4	Yes
Barium	3/3	17.2-37.9	31.5	28.6	3.9	NA	7.3	Yes
Cobalt	3/3	0.67-2.5	1.85	1.86	3.01	NA	0.6	No
Copper	3/3	3.5-7.3	3.45	5.9	25.8	11	0.2	No
Iron	3/3	2480-4370	2035	3706.7	1000	NA	3.7	Yes
Lead	2/3	1.6-2	ND	1.33	8.5	2.5	0.2	No
Manganese	3/3	81.2-272	195	194.7	80	NA	2.4	Yes
Nickel	3/3	3.3-8.1	6.6	6.13	353.9	160	0.0	No
Selenium	1/3	4.6	ND	2.7	5	5	0.5	No
Thallium	1/3	3.7	ND	2.27	4	NA	0.6	No
Vanadium	2/3	1.1-1.6	0.3	0.95	19	NA	0.0	No
Zinc	3/3	19.8-29.7	13.75	23.43	235.6	100	0.0	No
Organics (µg/L)								
Bis(2-ethylhexyl)phthalate	1/3	1	ND	3.67	32	NA	0.1	No

1 Average of samples BGSW05 and BGSW06
2 See Table 2-25
ND = Not detected
NA = No value available

9.8.2.2 Sediment

The maximum detected concentration of arsenic in Site 6 sediments exceeded its ET value (Table 9-34). No suitable sediment ETs were available for the inorganics aluminum, beryllium, cobalt, thallium, and vanadium. No inorganics in Site 6 sediments exceeded ET values using average concentrations (Table 9-35). The maximum detected concentrations of the organics anthracene, benzo(a)pyrene, benz(a)anthracene, and pyrene (all PAHs) exceeded sediment ETs in Site 6 sediments (Table 9-34). The average concentrations of the organics anthracene, benzo(a)pyrene, and benz(a)anthracene (all PAHs) exceeded ETs (Table 9-35).

The maximum detected concentrations of the inorganics arsenic, barium, copper, lead, mercury, nickel, and zinc in Site 17 sediments exceeded ET values (Table 9-36). No suitable sediment ETs were available for the inorganics aluminum, beryllium, cobalt, selenium, and vanadium. The average concentrations of the inorganics arsenic, barium, copper, lead, and nickel in Site 17 sediments exceeded ETs (Table 9-37). No organics in Site 17 sediments had maximum detected concentrations in excess of ET values (Table 9-36). The average concentration of the organic benz(a)anthracene exceeded its ET in Site 17 sediments (Table 9-37).

9.8.3 Sites 6 and 17 - Discussion

Sites 6 and 17 surface water and sediment data, bioaccumulatable and biomagnifiable contaminants in the Ware Creek watershed, RI Addendum background sampling data, and RI Ware Creek watershed sampling data are discussed below.

9.8.3.1 Sites 6 and 17 Surface Water and Sediment

Of the inorganics detected in Site 6 surface waters, aluminum, barium, iron, lead, and silver had significantly elevated HQ values based on their maximum detected concentrations (Table 9-30). Cobalt, copper, manganese, selenium, thallium, and vanadium also had maximum concentrations in excess of ET values, but their HQ values were relatively low. Using the average contaminant concentrations, HQ values for aluminum, barium, iron, lead, and silver were still elevated, and cobalt, copper, manganese, and thallium only slightly exceeded thresholds (Table 9-31). No organics were detected. Of the COCs with elevated HQ values, silver was detected in only one sample at a level less than 1 ppb, and the remainder of these COCs were detected in all three samples. All the maximum values for these samples were detected in sample 06SW06, with the exception of the maximum for manganese, a common, essential nutrient (sample 06SW05).

TABLE 9-34
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 6
MAXIMUM CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Sediment Threshold[2]	Effects Range-Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Inorganics (mg/kg)									
Aluminum	6/6	2050-14,500	2390	14,500	NA	NA	NA		Yes
Antimony	1/6	0.51	ND	0.51	12	NA	NA	0.0	No
Arsenic	6/6	1.9-22.5	9.9	22.5	8.2	8.2	70	2.7	Yes
Barium	6/6	5-14.6	3.2	14.6	20	NA	NA	0.7	No
Beryllium	6/6	0.11-1.2	0.34	1.2	NA	NA	NA		Yes
Chromium	3/6	14.4-42.6	25.3	42.6	81	81	370	0.5	No
Cobalt	6/6	0.33-1.8	0.51	1.8	NA	NA	NA		Yes
Copper	6/6	0.75-7.5	1	7.5	34	34	270	0.2	No
Lead	6/6	3.8-25.1	4.4	25.1	46.7	46.7	218	0.5	No
Manganese	6/6	4.1-32.3	3.9	32.3	460	NA	NA	0.0	No
Nickel	6/6	0.93-5.1	1.6	5.1	20.9	20.9	51.6	0.2	No
Silver	2/6	0.12-0.26	ND	0.26	1	1	3.7	0.3	No
Thallium	1/6	0.92	ND	0.92	NA	NA	NA		Yes
Vanadium	6/6	3.9-104	29.7	104	NA	NA	NA		Yes
Zinc	6/6	4.5-26.2	12.5	26.2	150	150	410	0.2	No
Organics (µg/kg)									
Acenapthylene	1/6	56	ND	56	4722	44	640	0.0	No
Anthracene	1/6	69	ND	69	43	85.3	1100	1.6	Yes
Benzo(a)pyrene	2/6	100-280	ND	280	217	430	1600	1.3	Yes
Benzo(a)anthracene	1/6	280	ND	280	181	261	1600	1.5	Yes
Benzo(b)fluoranthene	1/6	370	ND	370	665	NA	NA	0.6	No
Benzo(k)fluoranthene	1/6	150	ND	150	665	NA	NA	0.2	No
Benzo(g,h,i)perylene	1/6	150	ND	150	665	NA	NA	0.2	No
Bis(2-ethylhexyl)phthalate	1/6	96	ND	96	1.00E+06	NA	NA	0.0	No
Butylbenzylphthalate	1/6	300	ND	300	11000	NA	NA	0.0	No
Chrysene	1/6	350	ND	350	384	384	2800	0.9	No
Flourene	1/6	65	ND	65	1027	19	540	0.0	No
Fluoranthene	1/6	780	ND	780	28806	600	5100	0.0	No

TABLE 9-34
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 6
MAXIMUM CONCENTRATION
NWS EARLE, COLTS NECK, NEW JERSEY
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Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Sediment Threshold[2]	Effects Range-Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Chrysene	1/6	350	ND	350	384	384	2800	0.9	No
Flourene	1/6	65	ND	65	1027	19	540	0.0	No
Fluoranthene	1/6	780	ND	780	28806	600	5100	0.0	No
Indeno(1,2,3-cd)pyrene	1/6	150	ND	150	665	NA	NA	0.2	No
Phenanthrene	1/6	340	ND	340	3127	240	1500	0.1	No
Pyrene	1/6	760	ND	760	665	665	2600	1.1	Yes
4,4'-DDD	1/6	15	ND	15	241	NA	NA	0.0	No
4,4'-DDE	1/6	3.6	ND	3.6	1177	2.2	27	0.0	No
Alpha-Chlordane	1/6	9.8	ND	9.8	7628	NA	NA	0.0	No
Gamma-Chlordane	1/6	8.1	ND	8.1	4851	NA	NA	0.0	No

1 Sample BGSD07
2 See Table 2-27
NA = No value available

TABLE 9-35
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 6
AVERAGE CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Sediment Threshold[2]	Effects-Range Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Inorganics (mg/kg)									
Aluminum	6/6	2050-14,500	2390	5,548	NA	NA	NA		Yes
Antimony	1/6	0.51	ND	0.29	12	NA	NA	0.0	No
Arsenic	6/6	1.9-22.5	9.9	7.58	8.2	8.2	70	0.9	No
Barium	6/6	5-14.6	3.2	11.12	20	NA	NA	0.6	No
Beryllium	6/6	0.11-1.2	0.34	0.38	NA	NA	NA		Yes
Chromium	3/6	14.4-42.6	25.3	15.3	81	81	370	0.2	No
Cobalt	6/6	0.33-1.8	0.51	0.9	NA	NA	NA		Yes
Copper	6/6	0.75-7.5	1	4.24	34	34	270	0.1	No
Lead	6/6	3.8-25.1	4.4	11.2	46.7	46.7	218	0.2	No
Manganese	6/6	4.1-32.3	3.9	14	460	NA	NA	0.0	No
Nickel	6/6	0.93-5.1	1.6	2.51	20.9	20.9	51.6	0.1	No
Silver	2/6	0.12-0.26	ND	0.21	1	1	3.7	0.2	No
Thallium	1/6	0.92	ND	0.53	NA	NA	NA		Yes
Vanadium	6/6	3.9-104	29.7	29.8	NA	NA	NA		Yes
Zinc	6/6	4.5-26.2	12.5	15.5	150	150	410	0.1	No
Organics (µg/kg)									
Acenapthylene	1/6	56	ND	209	4722	44	640	0.0	No
Anthracene	1/6	69	ND	212	43	85.3	1100	4.9	Yes
Benzo(a)pyrene	2/6	100-280	ND	228	217	430	1600	1.1	Yes
Benzo(a)anthracene	1/6	280	ND	247	181	261	1600	1.4	Yes
Benzo(b)fluoranthene	1/6	370	ND	262	665	NA	NA	0.4	No
Benzo(k)fluoranthene	1/6	150	ND	225	665	NA	NA	0.3	No
Benzo(g,h,i)perylene	1/6	150	ND	225	665	NA	NA	0.3	No
Bis(2-ethylhexyl)phthalate	1/6	96	ND	216	1.00E+06	NA	NA	0.0	No
Butylbenzylphthalate	1/6	300	ND	241	11000	NA	NA	0.0	No
Chrysene	1/6	350	ND	258	384	384	2800	0.7	No
Flourene	1/6	65	ND	211	1027	19	540	0.2	No
Fluoranthene	1/6	780	ND	330	28806	600	5100	0.0	No

TABLE 9-35
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 6
AVERAGE CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY
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Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Sediment Threshold[2]	Effects-Range Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Flourene	1/6	65	ND	211	1027	19	540	0.2	No
Fluoranthene	1/6	780	ND	330	28806	600	5100	0.0	No
Indeno(1,2,3-cd)pyrene	1/6	150	ND	225	665	NA	NA	0.3	No
Phenanthrene	1/6	340	ND	257	3127	240	1500	0.0	No
Pyrene	1/6	760	ND	327	665	665	2600	0.5	No
4,4'-DDD	1/6	15	ND	4.5	241	NA	NA	0.0	No
4,4'-DDE	1/6	3.6	ND	2.6	1177	2.2	27	0.0	No
Alpha-Chlordane	1/6	9.8	ND	2.7	7628	NA	NA	0.0	No
Gamma-Chlordane	1/6	8.1	ND	2.4	4851	NA	NA	0.0	No

1 Sample BGSD07
2 See Table 2-27
NA = No value available

TABLE 9-36

SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 17
MAXIMUM CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Sediment Threshold[2]	Effects Range-Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Inorganics (mg/kg)									
Aluminum	6/6	2660-15800	2875	15800	NA	NA	NA		Yes
Antimony	1/6	2.3	ND	2.3	12	NA	NA	0.2	No
Arsenic	6/6	6.9-41.9	7.45	41.9	8.2	8.2	70	5.1	Yes
Barium	6/6	5.8-50.4	12.9	50.4	20	NA	NA	2.5	Yes
Beryllium	6/6	0.33-1.9	0.41	1.9	NA	NA	NA		Yes
Cadmium	4/6	0.28-0.66	0.45	0.66	1.2	1.2	9.6	0.6	No
Chromium	5/6	11.9-69	15.7	69	81	81	370	0.9	No
Cobalt	6/6	1.1-21.1	1.55	21.1	NA	NA	NA		Yes
Copper	6/6	3.4-83.2	3.75	83.2	34	34	270	2.4	Yes
Lead	6/6	8.7-236	6.45	236	46.7	46.7	218	5.1	Yes
Manganese	6/6	12.8-218	42.1	218	460	NA	NA	0.5	No
Mercury	1/6	0.31	ND	0.31	0.15	0.15	0.71	2.1	Yes
Nickel	6/6	2.7-29.3	3.6	29.3	20.9	20.9	51.6	1.4	Yes
Selenium	1/6	5	ND	5	NA	NA	NA		Yes
Silver	3/6	0.13-0.17	0.19	0.17	1	1	3.7	0.2	No
Vanadium	6/6	16.2-96.2	16.6	96.2	NA	NA	NA		Yes
Zinc	6/6	14.9-188	27.6	188	150	150	410	1.3	Yes
Organics (µg/kg)									
Benzo(a)pyrene	2/4	43-140	166.3	140	414	430	1600	0.3	No
Benzo(a)anthracene	1/4	120	153.8	120	346	261	1600	0.3	No
Benzo(b)fluoranthene	4/4	64-240	196.3	240	665	NA	NA	0.4	No
Benzo(k)fluoranthene	1/4	92	142.8	92	665	NA	NA	0.1	No
Benzo(g,h,i)perylene	1/4	66	136.8	66	665	NA	NA	0.0	No
Bis(2-ethylhexyl)phthalate	1/4	54	ND	54	2.03E+06	NA	NA	0.0	No
Chrysene	4/4	50-180	176.3	180	384	384	2800	0.5	No
Fluoranthene	4/4	93-400	231.3	400	55000	600	5100	0.0	No

TABLE 9-36
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 17
MAXIMUM CONCENTRATIONS
PAGE 2 OF 2

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Maximum Concentration	Representative Sediment Threshold[2]	Effects Range-Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Indeno(1,2-cd)pyrene	1/4	68	138.8	68	665	NA	NA	0.1	No
Phenanthrene	2/4	63-200	166.3	200	5970	240	1500	0.0	No
Pyrene	4/4	75-360	211.3	360	665	665	2600	0.5	No
4,4'-DDT	1/6	39	ND	39	2459	1.5	46.1	0.0	No
4,4'-DDD	2/6	23-42	ND	42	461	NA	NA	0.0	No
4,4'-DDE	3/6	4.8-110	ND	110	2246	2.2	27	0.0	No
Aroclor 1248	1/6	57	ND	57	180	22.7	180	0.3	No
Aroclor 1254	1/6	120	ND	120	677	22.7	180	0.2	No
Alpha-Chlordane	1/6	14	ND	14	14563	NA	NA	0.0	No
Endrin	1/6	10	ND	10	309	NA	NA	0.0	No
Gamma-Chlordane	1/6	10	ND	10	2179	NA	NA	0.0	No

1 Average of samples BGSD05 and BGSD06
2 See Table 2-28
ND = Not detected
NA = No value available

TABLE 9-37

SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 17
AVERAGE CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Sediment Threshold[2]	Effects-Range Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Inorganics (mg/kg)									
Aluminum	6/6	2660-15800	2875	6948	NA	NA	NA		Yes
Antimony	1/6	2.3	ND	0.59	12	NA	NA	0.1	No
Arsenic	6/6	6.9-41.9	7.45	15.3	8.2	8.2	70	1.9	Yes
Barium	6/6	5.8-50.4	12.9	25.7	20	NA	NA	1.3	Yes
Beryllium	6/6	0.33-1.9	0.41	0.77	NA	NA	NA		Yes
Cadmium	4/6	0.28-0.66	0.45	0.29	1.2	1.2	9.6	0.2	No
Chromium	5/6	11.9-69	15.7	31	81	81	370	0.4	No
Cobalt	6/6	1.1-21.1	1.55	5	NA	NA	NA		Yes
Copper	6/6	3.4-83.2	3.75	38.9	34	34	270	1.1	Yes
Lead	6/6	8.7-236	6.45	53.6	46.7	46.7	218	1.1	Yes
Manganese	6/6	12.8-218	42.1	57.4	460	NA	NA	0.1	No
Mercury	1/6	0.31	ND	0.14	0.15	0.15	0.71	0.9	No
Nickel	6/6	2.7-29.3	3.6	8.03	20.9	20.9	51.6	1.4	Yes
Selenium	1/6	5	ND	1.25	NA	NA	NA		Yes
Silver	3/6	0.13-0.17	0.19	0.16	1	1	3.7	0.2	No
Vanadium	6/6	16.2-96.2	16.6	45.1	NA	NA	NA		Yes
Zinc	6/6	14.9-188	27.6	59.5	150	150	410	0.4	No
Organics (µg/kg)									
Benzo(a)pyrene	2/4	43-140	166.3	320	414	430	1600	0.8	No
Benzo(a)anthracene	1/4	120	153.8	364	346	261	1600	1.1	Yes
Benzo(b)fluoranthene	4/4	64-240	196.3	146	665	NA	NA	0.2	No
Benzo(k)fluoranthene	1/4	92	142.8	92	665	NA	NA	0.1	No
Benzo(g,h,i)perylene	1/4	66	136.8	66	665	NA	NA	0.0	No
Bis(2-ethylhexyl)phthalate	1/4	54	ND	54	2.03E+06	NA	NA	0.0	No
Chrysene	4/4	50-180	176.3	122	384	384	2800	0.4	No
Fluoranthene	4/4	93-400	231.3	228	55000	600	5100	0.0	No

TABLE 9-37
SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN - SITE 17
AVERAGE CONCENTRATIONS
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Contaminant of Concern	Frequency of Detection	Range of Detections	Background Concentration[1]	Average Concentration	Representative Sediment Threshold[2]	Effects-Range Low	Effects Range-Median	Hazard Quotient	Retained as COC?
Indeno(1,2-cd)pyrene	1/4	68	138.8	68	665	NA	NA	0.1	No
Phenanthrene	2/4	63-200	166.3	151	5970	240	1500	0.0	No
Pyrene	4/4	75-360	211.3	199	665	665	2600	0.3	No
4,4'-DDT	1/6	39	ND	8.46	2459	1.5	46.1	0.0	No
4,4'-DDD	2/6	23-42	ND	12.4	461	NA	NA	0.0	No
4,4'-DDE	3/6	4.8-110	ND	21.6	2246	2.2	27	0.0	No
Aroclor 1248	1/6	57	ND	40.1	180	22.7	180	0.2	No
Aroclor 1254	1/6	120	ND	50.6	677	22.7	180	0.1	No
Alpha-Chlordane	1/6	14	ND	3.9	14563	NA	NA	0.0	No
Endrin	1/6	10	ND	4.7	309	NA	NA	0.0	No
Gamma-Chlordane	1/6	10	ND	3.26	2179	NA	NA	0.0	No

[1] Average of samples BGSD05 and BGSD06

[2] See Table 2-28

ND = Not detected

NA = No value available

Maximum detected concentrations of aluminum, iron, and lead were all two orders of magnitude higher in 06SW06 than the concentrations detected in the other two Site 6 surface water samples (06SW05 and 06SW07). In addition, the concentrations of these three inorganics and of barium in the other two samples were comparable to background concentrations from sample BGSW07 (Table 9-30).

The concentrations of aluminum, barium, and iron in 1995 RI groundwater samples were all comparable to background. Lead and silver were not detected in groundwater. Aluminum, barium, iron, lead, and manganese in Site 6 surface waters (samples that were collected close to the landfill) were not found to pose significant potential risks to ecological receptors in the 1996 RI ecological risk assessment. Of these inorganics, only lead was found to pose potential significant risk in sediments in the 1996 RI ecological risk assessment. As with surface water, those samples were collected close to the landfill.

Of the inorganics detected in Site 6 sediments, only the maximum detected concentration of arsenic exceeded its threshold value (HQ = 2.7), and no inorganics exceeded ETs using average detected concentrations (Tables 9-34 and 9-35). No suitable sediment ETs were available for aluminum, berylllium, cobalt, thallium, and vanadium. Of these, thallium was detected only in one of six samples and was less than 1 mg/kg, and the average concentrations of beryllium and cobalt were comparable to background concentrations from sample BGSD07. The maximum detected concentrations of aluminum and vanadium were significantly higher than the concentrations in the other five samples and were detected in sample 06SD07. Although iron was not included in the sediment assessment, due to its general lack of sediment toxicity and high naturally occurring concentrations, the concentration of iron in sediment sample 06SD07 was also the highest detected among all samples. The concentrations of aluminum and vanadium in sediment sample 06SD10, which was collected in the same area of the marsh as sample 06SD07 but closer to Site 6, were significantly lower and fairly comparable to background. Also, the surface water concentrations of aluminum and vanadium in sample 06SW07 were not elevated. Note that aluminum is one of the most common metals in the earth's crust (Goyer, 1986) and that vanadium is not generally considered to be toxic in the environment (Mailman, 1980).

As previously mentioned, aluminum, barium, iron, lead, and silver were all significantly elevated in surface water sample 06SW06. However, these metals were either not detected, were comparable to background, did not exceed screening values, or a combination of these factors in the sediment sample collected at the same location (06SD06). This was also true for the concentrations of these contaminants in sediment sample 06SD09, which was collected in the same drainageway in the marsh as 06SD06, but closer to Site 6. As discussed earlier, data from the 1993 SI and 1996 RI indicate that groundwater was minimally impacted by Site 6 contaminants (i.e., groundwater-to-surface water migration of contaminants is minimal), resulting in erosion/runoff as the only potential pathway. If erosion/runoff from the Site 6 landfill toe were occurring, concentrations of aluminum, beryllium, iron, lead, and silver would probably be elevated in the samples collected closer to the landfill. Concentrations of these contaminants were not elevated in surface water or sediment samples collected closer to the landfill. Since water flow in the portion of the marsh near Site 6 is low and ephemeral, it is also unlikely that sample 06SD07 was impacted by Site 6 contaminants.

Of the organics detected in Site 6 sediments, only the maximum detected concentrations of anthracene, benzo(a)pyrene, benz(a)anthracene, and pyrene exceeded site-specific thresholds. HQ values were all low (Table 9-34). PAHs in Site 6 sediments did not exceed or were comparable to ER-Ls, which are considered to be conservative sediment thresholds. Also, these compounds were detected only in one sample, except benzo(a)pyrene, which was detected in two samples. HQ values using average concentrations were comparable to the maximum scenario, mainly because one-half the detection limit was used for non-detects. Concentrations of PAHs in 1995 samples collected close to the landfill were higher than in 1996 RI samples, suggesting minimal migration and related impacts from these contaminants deeper into the marsh.

Of the inorganics detected in Site 17 surface water, the maximum detected concentrations of aluminum, barium, iron, and manganese all exceeded ET values (Table 9-33). HQ values, however, were relatively low, with the exception of barium (HQ = 9.7). Using average concentrations, aluminum, barium, iron, and manganese still exceeded ETs but the HQ values were lower; the HQ for barium was slightly elevated (HQ = 7.3; Table 9-33), yet the background value for barium was higher than the average concentration in Site 17 surface water. Background values near most Superfund sites are commonly comparable to or higher than the threshold for barium, which is a Tier II EPA value (EPA, 1996b). As a result, the threshold value for this metal appears to be overly conservative and largely accounts for the elevated HQ. Aluminum, iron, and manganese are common elements, and iron and manganese are essential nutrients. These three metals are high throughout the base, probably due to high naturally occurring concentrations. Only one organic, bis(2-ethylhexyl) phthalate, was detected in surface water, but it was not a COC.

In Site 17 sediments, the inorganics arsenic, barium, copper, lead, mercury, nickel, and zinc exceeded ET values using maximum detected concentrations (Table 9-36), but HQ values were all relatively low (5.1 or less). The maximum concentrations of copper, lead, mercury, nickel, and zinc were the only detections of those metals that exceeded ER-L values (Table 9-36), and all detections of arsenic other than the maximum were comparable to the ER-L for that metal. No ER-L value is available for barium. The maximum detected concentration of lead was the only detection of any metal to exceed an ER-M value. Using average concentrations, arsenic, barium, copper, lead, and nickel were COCs (Table 9-37), and all HQ values were low (1.9 or less). No suitable ETs were available for aluminum, beryllium, cobalt, selenium, and vanadium. Of these inorganics, selenium was detected in only one sample (5 mg/kg), and the average concentration of beryllium was comparable to the average background concentration from samples BGSD05 and BGSD06 (Table 9-37).

The maximum sediment concentrations for aluminum, cobalt, lead, and vanadium were in sample 17SD07. Most of the detections of these contaminants in the other five samples were comparable to the average background concentrations from samples BGSD05 and BGSD06. More importantly, sample 17SD07 was the sample collected farthest from Site 17 (Figure 9-1). Sediment samples collected in the same general area but closer to Site 17 all had concentrations of aluminum, cobalt, lead, and vanadium less (generally much less) than 17SD07, including 17SD05, 17SD06, and 17SD08 from RI Addendum sampling and 17SD04 from the 1995 RI sampling. In addition, aluminum, cobalt, lead, and vanadium were either not detected or not elevated in groundwater sample 17GW04, which was collected between the landfill and 17SW/SD07. The surface soil sample collected closest to 17SD07 at the landfill toe as part of 1995 RI samples (17SS01) had relatively low concentrations of these four metals (Table 9-3e). The detected soil concentrations in 17SS01 of aluminum (525 mg/kg), cobalt (2.2 mg/kg), lead (7.5 mg/kg), and vanadium (6.0 mg/kg) all fall within the ranges of background soil concentrations found in the eastern United States of 10,000 to 20,000 mg/kg for aluminum, 0.3 to 70 mg/kg for cobalt, 10 to 15 mg/kg for lead, and 20 to 30 mg/kg for vanadium (Shacklette and Boerngen, 1984). The concentrations of those metals in 17SS01 are also all lower than the concentrations in the surface fraction of sample BGSB04 (collected as a 1995 RI Waterfront background sample) of 5,310 mg/kg for aluminum, 5.0 mg/kg for cobalt, 23.3 mg/kg for lead, and 64.0 mg/kg for vanadium. This suggests that the elevated concentrations of those inorganics in sediment sample 17SD07 may be indicative of a "hot spot" of contamination that is unrelated to groundwater or surface soil erosion/runoff from the Site 17 landfill.

Using the maximum and average detected concentrations of organics, only benz(a)anthracene exceeded its threshold, and the HQ only slightly exceeded one (Tables 9-36 and 9-37). Benz(a)anthracene was detected in only one of four sediment samples. This is in contrast to the results of the RI ecological risk assessment in which Site 17 sediment COCs from samples collected adjacent to the landfill were more numerous and HQ values were higher, primarily for PAH compounds. This indicates that Site 17-related impacts on the marsh appear to be minor.

9.8.3.2 Bioaccumulatable and Biomagnifiable Contaminants

The concentrations of bioaccumulatable and biomagnifiable contaminants were low in Site 6 and Site 17 sediments. In general, these contaminants consist of lead, mercury, organochlorine pesticides, and PCBs (although a few other contaminants bioaccumulate to a lesser degree under certain circumstances). All these contaminants and contaminant classes were either not detected or did not exceed screening thresholds in Site 6 sediment samples. In Site 17 sediment samples, all organochlorine pesticides and PCBs analyzed for were either not detected or did not exceed thresholds. Mercury was detected in only one of six sediment samples at Site 17, and the HQ value was low (HQ = 2.1). Lead was detected in all six sediment samples at Site 17, but only the maximum detected concentration exceeded the threshold, and the HQ was also relatively low (HQ = 2.7). No bioaccumulatable organics were detected in surface water from either site. Mercury was detected in one of three surface water samples at Site 6, but it did not exceed its threshold. Mercury was not detected in Site 17 surface water. Lead was detected in three of three surface water samples at Site 6 and two of three samples at Site 17, but the only exceedance was from the maximum detection at Site 6. Therefore, the potential for bioaccumulation or biomagnification of contaminants in the marsh food web by aquatic or semi-aquatic receptors appears to be remote.

9.8.3.3 RI Addendum Waterfront Background Surface Water and Sediment Samples

As mentioned earlier, three background samples (BGSW/SD05, BGSW/SD06, and BGSW/SD07) were collected during RI Addendum sampling activities (Figure 11-1). Samples BGSW/SD05 and BGSW/SD06 were collected in a tributary of Ware Creek upstream of the marsh, to investigate whether contaminants were migrating to the marsh, and into the watershed, from the inland portion of the Waterfront complex. Sample BGSWSD07 was collected several hundred feet north of Site 6 to ascertain whether contaminants were present in the marsh in areas believed to be unimpacted by Waterfront contaminant inputs or other Navy-related areas (i.e., the northeastern portion of the watershed).

Surface water contaminant concentrations in samples BGSW05 and BGSW06 were relatively low (Appendix Table A-d). Many metals analyzed for in those two samples were not detected, and those that were detected generally did not exceed the surface water screening values that were used for screening Site 17 contaminant concentrations (Table 9-33). The exceedances were minor and were for aluminum, barium, iron, and manganese. Aluminum, iron, and manganese are naturally occurring elements and iron and manganese are essential nutrients. These metals are high throughout the base, probably due to natural conditions. Barium in samples BGSW05 and BGSW06 exceeded the threshold used, but as discussed, that threshold appears to be overly conservative. All background samples collected during 1996 RI Addendum and 1995 RI sampling had barium concentrations in excess of its surface water threshold. No organics were detected in the two Site 17 background surface water samples. No inorganic concentrations in background sediment samples BGSD05 and BGSD06 (average of the two; Appendix Table A-g) exceeded the sediment thresholds used for the Site 17 sediment assessment (Table 9-36). Of the sediment inorganics that had no available thresholds (aluminum, beryllium, cobalt, selenium, and vanadium), the average background concentrations were all lower than the site-specific concentrations.

No PAHs were detected in sample BGSD05, and although several PAHs were detected in sample BGSD06, none exceeded Site 17 threshold values (Table 9-36). No pesticides or PCBs were detected in either of these two background sediment samples. As a result, it appears that contaminant inputs to the marsh and Ware Creek watershed from the inland portion of the Waterfront complex are negligible, and the use of samples BGSWSD05 and BGSWSD06 as background samples is appropriate.

Sample BGSWSD07, which was used for background comparisons for Site 6, generally had surface water contaminant concentrations lower than the thresholds that were used for Site 6 screening. The exceedances were for aluminum, barium, iron, lead, and selenium and thallium. Aluminum and iron were elevated throughout the Waterfront, presumably due to naturally occurring conditions, The exceedance for barium, again, is probably due to the overly conservative threshold. Background lead, selenium, and thallium barely exceeded the surface water thresholds (Table 9-30). In addition, the maximum and average concentrations of aluminum, barium, iron, lead, and thallium in Site 6 surface water samples were all higher than the concentrations in sample BGSW07. The maximum detected concentration of selenium was comparable to the BGSW07 concentration. Of the inorganics in sediment sample BGSD07, only the maximum detected concentration of arsenic exceeded a Site 6 sediment threshold, and the exceedance was minuscule (Table 9-34). No inorganics in BGSD07 exceeded the maximum detected Site 6 sediment concentrations and only a few detected concentrations in that sample (arsenic and chromium) exceeded average concentrations in Site 6 sediments. Yet, these exceedances were insignificant (Table 9-35). No PAHs, pesticides, or PCBs were detected in sediment sample BGSD07. Hence, the use of BGSWSD07 as a background sample for Site 6 is appropriate.

9.8.3.4 RI Ware Creek Watershed Surface Water and Sediment Samples

Two surface water and sediment samples (WSSWSD21 and WSSWSD22) were collected in the Ware Creek watershed as part of the 1995 RI watershed sampling program. As discussed earlier, these two samples were collected to investigate contaminant inputs into the Ware Creek watershed. Sample WSSWSD21 was collected several hundred feet upstream of RI Addendum background sample BGSWSD05 (Figure 11-1). Few inorganics were detected in sample WSSWSD21, and only barium, iron, and manganese exceeded Site 17 surface water thresholds (1996 RI report Table 30-4a, and Table 9-33). Again, the threshold for barium is highly conservative and iron is ubiquitous. The concentration of manganese (an essential nutrient) only slightly exceeded the threshold and was less than the maximum and average site-specific concentrations. Mercury was detected in WSSW21 and not in Site 17 surface water, but the concentration was relatively low (0.021 µg/L). The AWQC for total and methyl mercury are 1.3 and 0.003 µg/L, respectively (EPA, 1996b). Mercury was not detected in samples BGSW05 and BGSW06, which were collected downgradient of WSSW21. For the most part, sediment inorganic concentrations in WSSD21 were less than Site 17 sediment threshold concentrations (1996 RI report Table 30-2a and Table 9-36). Arsenic and barium in WSSD21 slightly exceeded Site 17 sediment thresholds. In general, inorganic concentrations in WSSD21 were comparable to BGSD05 concentrations. No PAHs were detected in WSSD21 and only one volatile organic compound, PCE (0.018 mg/kg), was detected. Pesticides/PCBs were not analyzed for in that sample. These data corroborate the absence of contaminant inputs into the Ware Creek watershed from the inland Waterfront complex evidenced by data from samples BGSWSD05 and BGSWSD06.

Sample WSSW/SD22 was collected directly upgradient of RI Site 15 in a small ditch near the Route 36 gate (Figure 11-1). Water flow in the ditch is low and ephemeral, flowing only after periods of heavy rainfall. The ditch originates near this area, and receives drainage from the roadway and parking lots near Site 15; therefore, is not connected hydrologically to the inland portion of the Waterfront. The surface water concentrations of aluminum, barium, cobalt, manganese, selenium, vanadium, and zinc in sample WSSW22 were higher than the Site 17 surface water thresholds. Arsenic, beryllium, cadmium, and 4,4'-DDD were also detected in SWSW22. No apparent Navy-related contaminant sources are located upgradient of this sampling site. The surface water concentrations in samples 15SW01 and 15SW02, collected as part of the 1995 RI sampling activities for RI Site 15, were lower for all of the inorganics detected in WSSW22. These two samples were collected immediately downgradient of WSSW22. Furthermore, the maximum and average concentrations of all inorganics in Site 17 surface water samples were less than the concentrations in WSSW22. Surface water from the Site 15 area eventually drains to the same part of the marsh as the Site 17 surface water.

Sediment concentrations of arsenic, barium, cadmium, mercury, nickel, and silver in sample WSSD22 were higher than the sediment thresholds used for Site 17 (1996 RI report Table 30-2a and Table 9-36), although it should be noted that all the detections were "J" values. Yet, the sediment concentrations of arsenic, cadmium, nickel, and silver in samples 15SD01 and 15SD02, collected immediately downgradient of WSSD22, were lower than the concentrations in WSSD22. The maximum concentrations of barium and mercury in 15SD01 and 15SD02 were slightly higher than in WSSD22. However, the maximum detected concentrations of arsenic, cadmium, nickel, and silver were much lower in Site 17 sediment samples than in WSSD22. The maximum concentrations of barium and mercury were slightly higher in Site 17 sediment samples. Nonetheless, mercury was detected in only one of six Site 17 sediment samples and the average concentration of barium in Site 17 sediments only slightly exceeds the Site 17 threshold. No PAHs were detected in WSSD22 and only low levels of 2-butanone (0.27 mg/kg), 4,4'-DDE (0.026 mg/kg), and alpha-chlordane (0.0024 mg/kg) were detected.

After review of the Site 17 data, it appears that migration of contaminants from sample location WSSW/SD022 and the Site 15 area to the marsh and greater watershed is, at most, limited. The reason for the elevated concentrations of some inorganics in WSSW/SD22 is unclear, but the concentrations in samples collected immediately downgradient (Site 15) are, for the most part, lower. Contaminant concentrations in Site 17 samples are generally much lower, indicating that the elevated WSSW/SD22 concentrations may be localized or may even be a part of Site 15. The 1996 RI ecological risk assessment concluded that potential risks from Site 15 surface water and sediment samples were relatively low. The assessment also concluded that additional sediment samples could be collected downgradient to investigate potential off-site migration to the marsh but questioned the usefulness of these samples. Moreover, a watershed assessment for Ware Creek was conducted using the RI watershed samples that reached the same conclusions mentioned above (Section 30.5.6 of the RI report). The results of the Site 17 samples, which indicate relatively low levels of contaminants deeper into the marsh, appear to validate the conclusions of the 1996 RI Site 15 and Ware Creek watershed assessment.

On the whole, contaminant inputs from Sites 6 and 17 deep into the marsh appear to be minor. Data from Site 6 and 17 surface water and sediment samples show only spotty elevated concentrations of a few contaminants, primarily ubiquitous metals. In particular, aluminum, iron and lead were elevated in one surface water sample at Site 6 (06SW06) and aluminum, iron, and vanadium were elevated in one Site 6 sediment sample (06SD07). Aluminum, cobalt, lead, and vanadium were elevated in one Site 17 sediment sample (17SD07). Some other exceedances of conservative thresholds were observed in Site 6 and 17 surface water and sediments, but the exceedances were minor or subject to other mitigating circumstances. Contaminant inputs from the inland portion of the Waterfront complex appear to be minor, as evidenced by relatively low contaminant concentrations in surface water and sediment samples collected upstream of the marsh. Potential contaminant inputs from the Site 15 area are insignificant as well. Thus, additive inputs into the watershed from Navy-related contaminant sources, and related cumulative potential risks to ecological receptors, are low.

9.8.4 Summary and Conclusions

Sites 6 and 17 are former landfills located in the Waterfront area of NWS Earle. The two sites are located a few hundred feet apart, at the edge of a large marsh that connects to Sandy Hook Bay. The former landfills received a variety of waste materials. The results of the RI ecological risk assessment showed that several inorganics and organics, primarily PAH compounds, were present in surface water and sediment near the sites in excess of screening values. Concentrations of lead, zinc, and several PAHs in sediment collected near the Site 6 landfill toe were significantly elevated. Concentrations of several metals in surface water and several PAHs in sediments collected near the Site 17 landfill toe were significantly elevated. Since data from the 1993 SI and 1996 RI indicated minimal impacts to groundwater, erosion and overland runoff were considered possible from the landfill toes. However, surface water and sediment samples had not been collected farther away from the sites in the marsh. As a result, additional surface water and sediment samples were collected farther into the marsh at each site to determine the extent of the impacts of landfill-related contaminants on the marsh.

In Site 6 surface water and sediments, only a few contaminants that had high frequencies of detection exceeded screening levels. Of these, the most significant exceedances in surface water were for aluminum, iron, lead, and vanadium. The high concentrations were confined to sample 06SW06, which was one of the samples collected farthest from the former landfill. Sediment concentrations at this location were not significantly elevated and sediment contaminant concentrations in sample 06SD09, which was collected in the same area as 06SW06 but closer to the landfill, were also relatively low. In Site 6 sediments, the average concentrations of all metals were below threshold values. Concentrations of some inorganics for which no screening values were available were significantly elevated in sediment sample 06SD07. However, surface water concentrations at that location were not elevated and sediment concentrations in sample 06SD10, which was taken in the same general area as sample 06SD07 but closer to the landfill, were not significantly elevated. Frequencies of detection and HQ values for organics in Site 6 sediments were all low.

In Site 17 surface water, only barium significantly exceeded its threshold value, but the background concentration of this inorganic was higher than the average concentration. HQ values for inorganics in marsh sediments near Site 17 were all low. Sediment concentrations of aluminum, cobalt, and vanadium, which had no suitable ETs, were significantly elevated in sample 17SD07, but surface water concentrations of these metals at the same location were not elevated, and surface water and sediment concentrations of these contaminants in samples collected in the same general area as 17SD07 but closer to the landfill were all much lower. Only one organic in Site 17 sediments exceeded its threshold, and the HQ value was low.

In summary, significantly elevated contaminant concentrations and exceedances of threshold values from the 1995 RI samples and 1996 RI report ecological risk assessment were not prevalant in surface water and sediment samples collected farther into marsh from Sites 6 and 17. Therefore, impacts of contaminants from Site 6 and Site 17 on the marsh are minimal. Elevated concentrations of some inorganics were present but were confined primarily to ubiquitous metals in only a few samples collected relatively far from the landfill. This indicates that these elevated concentrations are most likely only indicative of contaminant "hot spots" and do not stem from landfill-related releases. Additive impacts on the watershed and cumulative effects from contaminants from both sites on marsh receptors are also unlikely. Concentrations of contaminants able to bioaccumulate and biomagnify were also relatively low. Thus, potential risks to organisms from exposure via the foodchain (e.g., wading birds) appear to be highly unlikely. Concentrations of contaminants in surface water and sediments in the two samples collected upstream from the marsh were low and, as a result, impacts to the marsh from upstream sources appear to be negligible.

The data indicate that the assessment endpoint chosen, the maintenance of receptor populations in the marsh, does not appear to be compromised from Sites 6, Site 17, or upstream contaminants; therefore, ecological risks to the marsh from Navy-related areas appear to be insignificant. Remedial action based on ecological risk concerns or additional, more focused ecological studies are therefore unwarranted.

9.8.5 Site-Specific Uncertainties

Significantly elevated concentrations of some metals (aluminum, beryllium, iron, lead, and silver), were present in surface water sample 06SW06. HQ values for these metals were also significantly elevated. However, sediment concentrations of those contaminants at the same sampling location were not elevated and were not elevated in sediment sample 06SD09, which was collected in the same drainageway, but closer to the landfill. Similarly, significantly elevated concentrations of some inorganics (aluminum, cobalt, and vanadium) were detected in sediment sample 17SD07. Yet, this sample was collected farthest from Site 17 and samples (surface water and sediment) collected in the same general area of the marsh but closer to the site did not have elevated concentrations of those metals. Therefore, these areas appear to be "hot spots" that are unrelated to the sites. Although other RI sites are located in the Waterfront (Sites 15 and 16) they were determined to have minimal ecological impacts on the surrounding areas in the RI report. Therefore, although these constituents do not appear to be due to Sites 6 and 17, their presence introduces uncertainty into the assessment. Additionally, the lack of adequate sediment toxicity data for aluminum and vanadium introduces uncertainty into the results for Site 17.

Despite heavier than average rainfall, sampling conditions precluded the collection of surface water samples at the RI Addendum sampling locations closest to the landfills. Although the definitive nature of the remainder of the data set heavily mitigates the lack of surface water data at those sampling locations, uncertainty is introduced into the risk assessment.

Potential risks were often considered to be low in the assessment if HQ values were low, although, theoretically, the potential for risk exists if a threshold is exceeded at all. These conclusions were made since most thresholds are based on data from laboratory studies that do not take into account ameliorating physico-chemical factors in the environment. Although the HQ cannot be interpreted as a probablisitic indicator of risk (i.e., an HQ of 10 cannot be assumed to correlate to 10 times more risk than an HQ of 1), a slight exceedance of a threshold generally indicates less potential risk than a major exceedance of a threshold. It should be noted, however, that contaminants with low HQ values were assessed on an individual basis for their potential for risk. For these reasons, it is unlikely that significant potential risks exist from the contaminants that only slightly exceeded surface water or sediment thresholds. Nonetheless, the conclusions that minor exceedances result in low potential risks introduces uncertainty into the results.

9.9 EVALUATION SUMMARY

Based on the 1995 RI results, low metals concentrations in groundwater exceed regulatory and human health risk assessments guideline cancer and non-cancer risk criteria. Metals in groundwater at levels above regulatory guidelines include arsenic, aluminum, cadmium, iron, magnesium, and sodium. However, the concentration of sodium chloride in the groundwater approaches the level of sea water and the shallow groundwater can not be considered a likely drinking water source. No organic compounds were found in groundwater at concentrations above regulatory guidelines.

The ecological risk assessment concluded that significantly elevated contaminant concentrations and exceedances of threshold values observed in RI surface water and sediment samples obtained near the toe of the landfill were not present in RI Addendum surface water and sediment samples collected farther into the marsh. Therefore, impacts of contaminants from Site 6, Site 17, and upstream areas on the marsh are low.

EPA guidance "Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance)," Directive No. 9355.0-62FS from the EPA Federal Facilities Restoration and Reuse Office, may be applicable when considering disposition of the site. However, based on the limited risk exhibted, less-restrictive institutional controls (e.g., erosion control) may be applicable.

10.0 SITE 26: EXPLOSIVE "D" WASHOUT AREA

10.1 SITE BACKGROUND AND PHYSICAL SETTING

Site 26, which is approximately 200 by 200 feet in size, is situated at the intersection of Macassar and Midway Roads. Two railway lines adjacent to the site run toward the northeast. The ground surface at the site is relatively flat, approximately 150 feet above MSL. The explosive "D" washwater percolation pit is located in the center of the site and measures approximately 30 feet in diameter and 10 feet in depth. A tile-lined open pipe runs from Building GB-1 to the percolation pit. A process leaching system north of the western end of Building GB-1, consisting of a grease trap and a cesspool-type leach tank, approximately 10 feet by 10 feet and 6 feet deep, was used for process waste disposal. The bottom of the leach tank is situated about 3 to 4 feet above high water table level, which is approximately 10 to 14 feet below ground surface in the area. The sides of the leach tank appear to be porous, possibly partially constructed of cement block masonary units arranged on their sides for effective drainage. Figure 10-1 shows site features and sample locations.

10.2 PREVIOUS INVESTIGATIONS

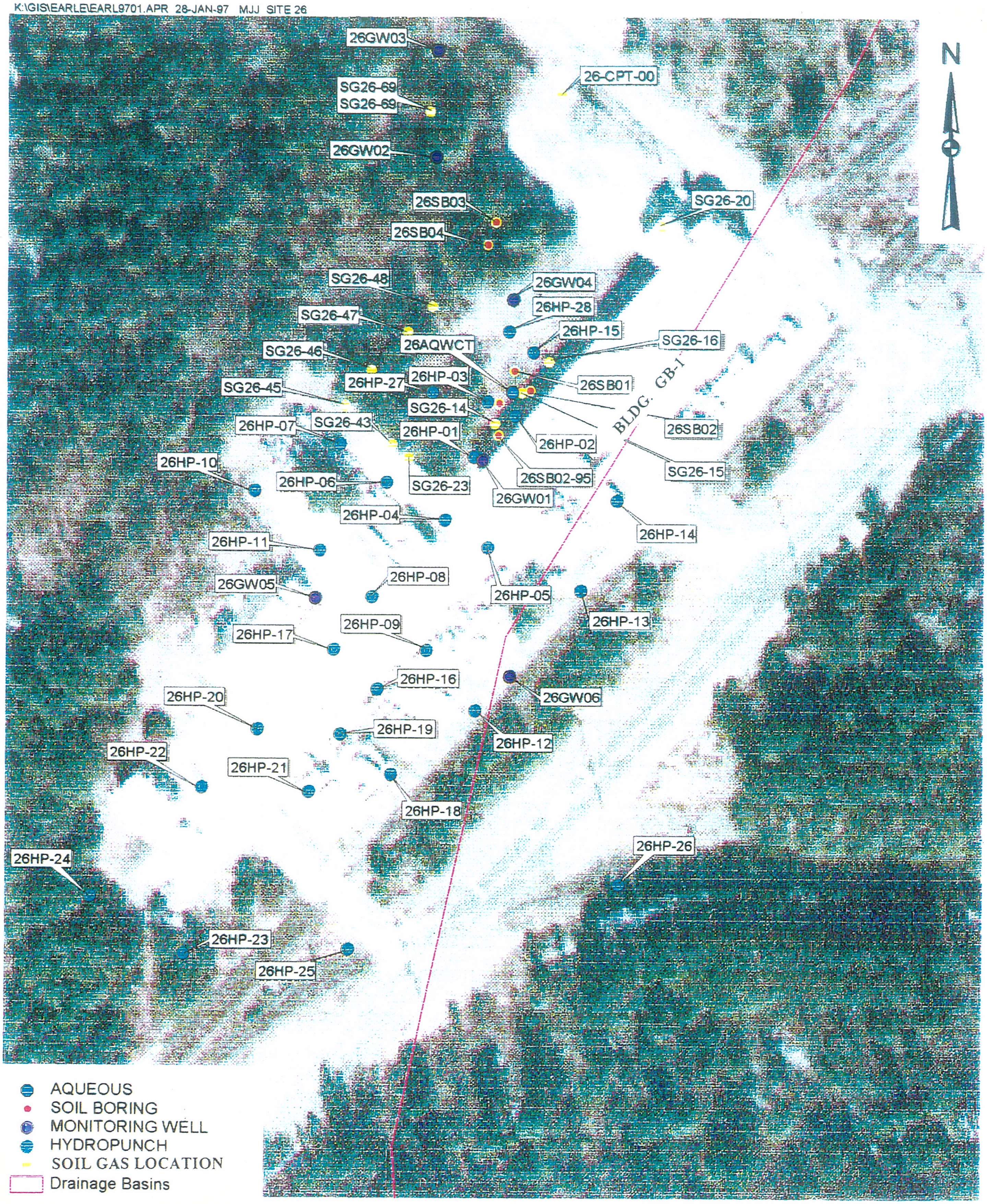
10.2.1 IAS, SI, and 1993 RI/FS

IAS

The 1983 IAS, consisting of interviews and site observations, concluded minimal probable impact based on the presumption that lost material would have been lost as a direct discharge to surface water and would no longer be present. The site was not recommended for a confirmation study.

SI and 1993 RI/FS

During the 1993 SI, three monitoring wells were installed. Groundwater samples were analyzed for picric acid and pH. Picric acid was not detected, and pH was within expected levels. During the 1993 RI/FS, four soil samples were collected from the settling basin. Lead was detected at elevated levels in three samples. All other metals were within normal background ranges. Picric acid was detected in one sample. No other explosive compounds were detected.



SAMPLE LOCATIONS
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE 10-1

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One monitoring well was installed near the percolation pit. Groundwater samples from all SI and RI/FS wells were collected and analyzed for TCL/TAL analytes, explosive compounds, pesticides/PCBs, VOCs, and drinking water metals. TCE was detected at MW26-01 at elevated levels (660 ug/L). Other VOCs, such as dichloroethanes, related to TCE as impurities or breakdown products, were also present. The source of TCE may be associated with the process leach tank system of Building GB-1. Low concentrations of several explosive compounds were detected in wells MW26-01 and MW26-04.

10.2.2 1995 RI

As part of the 1995 RI, B&R Environmental conducted the following field investigation activities at Site 26:

- Soil gas survey and analysis at 68 locations
- Sampling and analysis of subsurface soil samples from four soil borings
- Drilling and installation of two shallow permanent monitoring wells
- Sampling and analysis of groundwater from the wells
- Measurement of static-water levels in the wells

B&R Environmental also conducted a survey to establish the horizontal locations and vertical elevations of the soil gas grid corners, soil boring locations, selected existing monitoring wells, and the newly installed wells.

NJDEP Geographic Information System data initially indicated the presence of wetlands where the wooded upland areas are located north and west of the site. However, ground-truthing revealed that no wetlands are present in the area. Soils in this area contain no evidence of saturation, no wetland hydrology is present, and no streams or watercourses exist near the site. The closest wetlands are located approximately 300 yards to the northwest.

10.2.3 Summary of Results

A soil gas survey was conducted to determine if the source of the TCE contamination is present behind Building GB-1 (the process leach tank) or in the percolation pit and to determine locations for soil borings and monitoring wells. Seventy-five soil gas samples, including seven field duplicates, were collected from 68 soil gas points and submitted to the field laboratory for BTEX, TCE, and PCE analyses. The soil gas points were placed with a uniform grid spacing of 25 feet and were located southwest and northwest of Building GB-1. The samples were collected near the soil/water interface at depths between 7 and 8 feet bgs and were representative of potential soil or groundwater conditions near the soil/water interface. In general, the soil gas results seemed to indicate a potential source area of TCE, possibly centered near MW26-01.

Four soil borings were drilled to determine the effect of the process leaching tank, grease trap, and percolation pit on the site's soils. The borings ranged in depth from 8 to 10 feet bgs and saturated conditions were encountered in the borings from 7 to 9 feet below grade. Samples were analyzed for TCL VOC, TAL metals analyses, and explosives. Antimony was detected at low levels in soil samples but not in background samples. VOCs and explosives were not detected in soil samples.

Two additional soil borings were drilled in December 1995 to further investigate subsurface soil conditions in the vicinity of the process leaching tank and grease trap. The borings ranged in depth from 10 to 12 feet bgs and saturated conditions were encountered in the borings to 10 feet below grade. Subsurface soil samples were collected continuously to the water table. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Two subsurface soil samples were submitted for TCL VOC analyses. TCE and 1,2-DCA were detected in these soil samples at concentrations above regulatory levels.

Groundwater samples were collected from the two newly installed monitoring wells and the four existing wells and analyzed for TCL VOC, TAL metals, and explosives. Barium, cadmium, silver, and zinc were detected at concentrations above background levels. TCE, 1,1-DCE, and chloroform were detected in groundwater samples.

10.2.4 Data Gaps (Goals of RI Addendum Investigation)

Previous results indicated groundwater impacts by TCE and 1,2-dichloroethane; however, the extent of contamination could not be determined. The goal of the RI Addendum investigation was to further characterize the source area (process leach tank) and the horizontal and vertical extent of VOC contamination in groundwater.

10.3 RI ADDENDUM INVESTIGATION

10.3.1 Direct-Push Sampling

B&R Environmental collected groundwater samples from 28 locations (26HP01 through 26HP28) between October 16 and 25, 1996. Sample locations are shown in Figure 10-1. The samples were collected at multiple depths at each location. Sixty-four groundwater samples, including one field duplicate sample, were analyzed for TCL VOCs using TRCs mobile laboratory. Table 10-1 summarizes direct-push sampling activities. To confirm mobile laboratory results, 14 of the samples were also analyzed for TCL VOCs by IEA.

TABLE 10-1
SITE 26 DIRECT-PUSH SAMPLING SUMMARY
NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depths (feet bgs)	Comments
26CPT-00					0-73	
26HP-01	26HP01-23	23.6-25.6	TRC[2]	10/16/96		
	26HP01-79	77-79	TRC	10/17/96		
					0-25 and 40.7-100	Data for 25-40.7 feet bgs lost because of operator error. Clay layers encountered 23-25 feet, 41 feet, and 78-79 feet bgs.
26HP-02	26HP02-16	16-17.5	TRC; IEA [3]	10/18/96		
	26HP02-24	24-25	TRC; IEA	10/18/96		
	26HP02-68	68-70	TRC; IEA	10/18/96		
					0-79	Clay layer encountered at 25 feet bgs and 70 feet bgs.
26HP-03	26HP03-10	10-12	TRC; IEA	10/18/96		
	26HP03-24	24.6-25.5	TRC; IEA	10/18/96		
	26HP03-68	68.5-70.5	TRC; IEA	10/18/96		Clay layer encountered at 25.5 feet bgs
26HP-04	26HP04-15	15-17	TRC	10/22/96		
	26HP04-23	23-25	TRC	10/22/96		
	26HP04-69	69-71	TRC	10/24/96		Clay layer encountered at 70.5 feet bgs.
26HP-05	26HP05-15	15-17	TRC	10/22/96		
	26HP05-21	21-23	TRC; IEA	10/22/96		
	26HP05-68	68-70	TRC	10/23/96		
					0 to 79	
26HP-06	26HP06-15	15-17	TRC	10/22/96		
	26HP06-23	23-25	TRC; IEA	10/22/96		
26HP-07	26HP07-25	25-27	TRC	10/22/96		
	26HP07-50	50-52	TRC	10/22/96		
26HP-08	26HP08-15	15-17	TRC	10/22/96		
	26HP08-23	23-25	TRC	10/22/96		
	26HP08-71	71-73	TRC	10/24/96		
					0 to 79	

TABLE 10-1
SITE 26 DIRECT-PUSH SAMPLING SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 3

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depths (feet bgs)	Comments
26HP-09	26HP09-15	15-17	TRC	10/23/96		
	26HP09-22	22-24	TRC	10/23/96		
26HP-10	26HP10-18	18-20	TRC	10/23/96		
	26HP10-25	25-27	TRC	10/23/96		
					0 to 80	
26HP-11	26HP11-18	18-20	TRC	10/23/96		
	26HP11-24	24-26	TRC	10/23/96		
26HP-12	26HP12-15	15-17	TRC	10/23/96		
	26HP12-22	22-24	TRC	10/23/96		
	26HP12-50	50-52	TRC	10/24/96		
	26HP12-71	71-73	TRC	10/24/96		Clay layer encountered at 73 feet bgs.
26HP-13	26HP13-14	14-16	TRC; IEA	10/23/96		Duplicate Sample 26DUP01
	26HP13-22	22-24	TRC	10/23/96		
	26HP13-67	67-69	TRC	10/24/96		Clay layer encountered at 69 feet bgs.
26HP-14	26HP14-13	13-15	TRC	10/24/96		
	26HP14-18	18-20	TRC	10/24/96		
26HP-15	26HP15-15	15-17	TRC	10/24/96		
	26HP15-23	23-25	TRC	10/24/96		
26HP-16	26HP16-15	15-17	TRC	10/24/96		
	26HP16-23	23-25	TRC; IEA	10/24/96		
	26HP16-71	71-73	TRC	10/24/96		
26HP-17	26HP17-15	15-17	TRC	10/24/96		
	26HP17-24	24-26	TRC	10/24/96		
26HP-18	26HP18-14	14-16	TRC	10/24/96		
	26HP18-21	21-23	TRC	10/24/96		
26HP-19	26HP19-15	15-17	TRC	10/24/96		
	26HP19-21	21-23	TRC	10/24/96		

TABLE 10-1
SITE 26 DIRECT-PUSH SAMPLING SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 3 OF 3

Sample Location	Sample Number	Screened Interval (feet bgs[1])	Sample Analyzed By	Date Sampled	CPT Lithology Profile Depths (feet bgs)	Comments
26HP-20	26HP20-15	15-17	TRC	10/25/96		
	26HP20-24	24-26	TRC	10/25/96		
26HP-21	26HP21-16	16-17	TRC	10/25/96		
	26HP21-24	24-26	TRC	10/25/96		
26HP-22	26HP22-15	15-17	TRC	10/25/96		
	26HP22-24	24-26	TRC	10/25/96		
26HP-23	26HP23-15	15-17	TRC; IEA	10/25/96		
	26HP23-23	23-25	TRC; IEA	10/25/96		
26HP-24	26HP24-15	15-17	TRC	10/25/96		
	26HP24-23	23-25	TRC	10/25/96		
26HP-25	26HP25-13	13-15	TRC	10/25/96		
	26HP25-21	21-23	TRC; IEA	10/25/96		
26HP-26	26HP26-09	9-11	TRC	10/25/96		
	26HP26-19	19-21	TRC	10/25/96		
26HP-27	26HP27-24	24-26	TRC; IEA	10/25/96		
26HP-28	26HP28-24	24-26	TRC	10/25/96		

Note: All samples were analyzed for Target Compound List Volatile Organic Compounds.

1 bgs = below ground surface

2 TRC - Tracer Research Corporation (mobile laboratory)

3 IEA (fixed-base laboratory)

10.3.2 Lithologic Profiling

Lithologic profiling was performed at eight locations (26CPT00, 26HP01, 26HP02, 26HP05, 26HP08, 26HP10, 26HP21, and 26HP22) between October 16 and 25, 1996. Profiling locations are shown in Figure 10-1. The maximum depths of any profile was 100 feet. The results of the profile are summarized in Table 10-1 and presented in Section 10.4.1.

10.4 SITE CHARACTERISTICS

10.4.1 Geology

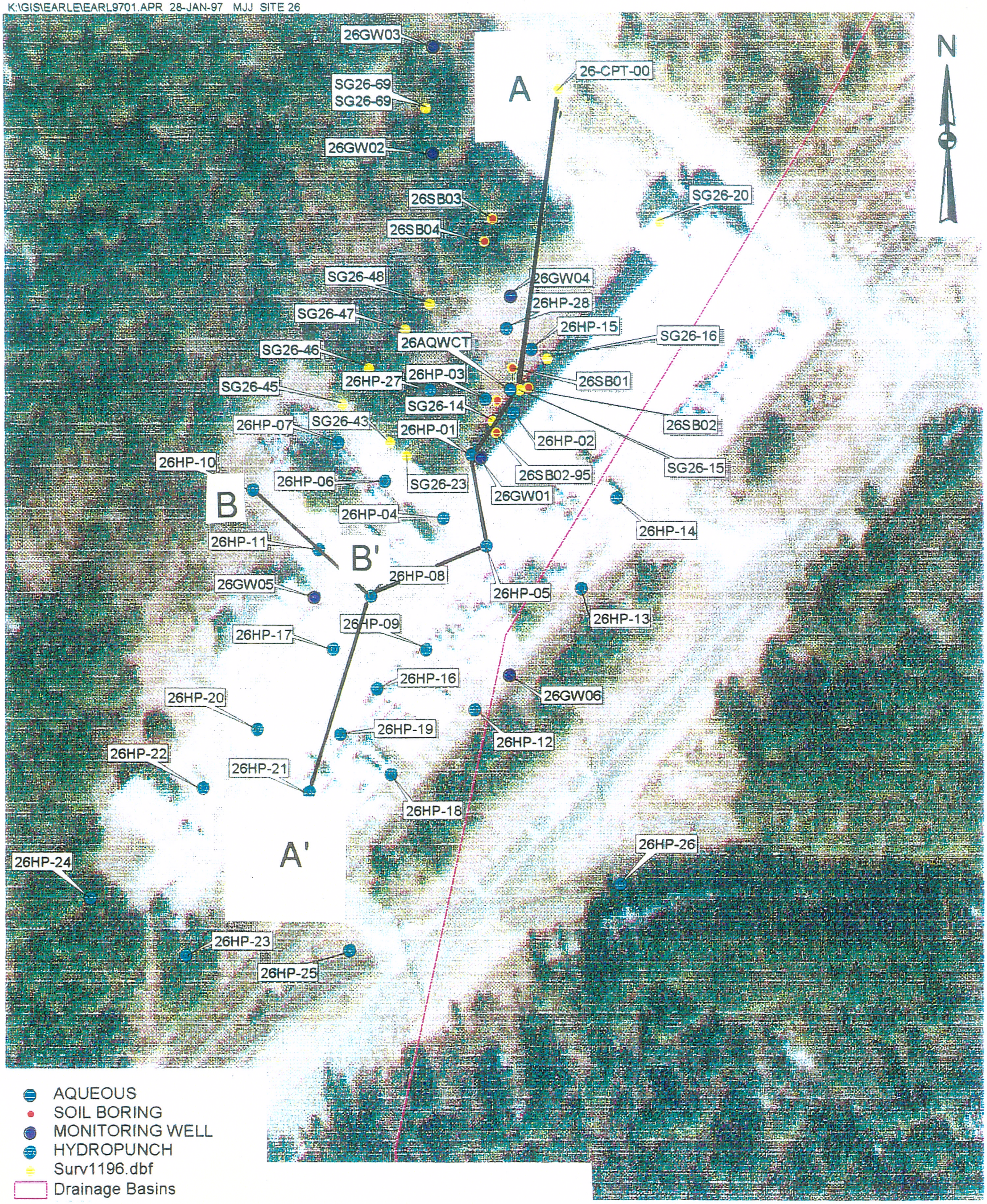
Regional mapping places Site 26 in the outcrop area of the Kirkwood Formation; upland gravel may be present at the site. The upland gravel has a maximum thickness of 10 feet, and the Kirkwood Formation ranges between 60 to 100 feet in thickness. The soil borings are no more than 24 feet deep and the CPT lithologic profile locations are no more than 100 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upland gravel and the Kirkwood Formation. In general, the borings encountered light yellowish-brown sand and gravel (probably representative of the upland gravel) and brownish-yellow, brown and gray, fine- to medium-grained and medium- to coarse-grained sand (probably representative of the Kirkwood Formation). Based on CPT lithologic profiling, the upper approximately 25-foot section penetrated was a sand. Silty clay and clayey silt was penetrated from approximately 25 to 45 feet and sand was penetrated from approximately 45 to 70 feet. A clayey silt was penetrated from approximately 80 to 87 feet in one of the locations. Lithologic profile diagrams for the site are provided in Figures 10-2, 10-3, and 10-4.

Based upon the boring log descriptions, wells MW26-02, MW26-03, MW26-05, and MW26-06 penetrated the upland gravel and the Kirkwood Formation, and wells MW26-01 and MW26-04 penetrated the Kirkwood Formation.

10.4.2 Hydrogeology

Shallow groundwater beneath the site occurs under unconfined conditions. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October 1995 groundwater elevation measurements, is toward the southwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

K:\GIS\EARLE\EARL9701.APR 28-JAN-97 MJJ SITE 26



CROSS-SECTION LOCATIONS

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE
10 – 2

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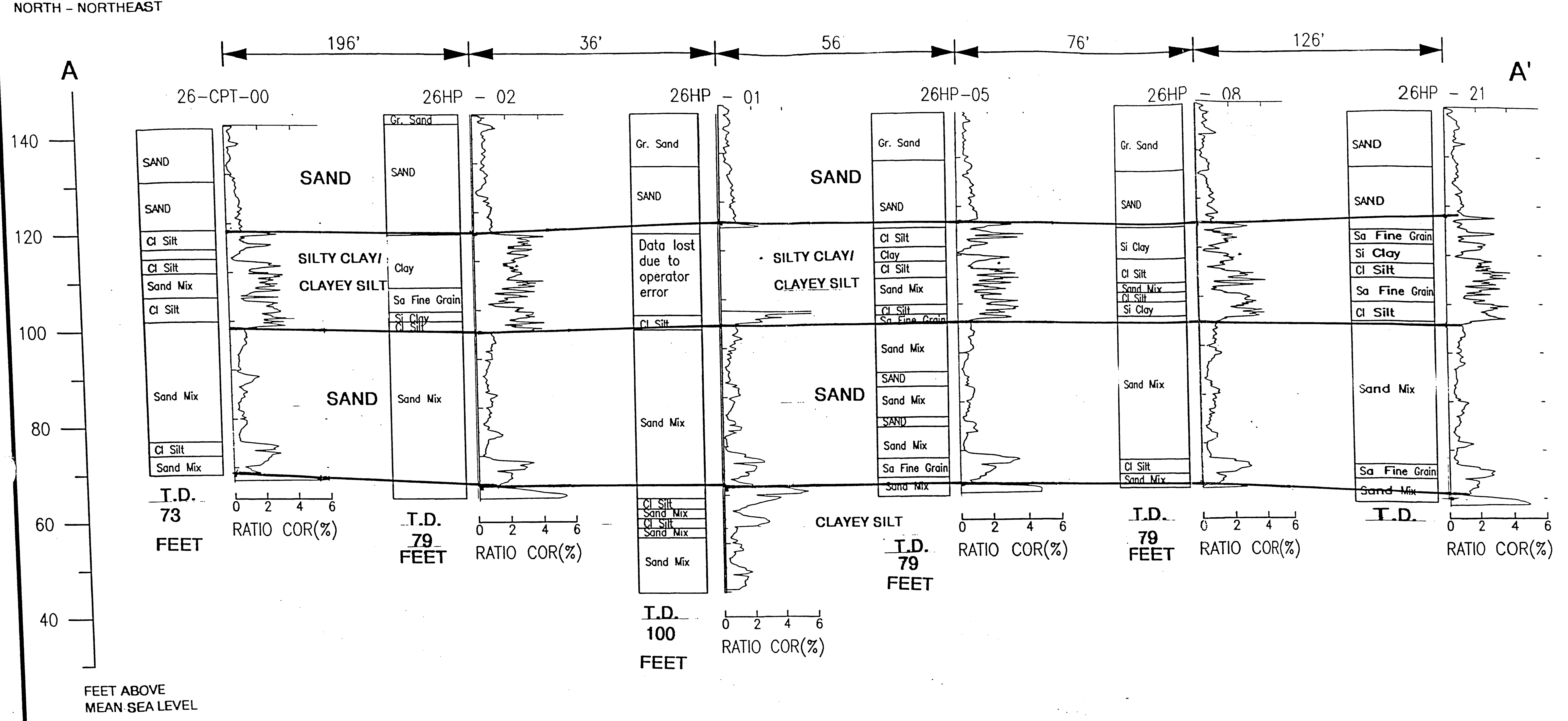
STRIKE SECTION A - A'



VERTICAL SCALE 1" = 20'
NOT TO HORIZONTAL SCALE
T.D. = TOTAL DEPTH

NO.	DATE		BY	CHK'D	APP'D	REFERENCES

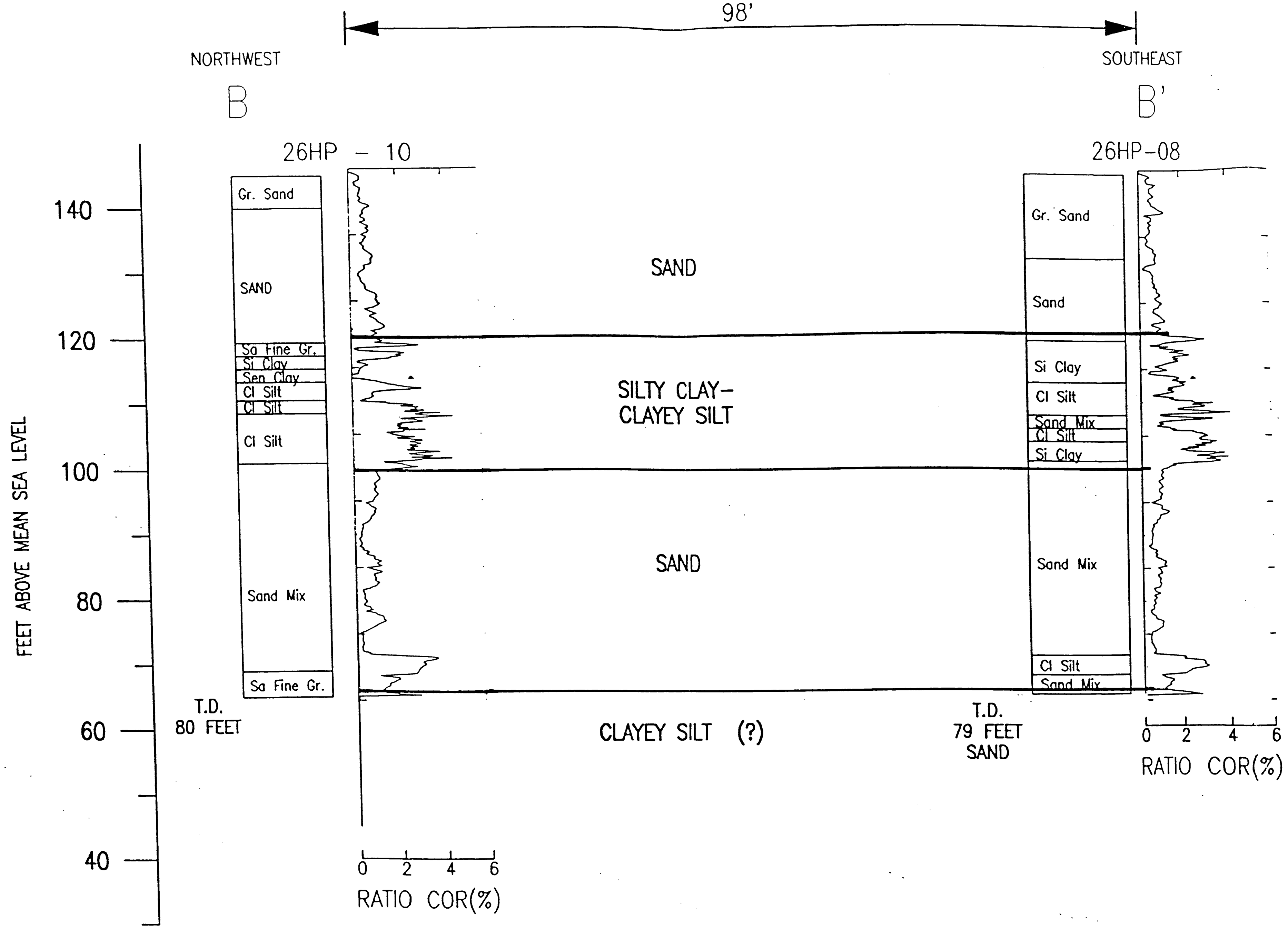
DRAWN BY A.S.M DATE 2/3/'97
CHECKED BY
COST/SCHED.-AREA
SCALE

Brown & Root Environmental

GEOLOGIC CROSS SECTIONS
SITE 26 - EXPLOSIVE "D" WASHOUT AREA
N W S EARLE, COLTS NECK, N.J.

CONTRACT NO. CTO 231
OWNER NO.
APPROVED BY
DATE
APPROVED BY
DATE
DRAWING NO. FIGURE 10-3
REV.

DIP SECTION B - B'



VERTICAL SCALE 1" = 20'
NOT TO HORIZONTAL SCALE
T.D. = TOTAL DEPTH

NO.	DATE		BY	CHK'D	APP'D	REFERENCES

DRAWN BY A.S.M DATE 2/3/'97
CHECKED BY
COST/SCHED.-AREA
SCALE

Brown & Root Environmental
GEOLOGIC CROSS SECTIONS
SITE 26 - EXPLOSIVE "D" WASHOUT AREA
N W S EARLE, COLTS NECK, N.J.

CONTRACT NO. CTO 231
OWNER NO.
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 10-4
REV.

Based on boring log descriptions, the wells are screened in the Kirkwood Formation. The hydraulic conductivities calculated for MW26-01, MW26-03, and MW26-04 are 3.85 x 10^{-4} cm/sec (1.09 ft/day), 1.92 x 10^{-3} cm/sec (5.44 ft/day), and 7.09 x 10^{-4} cm/sec (2.01 ft/day), respectively.

Based on pore pressure plots, the water table was encountered at approximately 10 feet and a lower water bearing zone was encountered at approximately 43 feet bgs. The clayey silty zone penetrated between approximately 25 and 45 feet bgs, shows a sharp rise in pre-pressure, indicating this zone probably serves as a semi-confining layer. Two pieces of evidence corroborate the findings of the cone penetrometer pore pressure plots, confirming the presence of the semi-confining layer. Efforts to obtain groundwater samples using the direct-push sampler from within the clay and silt zone yielded no water, and the tool screen was found to be smeared with a plastic, clayey soil after attempts to obtain groundwater samples from the clay and silt zone. This indicates the possibility of clay soils. Also, the vertical distribution of chlorinated compounds detected indicated concentrations orders of magnitude lower below the postulated clay layer than above it, indicating that the clay layer is acting as an aquitard.

10.5 NATURE AND EXTENT OF CONTAMINATION

This section evaluates all sampling data for the 1995 RI and 1996 RI Addendum field activities. Subsurface soil and groundwater sample analysis results were compared to NWS Earle site-wide background samples as presented in Section 2.4.1.

10.5.1 Subsurface Soils

Six site-related subsurface soil samples (26 SB 01-02, 26 SB 02-04, 26 SB 03-06, 26 SB 04-02, and 26 SB 04-06) were collected at Site 26 (Figure 10-1). Tables 10-2 and 10-3 present the occurrence and distribution of inorganic and organic chemicals detected in site-related subsurface soil samples and compare them to background. Table 10-4 presents a comparison of detected compounds to ARARs and TBCs. Figure 10-5 shows sample locations and concentrations of compounds that exceed ARARs and TBCs.

10.5.1.1 Inorganics

Concentrations of most metals in site-related subsurface soil samples were within the same ranges as background samples. Antimony was detected at low levels, near the instrument detection limit, in two site-related subsurface soil samples but was not found in background samples. Barium was detected in one site-related sample, 26SB02-04, at levels greater than the concentration range associated with background samples.

TABLE 10-2
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5.9E+03	5370	6 / 6	557 - 3350	1655.83	NO	NO	3350
ANTIMONY *	NOT DETECTED	-	-	-	2 / 6	0.61 - 0.66	0.40	YES	-	0.55
ARSENIC *	8 / 8	1.35 - 14.4	1.7E+01	13.29	4 / 6	0.59 - 3.1	1.32	NO	NO	3.10
BARIUM *	8 / 8	0.92 - 31	3.0E+01	17.92	6 / 6	1.1 - 213	37.38	YES	YES	108.16
BERYLLIUM	2 / 8	0.12 - 0.28	1.2E+00	0.28	6 / 6	0.13 - 0.25	0.16	NO	NO	0.20
CADMIUM	1 / 8	0.57	5.2E-01	0.58	6 / 6	0.04 - 1.2	0.40	NO	NO	0.80
CALCIUM	8 / 8	28.6 - 799	8.6E+02	577.55	6 / 6	28.7 - 169	88.92	NO	NO	169.00
CHROMIUM	8 / 8	4.7 - 59.5	7.3E+01	54.73	6 / 6	2.2 - 7.8	4.83	NO	NO	7.80
COPPER	8 / 8	0.97 - 8.6	1.1E+01	8.66	5 / 6	0.52 - 2.3	1.00	NO	NO	2.30
IRON	8 / 8	3745 - 62500	6.0E+04	40871	6 / 6	961 - 6550	3220.17	NO	NO	6550
LEAD	8 / 8	1.4 - 39.4	4.0E+01	24.33	6 / 6	0.55 - 2.3	1.36	NO	NO	2.30
MAGNESIUM	8 / 8	18.5 - 619	1.6E+03	504.05	6 / 6	17.3 - 59	41.37	NO	NO	59.00
MANGANESE	8 / 8	2.6 - 214	1.9E+02	92.51	6 / 6	0.97 - 1.9	1.36	NO	NO	1.74
MERCURY	8 / 8	0.03 - 0.17	1.7E-01	0.13	1 / 6	0.064 - 0.064	0.01	NO	NO	0.03
NICKEL	4 / 8	1.8 - 7.2	7.3E+00	4.75	6 / 6	0.24 - 0.78	0.42	NO	NO	0.68
POTASSIUM	7 / 8	95 - 792	2.8E+03	793.35	5 / 6	77.7 - 185	114.75	NO	NO	185.00
SILVER *	2 / 8	0.37 - 0.67	6.2E-01	0.51	4 / 6	0.64 - 2.4	0.91	YES	YES	2.40
SODIUM	8 / 8	17.5 - 94.8	1.0E+02	79.35	6 / 6	98.6 - 160	130.43	YES	YES	157.27
THALLIUM	4 / 8	0.7 - 1.9	1.8E+00	1.38	3 / 6	0.7 - 0.92	0.59	NO	NO	0.92
VANADIUM	8 / 8	11.05 - 64	9.7E+01	64.71	6 / 6	1.2 - 8.1	4.27	NO	NO	8.10
ZINC	6 / 8	1.1 - 50.7	5.0E+01	31.35	4 / 6	1.6 - 89.3	17.89	NO	NO	46.93

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400, BGSB0105, BGSB0205, BGSB0305, BGSB0405

TABLE 10-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL) *	NOT DETECTED	-	-	2 / 8	3 - 140	53.99
METHYLENE CHLORIDE *	NOT DETECTED	-	-	1 / 8	2 - 2	2
TRICHLOROETHENE *	NOT DETECTED	-	-	#REF! / #REF!	#REF! - #REF!	#REF!

* - Selected as a COPC

TABLE 10-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SB01-02	26SB02-04	26SB03-04	26SB03-06	26SB04-02	26SB04-06	ARARS & TBCs		
LOCATION:	26SB01	26SB02	26SB03	26SB03	26SB04	26SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	06/26/95	06/26/95	06/26/95	06/26/95	06/26/95	06/26/95			
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
aluminum	3350	668	1780	557	2300	1280	-	-	-
antimony	0.56 U	0.55 U	0.55 U	0.66	0.61	0.59 U	14.0	340	-
arsenic	1.0 J	0.59 J	3.1 J	0.56 UJ	2.7 J	0.59 UJ	20.0	20.0	-
barium	3.4 J	213 J	2.3 J	1.1 J	2.2 J	2.3 J	700	47000	-
beryllium	0.13	0.25	0.16	0.13	0.16	0.14	1.00	1.00	-
cadmium	0.040	0.068	1.2 E	0.077	0.81	0.20	1.00	100	-
calcium	163	169	63.7	28.7	76.2	32.9	-	-	-
chromium, total	6.4	2.7	7.8	2.2	6.6	3.3	-	500	-
copper	0.59	1.6	2.3	0.088 U	0.94	0.52	600	600	-
iron	3270 J	2240 J	6550 J	961 J	4560 J	1740 J	-	-	-
lead	2.3 J	1.7 J	1.4 J	0.55 J	1.2 J	1.0 J	400	600	-
magnesium	59.0	31.1	52.9	17.3	58.2	29.7	-	-	-
manganese	1.9 J	1.2 J	1.6 J	1.1 J	1.0 J	1.4 J	-	-	-
mercury	0.064 J	0.0070 U	0.0072 U	0.0073 U	0.0068 U	0.0077 U	14.0	270	-
nickel	0.78	0.24	0.50	0.38	0.32	0.29	250	2400	-
potassium	95.2	77.7	185	55.2 U	185	118	-	-	-
silver	0.14 U	0.14 U	2.4	1.0	1.3	0.64	110	4100	-
sodium	160	146	103	144	98.6	131	-	-	-
thallium	0.67 U	0.92 J	0.87 J	0.70 J	0.68 U	0.71 U	2.00	2.00	-
vanadium	5.7	2.5	8.1	1.2	6.2	1.9	370	7100	-
zinc	3.1 J	89.3 J	12.8 J	0.50 UJ	1.6 J	0.52 UJ	1500	1500	-
VOLATILES	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	12.0 U	79000	1000000	1000
methylene chloride	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	12.0 UJ	49000	210000	1000
trichloroethene	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	12.0 U	23000	54000	1000

TABLE 10-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	ARARS & TBCs		
LOCATION:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
SAMPLE DATE:	12/05/95	12/05/95							
INORGANICS	mg/kg	mg/kg					mg/kg	mg/kg	mg/kg
aluminum	n/a	n/a					-	-	-
antimony	n/a	n/a					14.0	340	-
arsenic	n/a	n/a					20.0	20.0	-
barium	n/a	n/a					700	47000	-
beryllium	n/a	n/a					1.00	1.00	-
cadmium	n/a	n/a					1.00	100	-
calcium	n/a	n/a					-	-	-
chromium, total	n/a	n/a					-	500	-
copper	n/a	n/a					600	600	-
iron	n/a	n/a					-	-	-
lead	n/a	n/a					400	600	-
magnesium	n/a	n/a					-	-	-
manganese	n/a	n/a					-	-	-
mercury	n/a	n/a					14.0	270	-
nickel	n/a	n/a					250	2400	-
potassium	n/a	n/a					-	-	-
silver	n/a	n/a					110	4100	-
sodium	n/a	n/a					-	-	-
thallium	n/a	n/a					2.00	2.00	-
vanadium	n/a	n/a					370	7100	-
zinc	n/a	n/a					1500	1500	-
VOLATILES	ug/kg	ug/kg					ug/kg	ug/kg	ug/kg
1,2-dichloroethene (total)	3.0 J	140					79000	1000000	1000
methylene chloride	11.0 U	2.0 J					49000	210000	1000
trichloroethene	2.0 J	74.0					23000	54000	1000

TABLE 10-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

TABLE 10-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SB01-02	26SB02-04	26SB03-04	26SB03-06	26SB04-02	26SB04-06	ARARS & TBCs		
LOCATION:	26SB01	26SB02	26SB03	26SB03	26SB04	26SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	06/26/95	06/26/95	06/26/95	06/26/95	06/26/95	06/26/95			
MISCELLANEOUS	%	%	%	%	%	%	%	%	%
moisture	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 10-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	ARARS & TBCs		
LOCATION:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
SAMPLE DATE:	12/05/95	12/05/95							
MISCELLANEOUS	%	%					%	%	%
moisture	12.8	19.5					-	-	-

TABLE 10-4b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

DRAFT
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Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

\- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

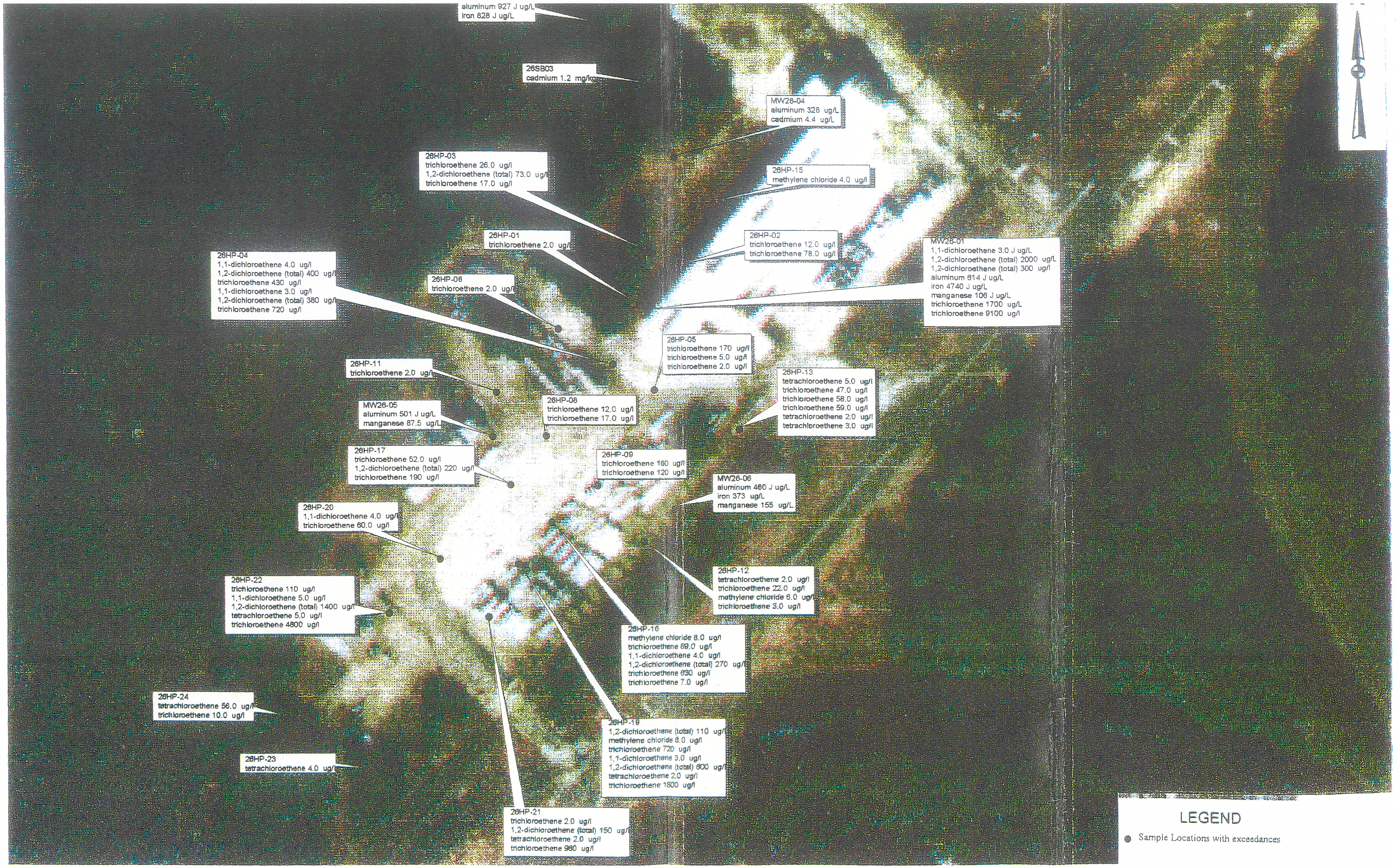


FIGURE 10-5

CONCENTRATIONS ABOVE SCREENING LEVELS
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

60 0 60 120 Feet

APR 07-FEB-96 MJJ Site 26 Tag 2

Brown & Root Environmental

10.5.1.2 Organics

Explosives and volatile organics were analyzed for but not detected in the first round of subsurface soil samples at Site 26.

In the two soil borings taken in December of 1995 to further investigate TCE near the process leach tank (26SB01-95 and 26SB02-95), TCE (2.0J ug/kg and 74.0 mg/kg respectively), and 1,2-dichloroethane (3.0 ug/kg and 140 ug/kg respectively) were found at concentrations above regulatory levels. Table 10-4 presents data and compares it to ARARs and TBCs.

10.5.2 Groundwater

Six site-related groundwater samples (26 GW 01 through 26 GW 06) were collected from monitoring wells 26MW01 through 26MW06 at Site 26 during the 1995 RI. In 1996, during RI Addendum field activities, 65 groundwater samples were collected using Geoprobe® and analyzed for VOCs in the field by mobile lab. In addition, 26MW01 was sampled and identified as 26 GW 01-OCT.96 (Figure 10-1). Tables 10-5 and 10-6 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples. Table 10-7 presents a comparison of detected compounds to ARARs and TBCs. Figure 10-5 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

10.5.2.1 Inorganics

Concentrations of most metals in site-related groundwater samples were within ranges similar to background samples. Zinc was detected in four site-related groundwater samples (26 GW 01 through 26 GW 03 and 26 GW 05) at levels greater than the concentration range associated with background samples. Barium was found at elevated levels in samples 26 GW 01 through 26 GW 03 and cadmium and silver were detected in sample 26 GW 04 at levels greater than background ranges.

TABLE 10-5
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	9.6E+06	5098	6 / 6	328 - 927	539.33	NO	NO	792.03
BARIUM	11 / 11	2.6 - 518	5.8E+02	229.60	6 / 6	13.2 - 518	267.78	YES	NO	465.70
CADMIUM	5 / 11	0.6 - 1.9	2.3E+00	1.21	4 / 6	0.42 - 4.4	1.04	NO	NO	2.40
CALCIUM	11 / 11	506 - 17200	1.7E+04	8307	6 / 6	3540 - 17800	8440	YES	NO	17800
CHROMIUM	9 / 11	1.3 - 43.5	6.0E+01	29.36	3 / 6	1.2 - 1.4	0.89	NO	NO	1.40
COBALT	6 / 11	0.7 - 10.1	9.6E+00	4.06	5 / 6	0.92 - 5.8	2.69	NO	NO	5.80
COPPER	9 / 11	0.79 - 13.5	1.4E+01	6.53	6 / 6	0.81 - 13.8	6.22	NO	NO	13.80
IRON	11 / 11	153 - 7690	8.5E+03	4197	6 / 6	90.8 - 4740	1172	NO	NO	2628
LEAD	3 / 11	2.1 - 3	3.1E+00	2.44	1 / 6	2.6 - 2.6	1.06	NO	NO	1.92
MAGNESIUM	11 / 11	273 - 27400	2.3E+04	8450	6 / 6	636 - 2170	1416	NO	NO	2170
MANGANESE	11 / 11	3.3 - 65	1.2E+03	46.18	6 / 6	3.3 - 155	62.23	YES	NO	155.00
MERCURY	11 / 11	0.005 - 0.12	2.0E-01	0.12	6 / 6	0.012 - 0.11	0.05	NO	NO	0.11
NICKEL	10 / 11	0.81 - 25.5	2.6E+01	11.98	2 / 6	0.81 - 1	0.55	NO	NO	0.94
POTASSIUM	11 / 11	350 - 3245	2.5E+06	2811	6 / 6	362 - 3640	1385	NO	NO	3640
SILVER *	NOT DETECTED	-	2.4E-01	0.94	1 / 6	3.3 - 3.3	0.94	YES	YES	3.06
SODIUM	11 / 11	1850 - 11650	1.3E+04	8449	6 / 6	2360 - 12500	4875	NO	NO	8020
VANADIUM	10 / 11	0.69 - 42.25	4.0E+01	16.48	3 / 6	0.81 - 1.6	0.71	NO	NO	1.60
ZINC	6 / 9	3.7 - 348	4.4E+02	178.61	5 / 5	100 - 326	242.40	YES	NO	326.00

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 10-6
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,1-DICHLOROETHENE *	NOT DETECTED	-	-	33 - 72	0.02 - 5	5.00
1,2-DICHLOROETHENE (TOTAL) *	NOT DETECTED	-	-	25 - 72	0.1 - 2000	662.55
CARBON DISULFIDE *	NOT DETECTED	-	-	7 - 19	5 - 46	13.51
CARBON TETRACHLORIDE *	NOT DETECTED	-	-	2 - 72	0.002 - 0.002	0.002
CHLOROFORM *	1 / 11	2 - 2	2	1 - 72	1 - 1	1.00
ETHYLBENZENE *	NOT DETECTED	-	-	4 - 86	4 - 16	3.00
METHYLENE CHLORIDE *	1 / 11	1 - 1	1	11 / 72	0.6 - 8	8.00
TETRACHLOROETHENE *	NOT DETECTED	-	-	28 / 72	0.3 - 56	12.40
TRICHLOROETHENE *	NOT DETECTED	-	-	43 / 72	0.06 - 9100	9100
XYLENE (TOTAL) *	NOT DETECTED	-	-	1 / 86	20 - 20	2.67

* - Selected as a COPC

** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26GW01	26GW01	26GW02	26GW03	26GW04	26GW05	ARARS & TBCs		
LOCATION:	26GW01	26GW01	26GW02	26GW03	26GW04	26GW05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1996 RI, Field	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/22/95	10/16/96	07/22/95	07/22/95	07/23/95	08/15/95			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	614 E J	n/a	927 E J	406 E J	328 E	501 E J	-	-	200
barium	518	n/a	464	475	13.2	89.6	2000	2000 a	2000
cadmium	0.52	n/a	0.42	0.38 U	4.4 E	0.52	5.00	5.00 e	4.00
calcium	17800	n/a	3540	7010	4600	6590	-	-	-
chromium, total	1.3	n/a	1.2	1.4	1.0 U	1.0 U	100 *	100 a	100
cobalt	2.9	n/a	0.92	0.60 U	1.2	5.0	-	-	-
copper	8.7	n/a	13.8	9.2	4.0	0.82	1300	-	1000
iron	4740 E J	n/a	828 E J	719 E J	90.8	284	-	-	300
lead	2.6	n/a	1.5 U	1.5 U	1.5 UJ	1.5 U	15.0	-	10.0
magnesium	2170	n/a	636	2120	724	923	-	-	-
manganese	106 E J	n/a	10.6	3.3	11.0	87.5 E	-	-	50.0
mercury	0.012	n/a	0.021	0.014	0.11 J	0.080	2.00	2.00 b	2.00
nickel	0.75 U	n/a	1.0	0.81	0.75 U	0.75 U	100	100 a	100
potassium	3640	n/a	1100	362	569	1350	-	-	-
silver	0.94 U	n/a	0.94 U	0.94 U	3.3	0.94 U	-	100 a	-
sodium	4580	n/a	3250	2650	3910	2360	-	-	50000
vanadium	1.6	n/a	1.0	0.81	0.61 U	0.61 U	-	-	-
zinc	326	n/a	326	280	8.3 R	180	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	3.0 E J	0.0090 U	10.0 U	10.0 U	10.0 U	10.0 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	2000 E	300 E	10.0 U	10.0 U	10.0 U	10.0 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 UJ	n/a	10.0 UJ	10.0 U	10.0 UJ	10.0 U	-	-	-
carbon tetrachloride	10.0 U	0.070 U	10.0 U	10.0 U	10.0 U	10.0 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.70 U	10.0 U	10.0 U	10.0 U	10.0 U	100	100 e	6.00
ethylbenzene	10.0 U	1.0 U	10.0 U	10.0 U	10.0 U	10.0 U	700	700 a	700
methylene chloride	10.0 U	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	3.0 E	10.0 U	10.0 U	10.0 U	10.0 U	5.00	1000 e	1.00
trichloroethene	1700 E	9100 E	10.0 U	10.0 U	10.0 U	10.0 U	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26GW01	26GW01	26GW02	26GW03	26GW04	26GW05	ARARS & TBCs		
LOCATION:	26GW01	26GW01	26GW02	26GW03	26GW04	26GW05	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1996 RI, Field	1995 RI	1995 RI	1995 RI	1995 RI			
SAMPLE DATE:	07/22/95	10/16/96	07/22/95	07/22/95	07/23/95	08/15/95			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
xylene (total)	10.0 U	2.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10000	10000 a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26GW06	26HP01-23	26HP01-79	26HP02-16	26HP02-16-DUP	26HP02-24	ARARS & TBCs		
LOCATION:	26GW06	26HP01	26HP01	26HP02	26HP02	26HP02	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field			
SAMPLE DATE:	08/15/95	10/16/96	10/17/96	10/17/96	10/18/96	10/17/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	460 E J	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	46.9	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	0.38 U	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	11100	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	1.0 U	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	5.8	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	0.81	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	373 E	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	1.5 U	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	1920	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	155 E	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	0.083	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	0.75 U	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	1290	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	0.94 U	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	12500	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	0.61 U	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	100	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	0.20	0.0030 U	0.70 U	10.0 U	0.030 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	10.0 U	0.50	0.040 U	22.0	23.0	0.40 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	n/a	n/a	n/a	46.0	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0020	0.0020	0.040 U	10.0 U	0.0010 U	5.00	70.0 e	2.00
chloroform	1.0 J	0.030 U	0.0040 U	0.40 U	10.0 U	0.10 U	100	100 e	6.00
ethylbenzene	10.0 U	1.0 U	0.40 U	0.90 U	10.0 U	0.90 U	700	700 a	700
methylene chloride	10.0 U	0.10 U	0.050 U	12.0 U	10.0 U	0.50 U	5.00	2000 d	3.00
tetrachloroethene	1.0 J	0.40	1.0	0.60	10.0 U	0.40	5.00	1000 e	1.00
trichloroethene	1.0 J	2.0 E	0.20	12.0 E	78.0 E	1.0	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26GW06	26HP01-23	26HP01-79	26HP02-16	26HP02-16-DUP	26HP02-24	ARARS & TBCs		
LOCATION:	26GW06	26HP01	26HP01	26HP02	26HP02	26HP02	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field			
SAMPLE DATE:	08/15/95	10/16/96	10/17/96	10/17/96	10/18/96	10/17/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
xylene (total)	10.0 U	2.0 U	0.50 U	1.0 U	10.0 U	1.0 U	10000	10000 a	1000

TABLE 10-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP02-24-DUP	26HP02-68	26HP02-68-DUP	26HP03-10	26HP03-10-DUP	26HP03-24	ARARS & TBCs		
LOCATION:	26HP02	26HP02	26HP02	26HP03	26HP03	26HP03	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field			
SAMPLE DATE:	10/18/96	10/17/96	10/18/96	10/17/96	10/18/96	10/17/96			
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,1-dichloroethene	10.0 U	0.010 U	10.0 U	0.30	10.0 U	0.030 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	10.0 U	0.20 U	10.0 U	48.0	73.0 E	0.40 U	70.0 a	70.0 a	70.0
carbon disulfide	16.0	n/a	5.0 J	n/a	22.0	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0007 U	10.0 U	0.0010 U	10.0 U	0.0010 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.0080 U	10.0 U	0.020 U	10.0 U	0.030 U	100	100 e	6.00
ethylbenzene	10.0 U	0.60 U	10.0 U	16.0	10.0 U	0.90 U	700	700 a	700
methylene chloride	10.0 U	0.20 U	10.0 U	0.50 U	10.0 U	0.50 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	0.20 U	10.0 U	0.60	10.0 U	0.060 U	5.00	1000 e	1.00
trichloroethene	10.0 U	0.30	10.0 U	26.0 E	17.0 E	0.060 N	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP02-24-DUP		26HP02-68		26HP02-68-DUP		26HP03-10		26HP03-10-DUP		26HP03-24		ARARS & TBCs			
LOCATION:	26HP02		26HP02		26HP02		26HP03		26HP03		26HP03		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI		1996 RI, Field		1996 RI		1996 RI, Field		1996 RI		1996 RI, Field					
SAMPLE DATE:	10/18/96		10/17/96		10/18/96		10/17/96		10/18/96		10/17/96					
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	10.0	U	0.70	U	10.0	U	14.0	U	10.0	U	1.0	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP03-24-DUP	26HP03-68	26HP03-68-DUP	26HP04-15	26HP04-25	26HP04-69	ARARS & TBCs		
LOCATION:	26HP03	26HP03	26HP03	26HP04	26HP04	26HP04	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/18/96	10/17/96	10/18/96	10/22/96	10/22/96	10/24/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	0.010 U	10.0 U	4.0 E	3.0 E	0.0080 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	10.0 U	0.20 U	10.0 U	400 E	380 E	0.10 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	n/a	13.0	n/a	n/a	n/a	-	-	-
carbon tetrachloride	10.0 U	0.0010 U	10.0 U	0.0010 U	0.020 U	0.0005 U	5.00	70.0 e	2.00
chloroform	10.0 U	0.020 U	10.0 U	0.0080 U	0.20 U	0.0040 U	100	100 e	6.00
ethylbenzene	10.0 U	0.60 U	10.0 U	1.0 U	1.0 U	0.30 U	700	700 a	700
methylene chloride	10.0 U	0.20 U	10.0 U	0.30 U	8.0 U	0.20 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	0.20 U	10.0 U	0.20 U	0.060 U	0.10 U	5.00	1000 e	1.00
trichloroethene	10.0 U	0.30	10.0 U	430 E	720 E	0.040 U	5.00	-	1.00

TABLE 10-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP03-24-DUP	26HP03-68	26HP03-68-DUP	26HP04-15	26HP04-25	26HP04-69	ARARS & TBCs		
LOCATION:	26HP03	26HP03	26HP03	26HP04	26HP04	26HP04	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/18/96	10/17/96	10/18/96	10/22/96	10/22/96	10/24/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
xylene (total)	10.0 U	0.70 U	10.0 U	2.0 U	2.0 U	0.50 U	10000	10000 a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP05-15	26HP05-20	26HP05-21	26HP05-68	26HP06-15	26HP06-23	ARARS & TBCs		
LOCATION:	26HP05	26HP05	26HP05	26HP05	26HP06	26HP06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI			
SAMPLE DATE:	10/22/96	10/22/96	10/22/96	10/23/96	10/22/96	10/22/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.80	0.20	10.0 U	0.020 U	0.80	10.0 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	46.0	2.0 U	10.0 U	0.20 U	12.0 U	10.0 U	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	10.0 U	n/a	n/a	10.0 U	-	-	-
carbon tetrachloride	0.050 U	0.010 U	10.0 U	0.0010 U	0.050 U	10.0 U	5.00	70.0 e	2.00
chloroform	0.40 U	0.080 U	10.0 U	0.0080 U	0.40 U	10.0 U	100	100 e	6.00
ethylbenzene	1.0 U	1.0 U	10.0 U	0.30 U	1.0 U	10.0 U	700	700 a	700
methylene chloride	16.0 U	3.0 U	10.0 U	0.30 U	16.0 U	10.0 U	5.00	2000 d	3.00
tetrachloroethene	0.10 U	0.020 U	10.0 U	0.20 U	0.10 U	10.0 U	5.00	1000 e	1.00
trichloroethene	170 E	5.0 E	10.0 U	2.0 E	2.0 E	10.0 U	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	26HP05-15 26HP05 1996 RI, Field 10/22/96		26HP05-20 26HP05 1996 RI, Field 10/22/96		26HP05-21 26HP05 1996 RI 10/22/96		26HP05-68 26HP05 1996 RI, Field 10/23/96		26HP06-15 26HP06 1996 RI, Field 10/22/96		26HP06-23 26HP06 1996 RI 10/22/96		ARARS & TBCs Maximum Contaminant Level (MCL)	ARARS & TBCs Drinking Water Health Advisory (Lowest Criterion Shown)		ARARS & TBCs NJDEP Groundwater Quality Standard
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	2.0	U	2.0	U	10.0	U	0.50	U	2.0	U	10.0	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP06-25	26HP07-25	26HP07-50	26HP07-50-DUP	26HP08-15	26HP08-23	ARARS & TBCs		
LOCATION:	26HP06	26HP07	26HP07	26HP07	26HP08	26HP08	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/22/96	10/22/96	10/22/96	10/22/96	10/23/96	10/23/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.40	0.20	0.030	0.10	0.40 U	0.80	7.00	7.00 a	2.00
1,2-dichloroethene (total)	2.0 U	0.20 U	0.20 U	0.10	6.0 U	48.0	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.010 U	0.0010 U	0.0010 U	0.0002 U	0.020 U	0.020 U	5.00	70.0 e	2.00
chloroform	0.080 U	0.030 U	0.020 U	0.040 U	0.20 U	0.20 U	100	100 e	6.00
ethylbenzene	0.70 U	0.70 U	0.70 U	0.10 U	0.60 U	0.60 U	700	700 a	700
methylene chloride	3.0 U	0.80	0.40	2.0	8.0 U	8.0 U	5.00	2000 d	3.00
tetrachloroethene	0.020 U	0.0020 U	0.0020 U	0.0040 U	0.50	0.060 U	5.00	1000 e	1.00
trichloroethene	0.040 U	0.010 U	0.020 U	0.10 U	12.0 E	17.0 E	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP06-25		26HP07-25		26HP07-50		26HP07-50-DUP		26HP08-15		26HP08-23		ARARS & TBCs				
LOCATION:	26HP06		26HP07		26HP07		26HP07		26HP08		26HP08		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard	
DATA SOURCE:	1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field						
SAMPLE DATE:	10/22/96		10/22/96		10/22/96		10/22/96		10/23/96		10/23/96						
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L	
xylene (total)	1.0	U	1.0	U	1.0	U	0.20	U	1.0	U	6.0	U	10000	10000	a	1000	

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP08-71	26HP09-15	26HP09-22	26HP10-18	26HP10-25	26HP11-18	ARARS & TBCs		
LOCATION:	26HP08	26HP09	26HP09	26HP10	26HP10	26HP11	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/24/96	10/23/96	10/23/96	10/23/96	10/23/96	10/23/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.0080 U	0.70	2.0	0.30	0.10	0.20	7.00	7.00 a	2.00
1,2-dichloroethene (total)	0.10 U	45.0	35.0	2.0 U	0.20 U	2.0 U	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.0005 U	0.020 U	0.050 U	0.010 U	0.0010 U	0.010 U	5.00	70.0 e	2.00
chloroform	0.0040 U	0.20 U	0.40 U	0.080 U	0.10 U	0.090 U	100	100 e	6.00
ethylbenzene	0.10 U	1.0 U	0.60 U	0.60 U	0.30 U	0.60 U	700	700 a	700
methylene chloride	0.20 U	8.0 U	16.0 U	3.0 U	1.0	3.0 U	5.00	2000 d	3.00
tetrachloroethene	0.080 U	0.60	0.10 U	0.020 U	0.0070 U	0.20 U	5.00	1000 e	1.00
trichloroethene	0.0020 U	160 E	120 E	0.040 U	0.0040 U	2.0 E	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP08-71		26HP09-15		26HP09-22		26HP10-18		26HP10-25		26HP11-18		ARARS & TBCs				
LOCATION:	26HP08		26HP09		26HP09		26HP10		26HP10		26HP11		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard	
DATA SOURCE:	1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field						
SAMPLE DATE:	10/24/96		10/23/96		10/23/96		10/23/96		10/23/96		10/23/96						
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L	
xylene (total)	0.20	U	2.0	U	1.0	U	1.0	U	0.50	U	1.0	U	10000	10000	a	1000	

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP11-24	26HP12-15	26HP12-22	26HP12-50	26HP12-71	26HP13-14	ARARS & TBCs		
LOCATION:	26HP11	26HP12	26HP12	26HP12	26HP12	26HP13	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/23/96	10/23/96	10/23/96	10/24/96	10/24/96	10/23/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.40	0.20	0.10	0.060	0.0080 U	0.20	7.00	7.00 a	2.00
1,2-dichloroethene (total)	2.0 U	0.20 U	26.0	0.10	0.10 U	7.0	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.010 U	0.0010 U	0.0010 U	0.0005 U	0.0005 U	0.010 U	5.00	70.0 e	2.00
chloroform	0.20 U	0.050 U	0.40 U	0.0070 U	0.0040 U	0.10 U	100	100 e	6.00
ethylbenzene	0.60 U	0.30 U	0.30 U	0.10 U	0.10 U	0.30 U	700	700 a	700
methylene chloride	3.0 U	2.0	3.0	6.0 E	0.20 U	3.0 U	5.00	2000 d	3.00
tetrachloroethene	0.020 U	0.020 U	2.0 E	0.20 U	0.30	5.0 E	5.00	1000 e	1.00
trichloroethene	1.0	0.0040 U	22.0 E	3.0 E	1.0	47.0 E	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	26HP11-24 26HP11 1996 RI, Field 10/23/96		26HP12-15 26HP12 1996 RI, Field 10/23/96		26HP12-22 26HP12 1996 RI, Field 10/23/96		26HP12-50 26HP12 1996 RI, Field 10/24/96		26HP12-71 26HP12 1996 RI, Field 10/24/96		26HP13-14 26HP13 1996 RI, Field 10/23/96		ARARS & TBCs Maximum Contaminant Level (MCL)	ARARS & TBCs Drinking Water Health Advisory (Lowest Criterion Shown)		ARARS & TBCs NJDEP Groundwater Quality Standard
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	1.0	U	0.50	U	0.50	U	0.20	U	0.20	U	0.50	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP13-14-DU2	26HP13-14-DUP	26HP13-22	26HP13-22-DUP	26HP13-67	26HP14-13	ARARS & TBCs		
LOCATION:	26HP13	26HP13	26HP13	26HP13	26HP13	26HP14	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/23/96	10/23/96	10/23/96	10/23/96	10/24/96	10/24/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	10.0 U	10.0 U	0.80 U	0.020 U	0.0080 U	0.20 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	22.0	22.0	12.0 U	0.20 U	0.10 U	4.0 U	70.0 a	70.0 a	70.0
carbon disulfide	10.0 U	10.0 U	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	10.0 U	10.0 U	0.050 U	0.0010 U	0.0005 U	0.020 U	5.00	70.0 e	2.00
chloroform	10.0 U	10.0 U	0.40 U	0.10 U	0.0040 U	0.10 U	100	100 e	6.00
ethylbenzene	10.0 U	10.0 U	4.0	4.0	0.10 U	0.70 U	700	700 a	700
methylene chloride	10.0 U	10.0 U	16.0 U	0.30 U	0.20 U	5.0 U	5.00	2000 d	3.00
tetrachloroethene	10.0 U	10.0 U	2.0 E	3.0 E	0.20 U	0.040 U	5.00	1000 e	1.00
trichloroethene	58.0 E	59.0 E	0.20 U	0.60	0.030 U	0.060 U	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP13-14-DU2	26HP13-14-DUP	26HP13-22	26HP13-22-DUP	26HP13-67	26HP14-13	ARARS & TBCs		
LOCATION:	26HP13	26HP13	26HP13	26HP13	26HP13	26HP14	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI	1996 RI	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/23/96	10/23/96	10/23/96	10/23/96	10/24/96	10/24/96			
VOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
xylene (total)	10.0 U	10.0 U	0.50 U	0.50 U	0.20 U	1.0 U	10000	10000 a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	26HP14-18 26HP14 1996 RI, Field 10/24/96	26HP15-15 26HP15 1996 RI, Field 10/24/96	26HP15-23 26HP15 1996 RI, Field 10/24/96	26HP16-15 26HP16 1996 RI, Field 10/24/96	26HP16-23 26HP16 1996 RI, Field 10/24/96	26HP16-71 26HP16 1996 RI, Field 10/24/96	ARARS & TBCs Maximum Contaminant Level (MCL)	 Drinking Water Health Advisory (Lowest Criterion Shown)	 NJDEP Groundwater Quality Standard
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.020 U	0.50	0.30	0.60	4.0 E	0.020	7.00	7.00 a	2.00
1,2-dichloroethene (total)	0.20 U	2.0 U	0.20 U	57.0	270 E	0.20	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.0010 U	0.010 U	0.0010 U	0.0010 U	0.010 U	0.0005 U	5.00	70.0 e	2.00
chloroform	0.20 U	0.080 U	0.0080 U	0.30 U	0.080 U	0.0040 U	100	100 e	6.00
ethylbenzene	0.30 U	0.30 U	0.30 U	0.30 U	5.0	1.0 U	700	700 a	700
methylene chloride	2.0	3.0 U	4.0 E	8.0 E	3.0 U	0.20 U	5.00	2000 d	3.00
tetrachloroethene	0.050 U	0.020 U	0.0090 U	0.30	0.30	0.070 U	5.00	1000 e	1.00
trichloroethene	0.50	0.040 U	0.10 U	89.0 E	630 E	7.0 E	5.00	-	1.00

TABLE 10-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP14-18		26HP15-15		26HP15-23		26HP16-15		26HP16-23		26HP16-71		ARARS & TBCs			
LOCATION:	26HP14		26HP15		26HP15		26HP16		26HP16		26HP16		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field					
SAMPLE DATE:	10/24/96		10/24/96		10/24/96		10/24/96		10/24/96		10/24/96					
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	0.50	U	0.50	U	0.50	U	0.50	U	0.60	U	0.20	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	26HP17-15 26HP17 1996 RI, Field 10/24/96	26HP17-24 26HP17 1996 RI, Field 10/24/96	26HP18-14 26HP18 1996 RI, Field 10/24/96	26HP18-24 26HP18 1996 RI, Field 10/24/96	26HP18-24-DUP 26HP18 1996 RI, Field 10/24/96	26HP19-15 26HP19 1996 RI, Field 10/24/96	ARARS & TBCs Maximum Contaminant Level (MCL)	ARARS & TBCs Drinking Water Health Advisory (Lowest Criterion Shown)	ARARS & TBCs NJDEP Groundwater Quality Standard
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	0.80 U	2.0	0.80 U	0.20 U	0.10	0.90	7.00	7.00 a	2.00
1,2-dichloroethene (total)	23.0	220 E	12.0 U	4.0 U	0.20 U	110 E	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.050 U	0.050 U	0.050 U	0.020 U	0.0010 U	0.010 U	5.00	70.0 e	2.00
chloroform	0.40 U	0.40 U	0.40 U	0.10 U	0.050 U	0.10 U	100	100 e	6.00
ethylbenzene	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	700	700 a	700
methylene chloride	16.0 U	16.0 U	16.0 U	5.0 U	0.60	6.0 E	5.00	2000 d	3.00
tetrachloroethene	0.40	0.10 U	0.10 U	0.040 U	0.0020 U	0.40	5.00	1000 e	1.00
trichloroethene	52.0 E	190 E	0.20 U	0.060 U	0.030 U	720 E	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP17-15	26HP17-24	26HP18-14	26HP18-24	26HP18-24-DUP	26HP19-15	ARARS & TBCs		
LOCATION:	26HP17	26HP17	26HP18	26HP18	26HP18	26HP19	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/24/96	10/24/96	10/24/96	10/24/96	10/24/96	10/24/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
xylene (total)	0.50 U	20.0	0.50 U	0.50 U	0.50 U	0.50 U	10000	10000 a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER: LOCATION: DATA SOURCE: SAMPLE DATE:	26HP19-21 26HP19 1996 RI, Field 10/24/96	26HP20-15 26HP20 1996 RI, Field 10/25/96	26HP20-24 26HP20 1996 RI, Field 10/25/96	26HP21-16 26HP21 1996 RI, Field 10/25/96	26HP21-24 26HP21 1996 RI, Field 10/25/96	26HP22-15 26HP22 1996 RI, Field 10/25/96	ARARS & TBCs Maximum Contaminant Level (MCL)	 Drinking Water Health Advisory (Lowest Criterion Shown)	 NJDEP Groundwater Quality Standard
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,1-dichloroethene	3.0 E	2.0 U	4.0 E	7.0 U	22.0 U	0.60 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	600 E	37.0 U	7.0 U	12.0 U	150 E	4.0	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
carbon tetrachloride	0.090 U	0.20 U	0.030 U	0.050 U	0.20 U	0.050 U	5.00	70.0 e	2.00
chloroform	0.80 U	1.0 U	0.30 U	0.50 U	1.0 U	0.50 U	100	100 e	6.00
ethylbenzene	0.70 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	700	700 a	700
methylene chloride	32.0 U	50.0 U	10.0 U	16.0 U	49.0 U	16.0 U	5.00	2000 d	3.00
tetrachloroethene	2.0 E	0.30 U	0.30	1.0	2.0 E	0.20 U	5.00	1000 e	1.00
trichloroethene	1800 E	0.90	60.0 E	2.0 E	960 E	110 E	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP19-21		26HP20-15		26HP20-24		26HP21-16		26HP21-24		26HP22-15		ARARS & TBCs			
LOCATION:	26HP19		26HP20		26HP20		26HP21		26HP21		26HP22		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI, Field					
SAMPLE DATE:	10/24/96		10/25/96		10/25/96		10/25/96		10/25/96		10/25/96					
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	1.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP22-24	26HP23-15	26HP23-15-DUP	26HP23-23	26HP23-23-DUP	26HP24-15	ARARS & TBCs		
LOCATION:	26HP22	26HP23	26HP23	26HP23	26HP23	26HP24	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field			
SAMPLE DATE:	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	5.0 E	0.90 U	10.0 U	0.40 U	10.0 U	0.90 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	1400 E	19.0 U	10.0 U	9.0 U	10.0 U	19.0 U	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	10.0 J	n/a	9.0 J	n/a	-	-	-
carbon tetrachloride	0.20 U	0.080 U	10.0 U	0.40 U	10.0 U	0.080 U	5.00	70.0 e	2.00
chloroform	1.0 U	0.70 U	10.0 U	0.30 U	10.0 U	0.70 U	100	100 e	6.00
ethylbenzene	2.0 U	2.0 U	10.0 U	2.0 U	10.0 U	2.0 U	700	700 a	700
methylene chloride	49.0 U	24.0 U	10.0 U	12.0 U	10.0 U	25.0 U	5.00	2000 d	3.00
tetrachloroethene	5.0 E	4.0 E	10.0 U	0.080 U	10.0 U	56.0 E	5.00	1000 e	1.00
trichloroethene	4800 E	0.20 U	10.0 U	0.10 U	10.0 U	0.20 U	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP22-24	26HP23-15	26HP23-15-DUP	26HP23-23	26HP23-23-DUP	26HP24-15	ARARS & TBCs		
LOCATION:	26HP22	26HP23	26HP23	26HP23	26HP23	26HP24	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI	1996 RI, Field			
SAMPLE DATE:	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96			
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
xylene (total)	2.0 U	2.0 U	10.0 U	2.0 U	10.0 U	2.0 U	10000	10000 a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP24-23	26HP25-13	26HP25-21	26HP25-21-DUP	26HP26-09	26HP26-19	ARARS & TBCs		
LOCATION:	26HP24	26HP25	26HP25	26HP25	26HP26	26HP26	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field	1996 RI, Field	1996 RI, Field	1996 RI	1996 RI, Field	1996 RI, Field			
SAMPLE DATE:	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96	10/25/96			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	n/a	n/a	n/a	n/a	n/a	n/a	-	-	200
barium	n/a	n/a	n/a	n/a	n/a	n/a	2000	2000 a	2000
cadmium	n/a	n/a	n/a	n/a	n/a	n/a	5.00	5.00 e	4.00
calcium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
chromium, total	n/a	n/a	n/a	n/a	n/a	n/a	100 *	100 a	100
cobalt	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
copper	n/a	n/a	n/a	n/a	n/a	n/a	1300	-	1000
iron	n/a	n/a	n/a	n/a	n/a	n/a	-	-	300
lead	n/a	n/a	n/a	n/a	n/a	n/a	15.0	-	10.0
magnesium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
manganese	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50.0
mercury	n/a	n/a	n/a	n/a	n/a	n/a	2.00	2.00 b	2.00
nickel	n/a	n/a	n/a	n/a	n/a	n/a	100	100 a	100
potassium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
silver	n/a	n/a	n/a	n/a	n/a	n/a	-	100 a	-
sodium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	50000
vanadium	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
zinc	n/a	n/a	n/a	n/a	n/a	n/a	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	2.0 U	0.90 U	0.90 U	10.0 U	0.60 U	0.60 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	37.0 U	19.0 U	19.0 U	10.0 U	12.0 U	12.0 U	70.0 a	70.0 a	70.0
carbon disulfide	n/a	n/a	n/a	10.0 U	n/a	n/a	-	-	-
carbon tetrachloride	0.20 U	0.080 U	0.080 U	10.0 U	0.050 U	0.050 U	5.00	70.0 e	2.00
chloroform	1.0 U	0.70 U	0.70 U	10.0 U	0.50 U	0.50 U	100	100 e	6.00
ethylbenzene	2.0 U	2.0 U	2.0 U	10.0 U	2.0 U	2.0 U	700	700 a	700
methylene chloride	49.0 U	24.0 U	24.0 U	10.0 U	16.0 U	16.0 U	5.00	2000 d	3.00
tetrachloroethene	0.30 U	1.0	0.20 U	10.0 U	0.60	0.10 U	5.00	1000 e	1.00
trichloroethene	10.0 E	0.20 U	0.20 U	10.0 U	0.20 U	0.20 U	5.00	-	1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP24-23		26HP25-13		26HP25-21		26HP25-21-DUP		26HP26-09		26HP26-19		ARARS & TBCs			
LOCATION:	26HP24		26HP25		26HP25		26HP25		26HP26		26HP26		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field		1996 RI, Field		1996 RI, Field		1996 RI		1996 RI, Field		1996 RI, Field					
SAMPLE DATE:	10/25/96		10/25/96		10/25/96		10/25/96		10/25/96		10/25/96					
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	ug/L		ug/L
xylene (total)	2.0	U	2.0	U	2.0	U	10.0	U	2.0	U	2.0	U	10000	10000	a	1000

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP27-24		26HP27-24-DUP		26HP28-24		- - -	- - -	- - -	ARARS & TBCs				
LOCATION:	26HP27		26HP27		26HP28		- - -	- - -	- - -	Maximum Contaminant Level (MCL)		Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field		1996 RI		1996 RI, Field									
SAMPLE DATE:	10/25/96		10/25/96		10/25/96									
INORGANICS	ug/L		ug/L		ug/L					ug/L		ug/L		ug/L
aluminum	n/a		n/a		n/a					-		-		200
barium	n/a		n/a		n/a					2000		2000	a	2000
cadmium	n/a		n/a		n/a					5.00		5.00	e	4.00
calcium	n/a		n/a		n/a					-		-		-
chromium, total	n/a		n/a		n/a					100	*	100	a	100
cobalt	n/a		n/a		n/a					-		-		-
copper	n/a		n/a		n/a					1300		-		1000
iron	n/a		n/a		n/a					-		-		300
lead	n/a		n/a		n/a					15.0		-		10.0
magnesium	n/a		n/a		n/a					-		-		-
manganese	n/a		n/a		n/a					-		-		50.0
mercury	n/a		n/a		n/a					2.00		2.00	b	2.00
nickel	n/a		n/a		n/a					100		100	a	100
potassium	n/a		n/a		n/a					-		-		-
silver	n/a		n/a		n/a					-		100	a	-
sodium	n/a		n/a		n/a					-		-		50000
vanadium	n/a		n/a		n/a					-		-		-
zinc	n/a		n/a		n/a					-		2000	a	5000
VOLATILES	ug/L		ug/L		ug/L					ug/L		ug/L		ug/L
1,1-dichloroethene	0.60	U	10.0	U	0.60	U				7.00		7.00	a	2.00
1,2-dichloroethene (total)	12.0	U	10.0	U	12.0	U				70.0	a	70.0	a	70.0
carbon disulfide	n/a		10.0	U	n/a					-		-		-
carbon tetrachloride	0.050	U	10.0	U	0.050	U				5.00		70.0	e	2.00
chloroform	0.50	U	10.0	U	0.50	U				100		100	e	6.00
ethylbenzene	2.0	U	10.0	U	2.0	U				700		700	a	700
methylene chloride	16.0	U	10.0	U	16.0	U				5.00		2000	d	3.00
tetrachloroethene	0.50		10.0	U	1.0					5.00		1000	e	1.00
trichloroethene	0.20	U	10.0	U	0.20	U				5.00		-		1.00

TABLE 10-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26HP27-24		26HP27-24-DUP		26HP28-24		---	---	---	ARARS & TBCs			
LOCATION:	26HP27		26HP27		26HP28		---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1996 RI, Field		1996 RI		1996 RI, Field								
SAMPLE DATE:	10/25/96		10/25/96		10/25/96								
VOLATILES	ug/L		ug/L		ug/L					ug/L	ug/L		ug/L
xylene (total)	2.0	U	10.0	U	2.0	U				10000	10000	a	1000

TABLE 10-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

\- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

\- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

10.5.2.2 Organics

Monitoring Wells

In 1995, TCE (1 ug/L to 1,700 ug/L) was detected in two groundwater samples collected at Site 26. 1,1-DCE (3 ug/L), 1,2-DCE (2,000 ug/L), chloroform (1 ug/L), and PCE (1 ug/L) were each detected in one groundwater sample collected at Site 26 in 1995. Sample 26 GW 01 contained the highest levels of TCE, 1,1-DCE, and 1,2-DCE. This monitoring well is located near a leach tank along the northwestern end of Building GB-1. Trace levels of TCE, PCE, and chloroform were also detected in 26 GW 06, which is located approximately 90 feet south of the southwestern corner of Building GB-1. Explosives were analyzed for but not detected in groundwater samples collected at Site 26.

In order to confirm the levels of contamination exhibited in 26 GW 01, this well was sampled for VOCs during the 1996 RI Addendum. Results showed 1,2-DCE (300 ug/L), TCE (9,100 ug/L), and PCE (3 ug/L).

Direct-Push Samples

To further delineate the extent of groundwater contamination at Site 26, samples were collected by direct-push methodology and analyzed in the field for VOCs. Confirmation samples submitted to a fixed-based laboratory indicated that the field results were reliable. VOCs detected in these samples showed TCE in 39 samples (0.06 to 4,800 ug/L), 1,1-DCE in 32 samples (0.03 to 5 ug/L), 1,2-DCE in 23 samples (0.1 to 1,400 ug/L), PCE in 20 samples (0.4 to 56 ug/L), methylene chloride in 11 samples (0.8 to 8 ug/L), ethylbenzene in three samples (4 to 16 ug/L), carbon tetrachloride in two samples (0.002 ug/L), and xylene in one sample (20 ug/L). In addition, carbon disulfide was detected in seven of the eight confirmation samples (5 to 46 ug/L). Carbon disulfide was not a field parameter.

The highest levels of contaminants are in the area of the process leach tank and extends southwestward approximately 400 feet to sample location 26 HP 24. The extent of horizontal migration may be farther because this location, which was the farthest downgradient point, showed the highest levels of PCE at Site 26 (56 ug/L) and TCE (10 ug/L) at a level above ARARs.

The highest levels of TCE at the site extend southwestward from MW26-01 to sample locations 26 HP 21 and 26 HP 22. Samples from each location showed higher levels of VOCs at depths ranging from 18 to 25 feet bgs. Figures 10-6 through 10-8 show the groundwater contaminant concentrations. Figures 10-9 and 10-10 show the concentrations of TCE and 1,2-DCE in shallow groundwater (less than 17 feet bgs), respectively. Figures 10-11 and 10-12 show TCE and 1,2-DCE concentrations in deeper groundwater (18 to 25 feet bgs), respectively. Figures 10-13 and 10-14 present cross-sections with TCE concentrations along strike and dip, respectively. Figure 10-2 presented locations for cross-sections along strike (A-A') and dip (B-B') through Site 26. Figures 10-15 and 10-16 present cross-sections with 1,2-DCE concentrations along the strike and dip, respectively.

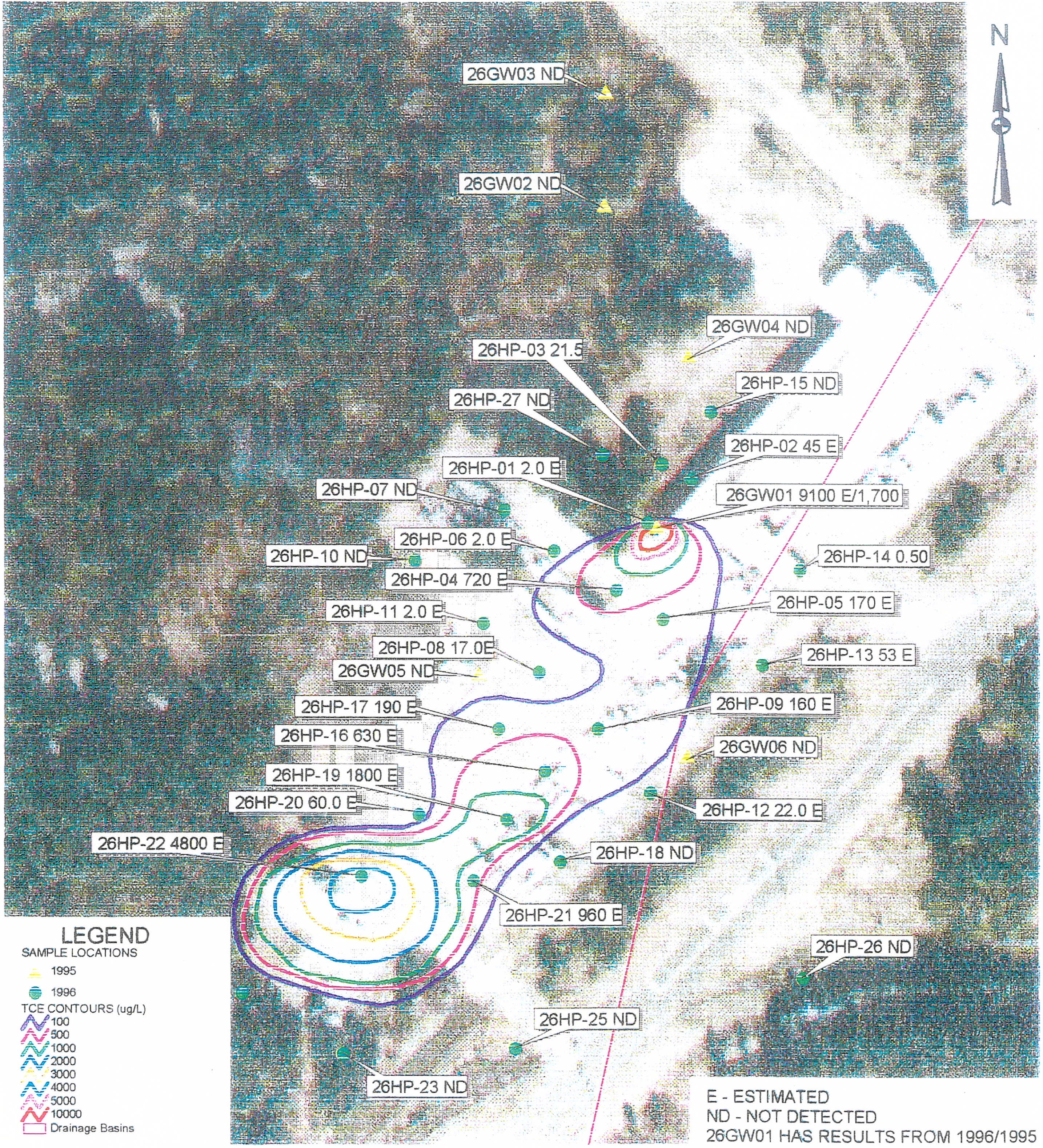
10.5.3 Conceptual Site Model

Figure 10-17 shows the conceptual site model. Apparently, over a period of years, liquid process wastes containing chlorinated VOCs from industrial operations performed in Building GB-1 were disposed, by way of a drain in Building GB-1, to the process leach tank system. Liquid wastes would have passed through the permeable walls and bottom of the process leach tank to enter the subsurface soil environment. Chlorinated VOCs (DNAPLs) disposed in this way would have migrated down to the semi-permeable clay layer barrier. After encountering the clay layer barrier, the DNAPL would have continued to migrate downward, but at a much slower rate. VOC compounds would also have migrated downgradient (to the southwest) with the slow rate of horizontal groundwater flow.

10.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 26 is described in this subsection. The various chemicals detected during the 1995 RI and 1996 RI Addendum field activities and their transport potential in the environment are discussed in Section 10.6.1. Persistence of detected chemicals in the environment is discussed in Section 10.6.2. Section 10.6.3 presents a brief discussion of contaminant trends.

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ SITE-26 TCEGW



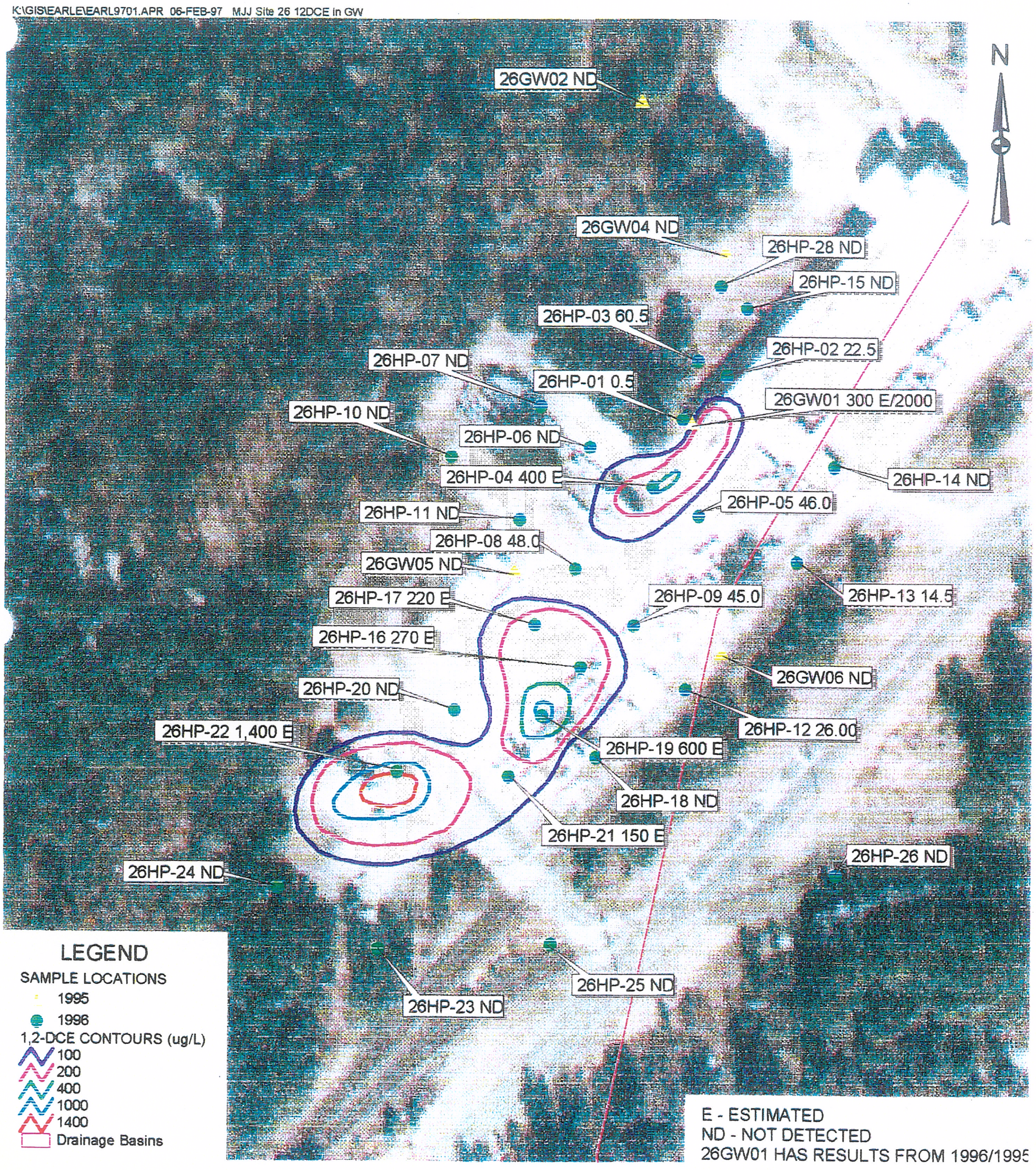
E - ESTIMATED
ND - NOT DETECTED
26GW01 HAS RESULTS FROM 1996/1995

COMPOUNDS IN GROUNDWATER TCE (ug/L) SHALLOW ZONE (<25')
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 10-6

80 0 80 160 Feet

Brown & Root Environmental



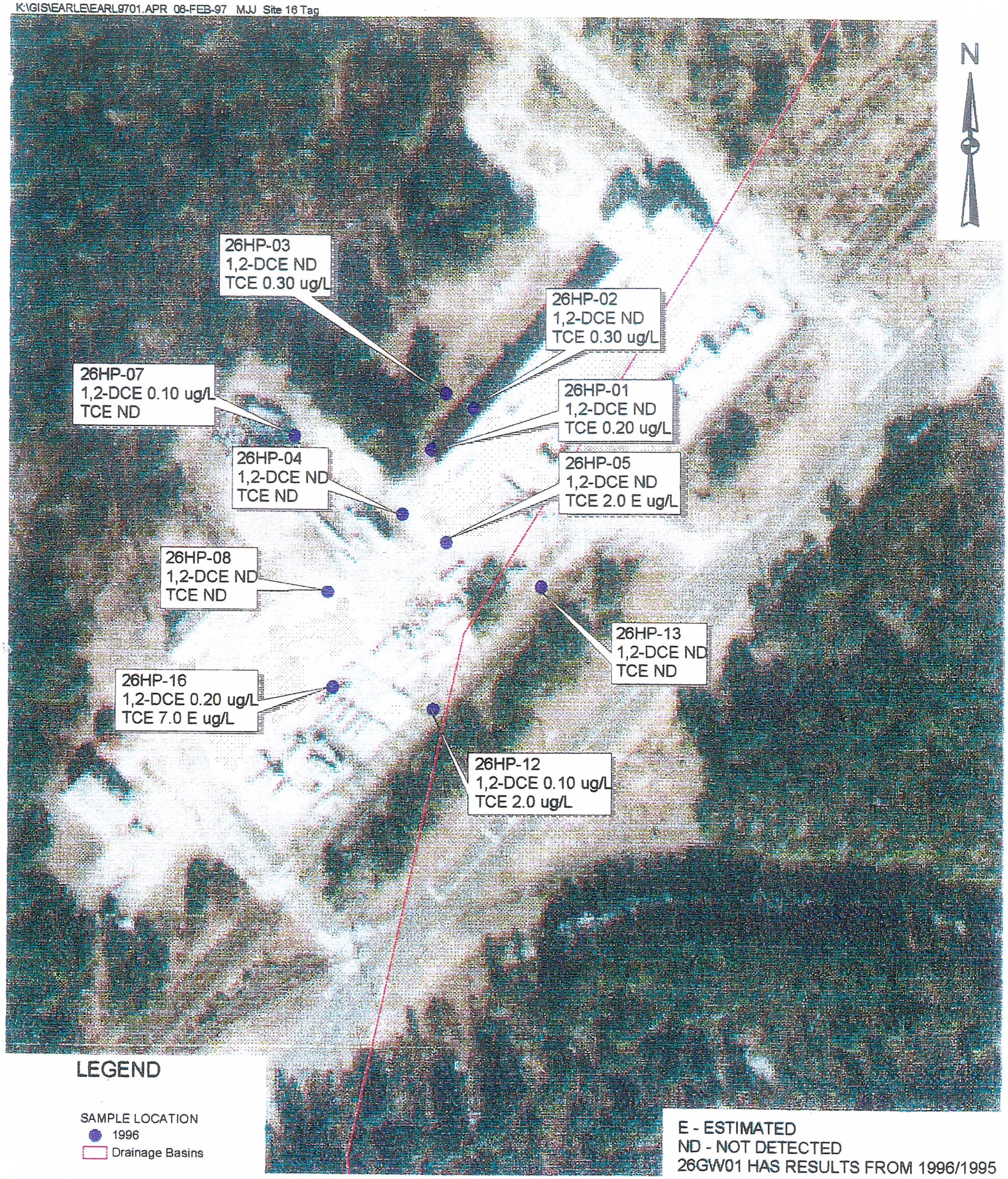
E - ESTIMATED
ND - NOT DETECTED
26GW01 HAS RESULTS FROM 1996/1995

COMPOUNDS IN GROUNDWATER 1,2-DCE (ug/L) SHALLOW ZONE (<25')
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 10-7

Brown & Root Environmental

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ Site 16 Tag



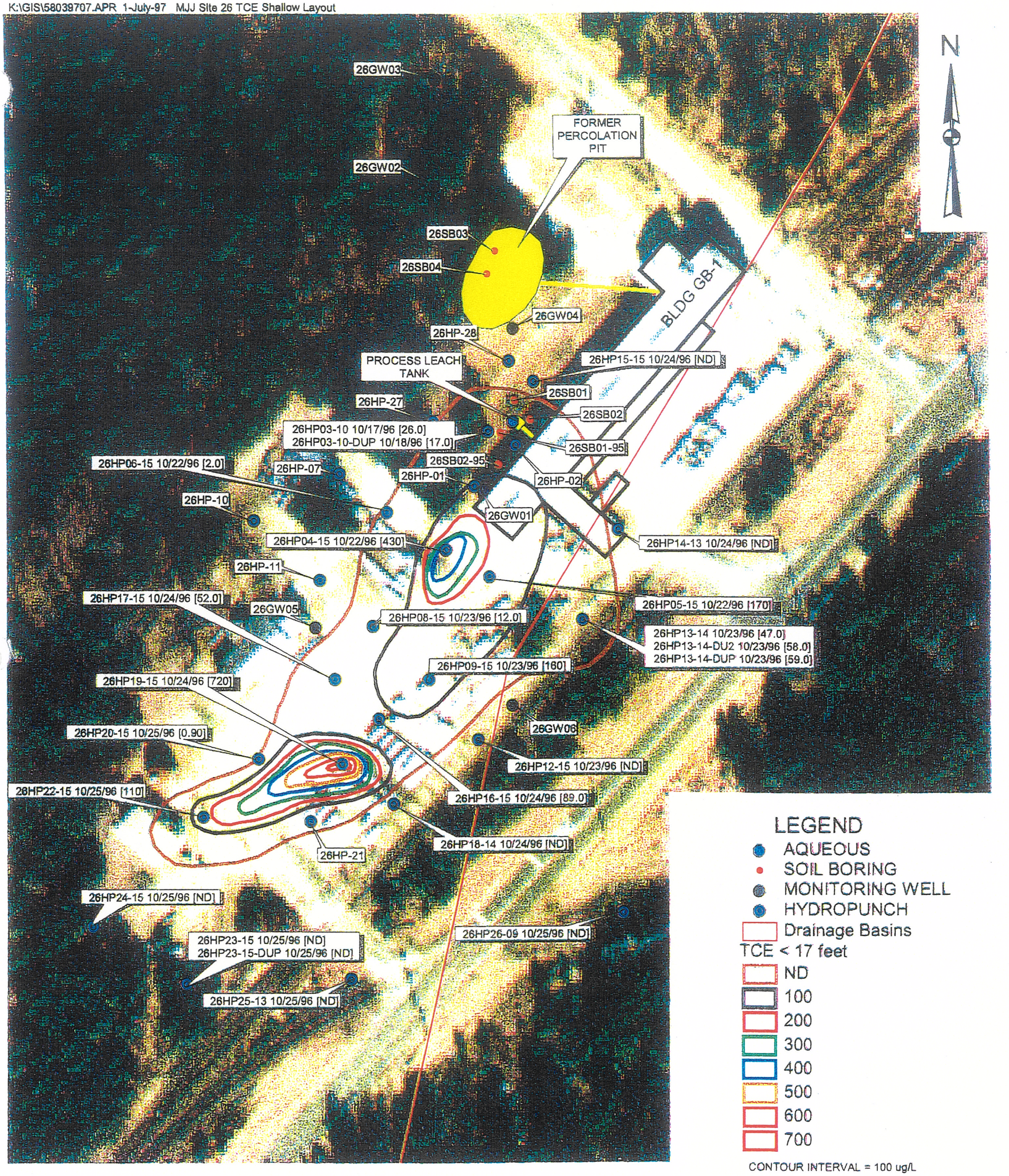
COMPOUNDS IN GROUNDWATER LOWER ZONE (45-79')
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE 10-8

Brown & Root Environmental

K:\GIS\58039707.APR 1-July-97 MJJ Site 26 TCE Shallow Layout



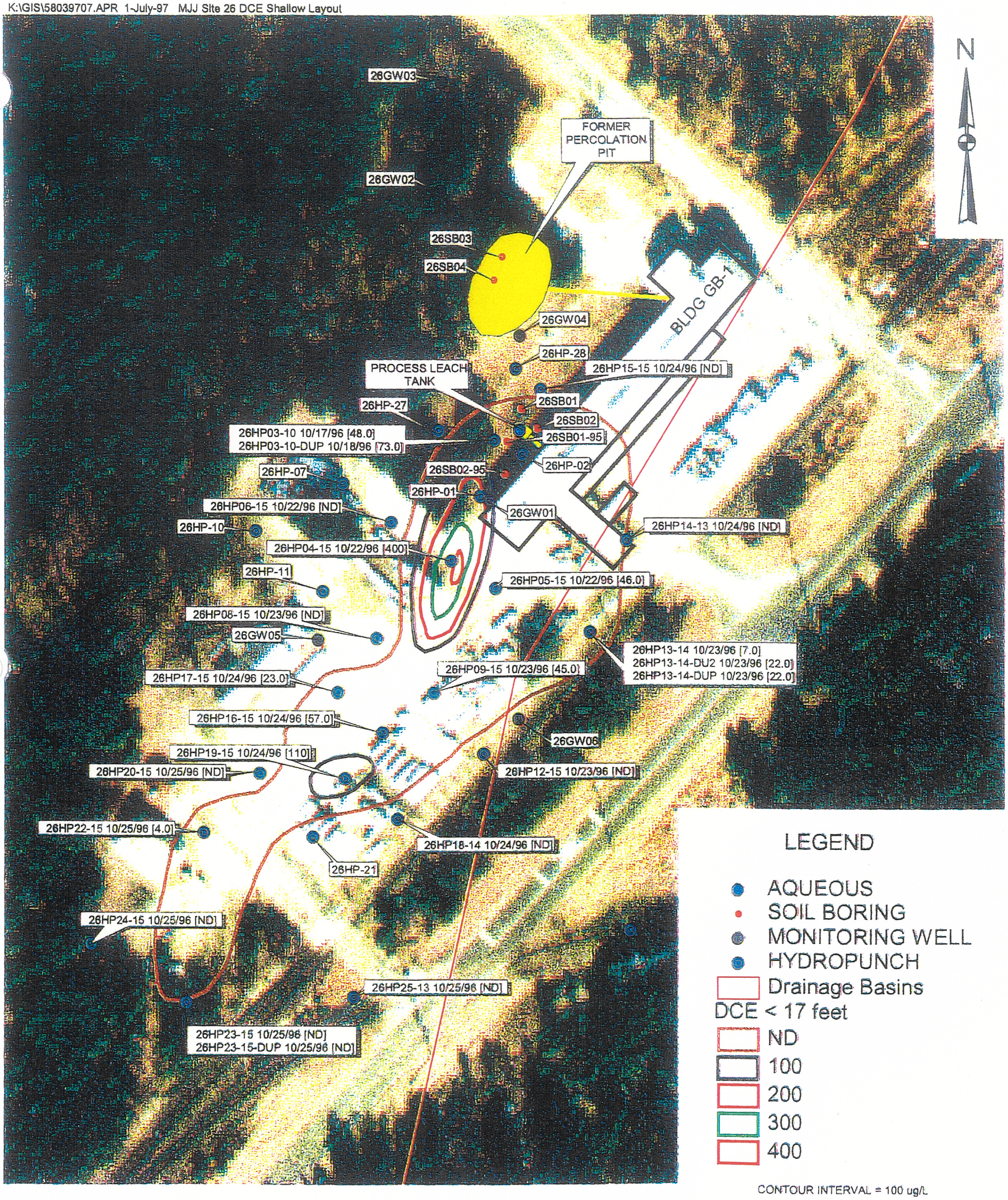
TCE IN GROUNDWATER (< 17 FEET)
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE 10-9

Brown & Root Environmental

K:\GIS\58039707.APR 1-July-97 MJJ Site 26 DCE Shallow Layout



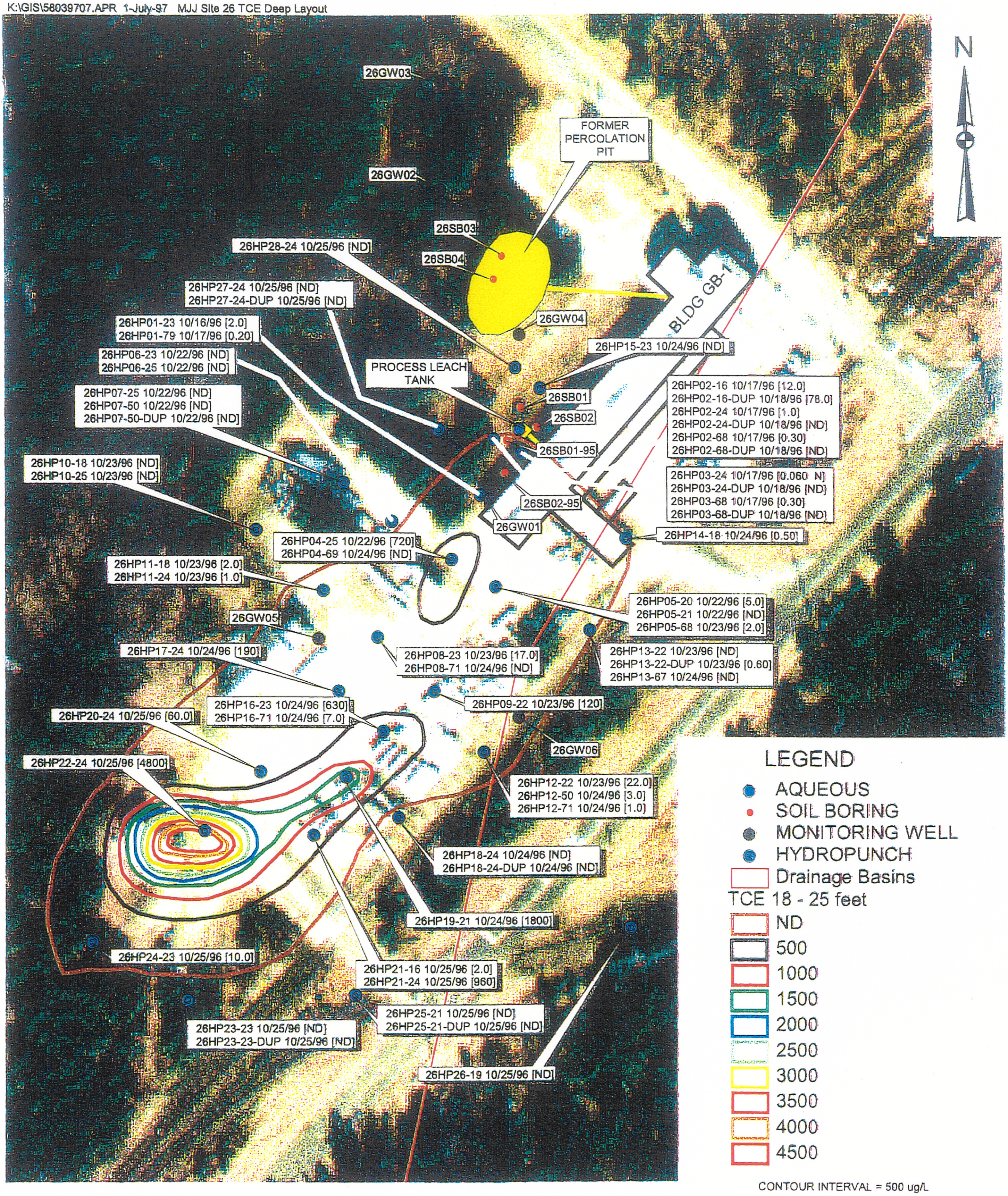
1,2-DCE IN GROUNDWATER (< 17 FEET)
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE 10-10

Brown & Root Environmental

K:\GIS\58039707.APR 1-July-97 MJJ Site 26 TCE Deep Layout



CONTOUR INTERVAL = 500 ug/L

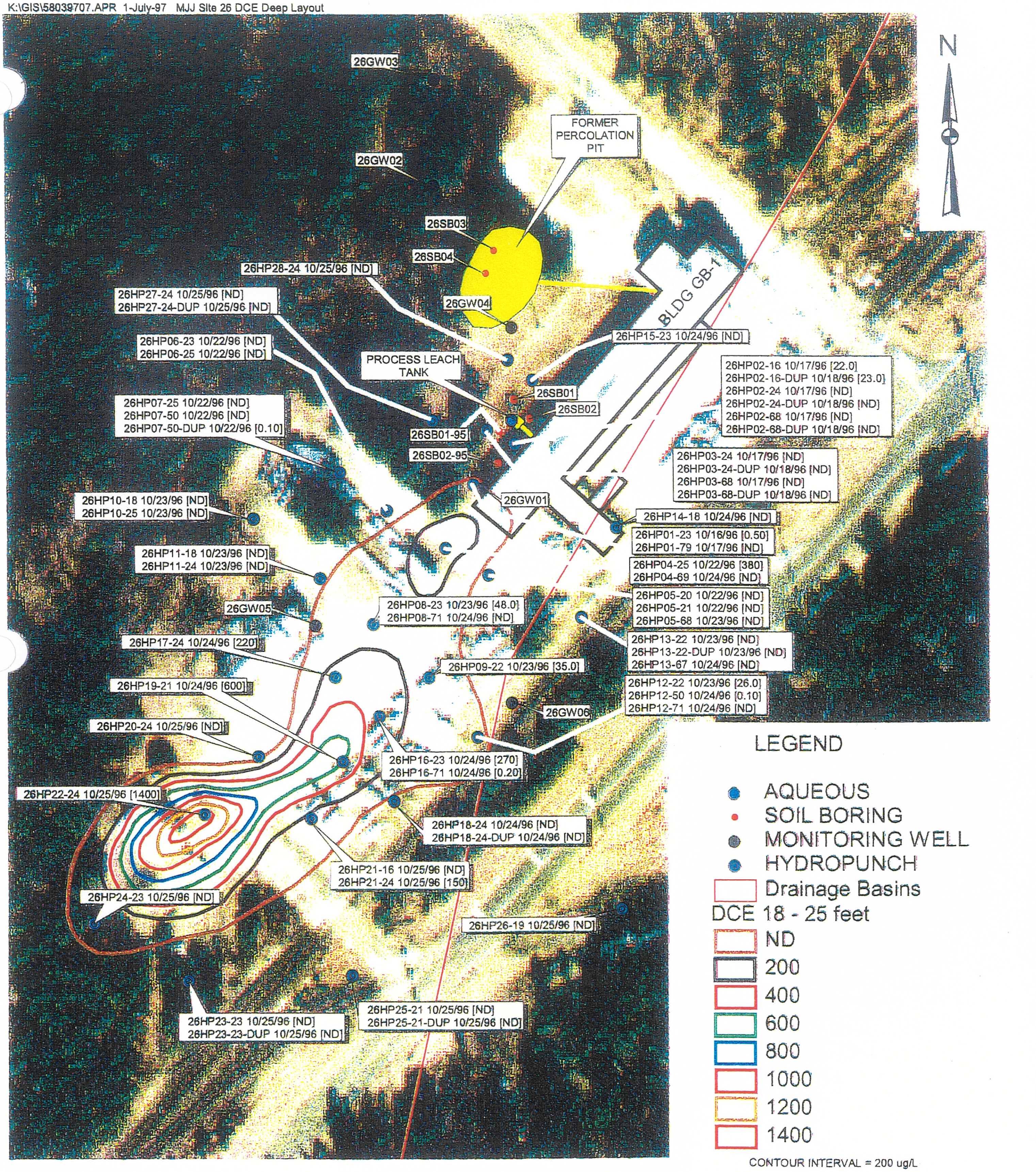
FIGURE 10-11

TCE IN GROUNDWATER (18-25 FEET)
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

Brown & Root Environmental

K:\GIS\58039707.APR 1-July-97 MJJ Site 26 DCE Deep Layout



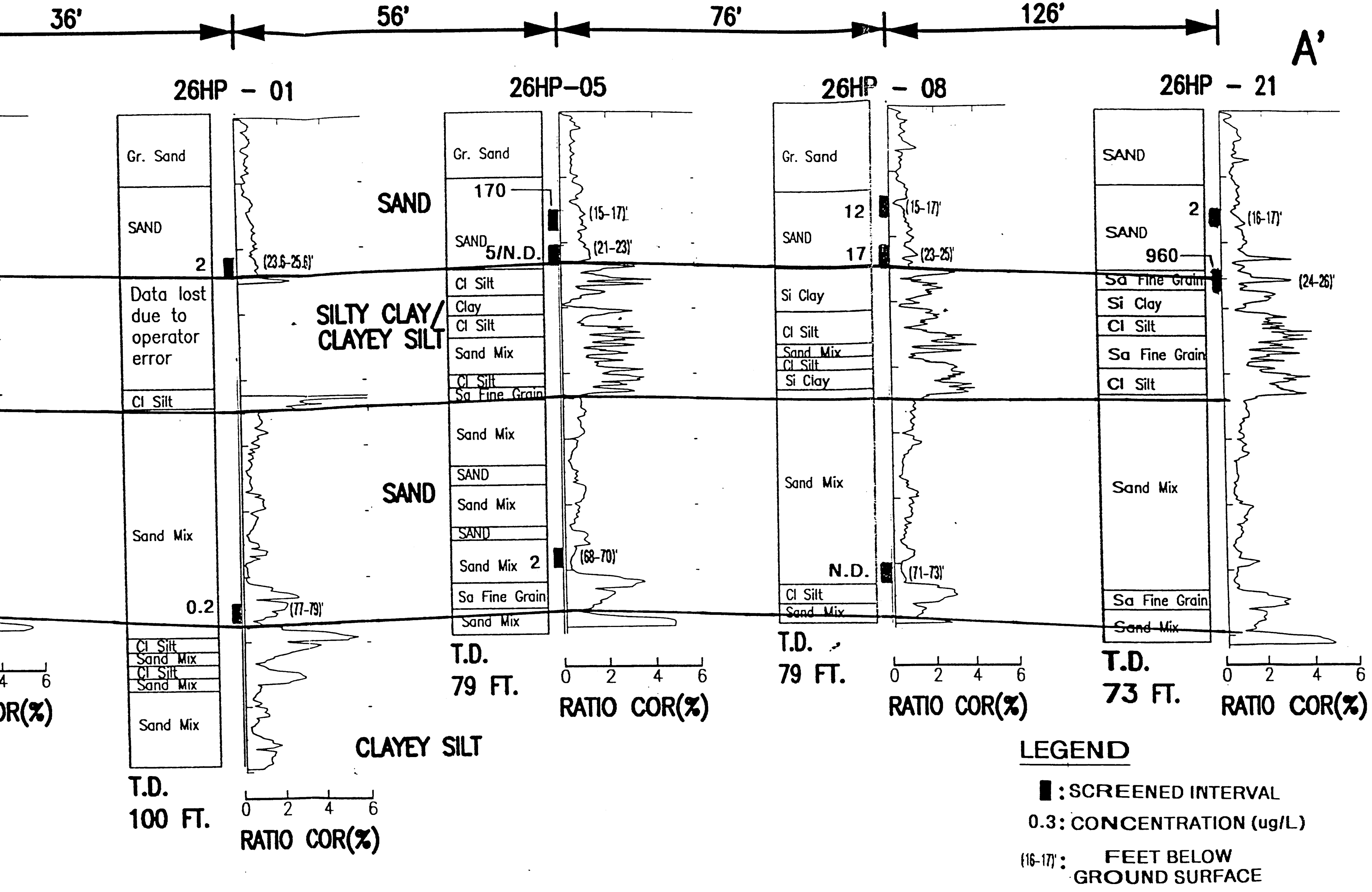
1,2-DCE IN GROUNDWATER (18-25 FEET)
SITE 26 - EXPLOSIVE "D" WASHOUT AREA

80 0 80 160 Feet

FIGURE 10-12

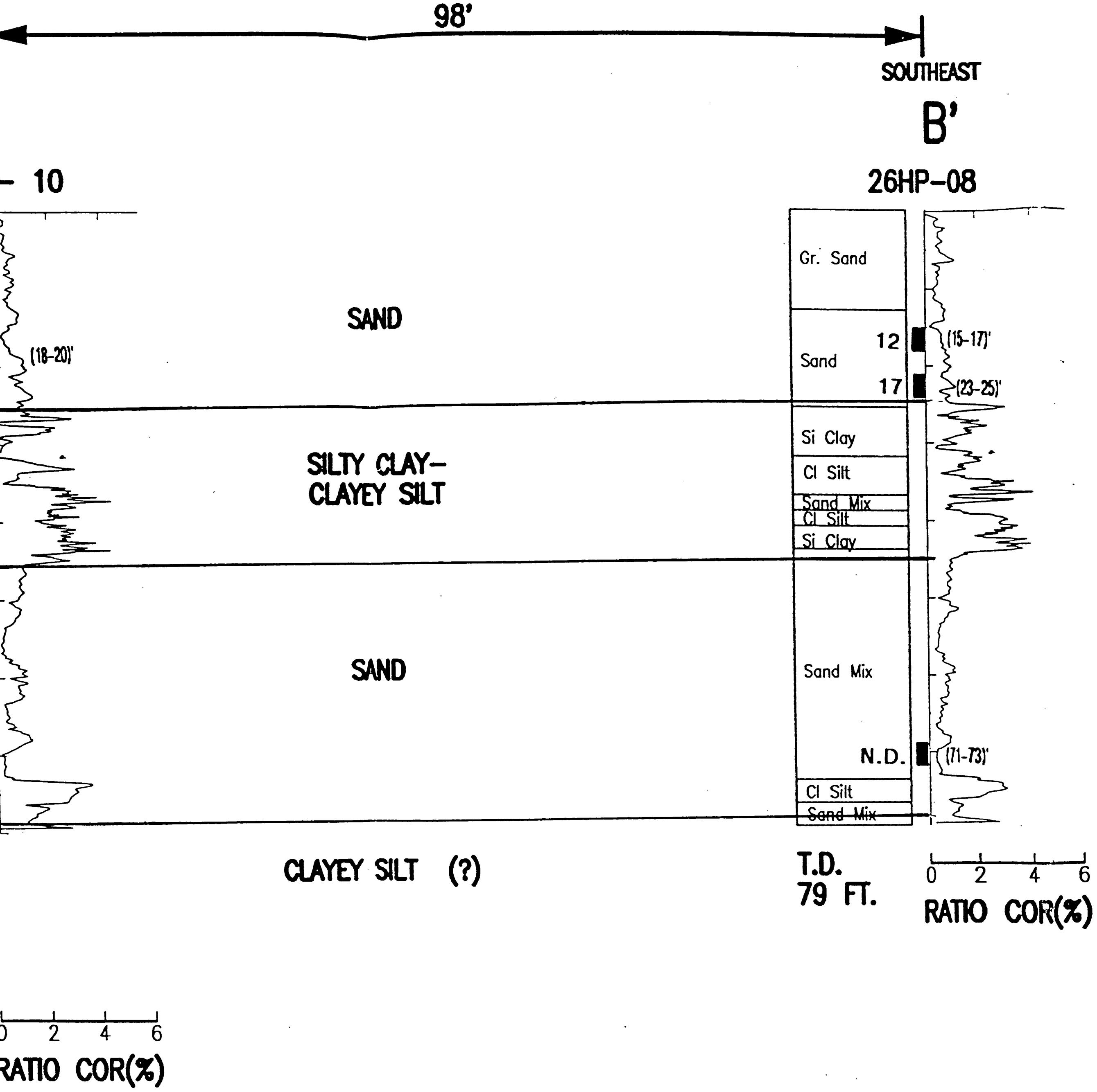
Brown & Root Environmental

STRIKE SECTION A – A'



VERTICAL SCALE 1" = 20'
NOT TO HORIZONTAL SCALE

DIP SECTION B – B'



LEGEND

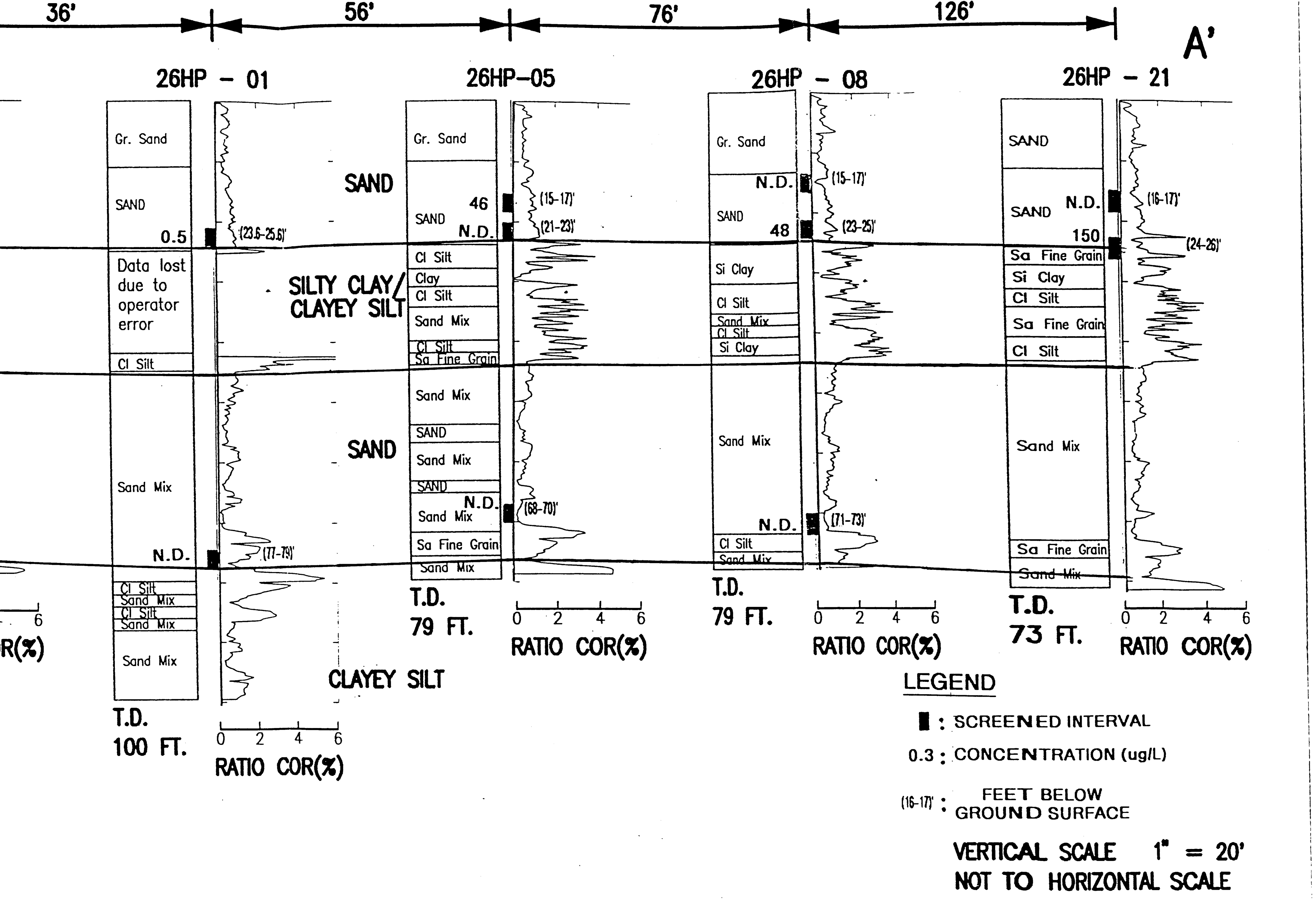
█ :SCREENED INTERVAL

0.3 :CONCENTRATION (ug/L)

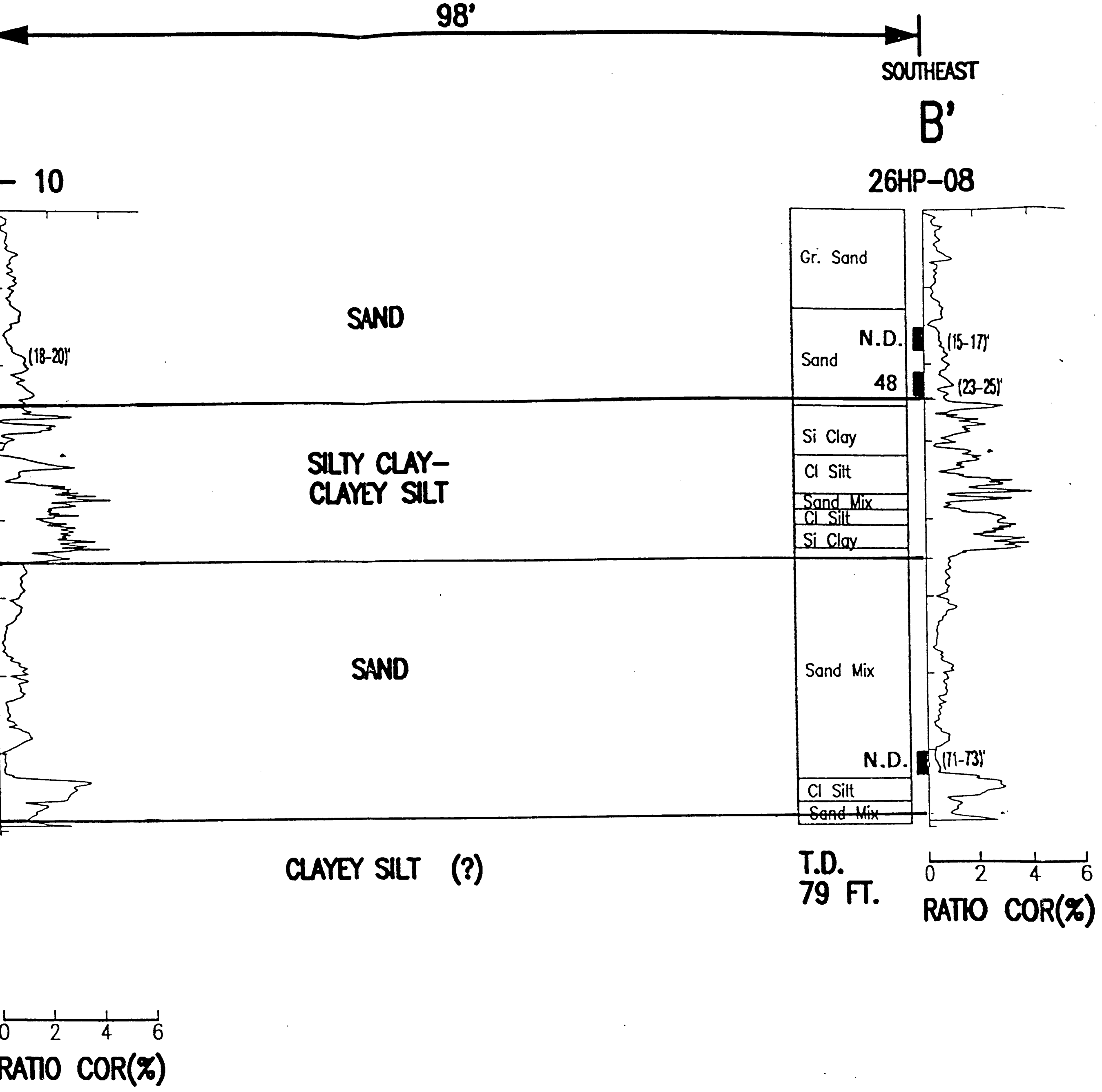
(16-17)' : FEET BELOW GROUND SURFACE

VERTICAL SCALE 1" = 20'
NOT TO HORIZONTAL SCALE

STRIKE SECTION A – A'



DIP SECTION B – B'



LEGEND

■ : SCREENED INTERVAL

0.3 : CONCENTRATION (ug/L)

(16-17)' : FEET BELOW GROUND SURFACE

VERTICAL SCALE 1" = 20'
NOT TO HORIZONTAL SCALE

C:\DWG\EARLE\FIG10 - 9

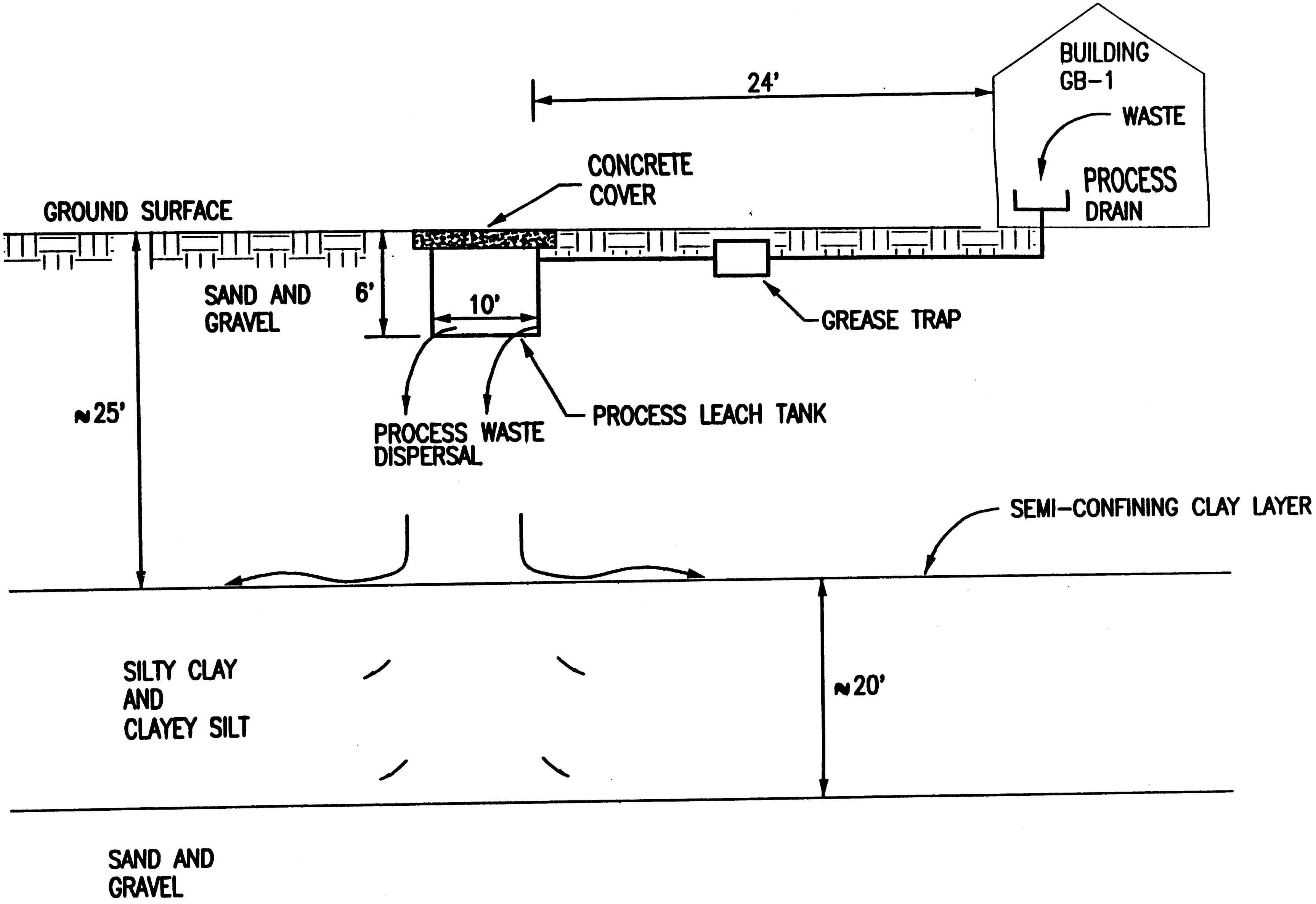


FIGURE 10-17

SITE CONCEPTUAL MODEL

GROUNDWATER CONTAMINATION ROUTE

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

NOT TO SCALE

Brown & Root Environmental

10.6.1 Detected Chemicals and Transport Potential

Analytical results for groundwater sampled at Site 26 indicate significant levels of TCE and associated degradation products in one monitoring well and trace levels of TCE, PCE, and chloroform in another well. Barium was detected in one subsurface soil sample at a level greater than the range of background samples. Zinc was detected in four site-related groundwater samples at similar levels that are greater than the concentration range associated with background samples. Barium was found at similarly elevated levels in three groundwater samples, and cadmium and silver were detected in sample 26 GW 04 at low levels that are greater than background. The physical transport data for the detected contaminants are presented in Table 2-8. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

The organic compounds detected in the groundwater are volatile and characteristically mobile in the environment (either through soil gas migration or groundwater transport). The detected chlorinated VOCs all possess specific gravities greater than 1, which indicates that a product source will tend to sink to the bottom of an aquifer rather than float on the water table.

The inorganic compounds have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility.

10.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment.

1,1-DCE and 1,2-DCE are associated with degradation of PCE and TCE (Cline and Viste, 1983) and may further degrade to vinyl chloride. Concentrations of the parent compounds (TCE and PCE) may diminish over time, depending upon the presence of contaminated source materials that could continue to leach new product into groundwater.

10.6.3 Observed Chemical Contaminant Trends

TCE, PCE, and several of their degradation by-products were detected in the groundwater and in subsurface soil. The levels detected at the location of maximum concentrations (MW26-01) and the lack of any pattern of significant concentrations in other nearby monitoring wells suggest that well MW26-01 may be in close proximity to the area where TCE or PCE was originally released. The similar levels of TCE and 1,2-DCE suggest that the release occurred a number of years ago. This monitoring well exhibited similar concentrations during 1993, 1995, and 1996 sampling investigations. Samples obtained by direct-push methodology indicate a groundwater plume extending from the leach tank area approximately 400 feet southwest to location 26 HP 24. This location showed elevated levels of PCE and TCE; however, was the farthest downgradient sample obtained. The highest levels of contaminants ranges in depth from approximately 15 to 25 bgs, which is a result of the specific gravity of these compounds and the effect of the clay layer acting as a barrier to free downward migration.

The levels of zinc detected in four groundwater samples and barium in three groundwater samples from wells west and north of Building GB-1 do not demonstrate a clear pattern of impact related to any known site-specific source. Similarly, no relationship was identified between historical site activities and the low levels of cadmium and silver that were detected in the monitoring well nearest the former picric acid percolation pit. It should be noted that picric acid and other explosive compounds were not found in samples collected near this pit or elsewhere in Site 26 groundwater and subsurface soil samples.

Antimony was detected at low levels, near the instrument detection limit, in two site-related subsurface soil samples but was not found in background samples. Barium was detected in one subsurface soil sample collected in the former percolation pit. Neither of these metals are apparently associated with former site activities. TCE and 1,2-DCE were found in subsurface soil near the building's grease trap and process leach tank.

10.6.4 Conclusions

TCE, PCE, and related chlorinated aliphatics at Site 26 have impacted the groundwater. Based upon the information gathered during this investigation, the source area appears to be in the vicinity of the southeastern corner of Building GB-1, possibly the process leach tank near monitoring well MW26-01. Lateral contaminant migration in shallow groundwater appears to extend in a relatively narrow band at least 400 feet to the southwest. With the exception of MW26-01, the monitoring well system appears to be located outside the influence of the groundwater plume. Since TCE and related chlorinated aliphatics are heavier than water, downward vertical migration of contamination has occurred. Contamination is greatest at depths of 15 to 25 feet.

Concentrations of most metals in site-related groundwater samples were within ranges similar to background samples. Zinc was detected in four site-related groundwater samples (26 GW 01, 29 GW 02, 26 GW 03, and 26 GW 05) at levels greater than the concentration range associated with background samples. Barium was found at elevated levels in samples 26 GW 01, 26 GW 02, and 26 GW 03, and cadmium and silver were detected in 26 GW 04 at levels exceeding background ranges. Considering the natural acidity of pine barren soils, which would tend to mobilize metals into groundwater, and the fact that overlying soils also contained (normal) quantities of the same metals (e.g., barium), the relatively low levels of metals were concluded to not represent a serious threat to human health and the environment.

Picric acid, an explosive that was previously associated with artillery shell washout processing at Site 26, was not detected in any groundwater or subsurface soil samples collected during this investigation. A 1993 sampling investigation revealed one soil sample within the settling basin that contained picric acid. This compound is not expected to persist in the environment due to its high water solubility and potential for biodegradation. Elevated levels of lead in the soils from the settling basin were detected in the 1993 investigation but were not confirmed in subsurface samples collected subsequently.

10.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 26. The risk assessment was performed using the approach outlined in Section 2.4. Tables 10-8 and 10-9 provide the selected COPCs and representative concentrations of inorganics and organics in site-related subsurface soil, and groundwater, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

TABLE 10-8
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCs SUBSURFACE SOIL - SITE 26 (mg/kg) NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
ANTIMONY	0.55
ARSENIC	3.1
BARIUM	108.16
SILVER	2.4
1,2-DICHLOROETHENE (TOTA	53.99
METHYLENE CHLORIDE*	2
TRICHLOROETHENE*	30.03

* Organic chemicals are in (ug/kg)

TABLE 10-9
REPRESENTATIVE CONCENTRATIONS OF SELECTED COPCs
GROUNDWATER - SITE 26 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION
SILVER	3.06
1,1-DICHLOROETHENE	5
1,2-DICHLOROETHENE (TOTAL)	662.55
CARBON DISULFIDE	13.51
CARBON TETRACHLORIDE	0.002
CHLOROFORM	1
ETHYLBENZENE	3
METHYLENE CHLORIDE	8
TETRACHLOROETHENE	12.4
TRICHLOROETHENE	9100
XYLENE (TOTAL)	2.67

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

10.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential and industrial receptors).

10.7.1.1 Future Industrial Employee

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 26 are 1.6E-05 (ingestion), 1.6E-05 (dermal contact), and 3.6E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 26 are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 26 in Tables 10-10 and 10-11, respectively.

CTE

No CTE analysis is required for subsurface soil exposure.

TABLE 10-10
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOT	N/A	N/A	N/A
METHYLENE CHLORIDE	5.2E-12	N/A	1.0E-15
TRICHLOROETHENE	1.2E-10	N/A	2.4E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	1.6E-05	1.6E-05	3.6E-09
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	1.6E-05	1.6E-05	3.6E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-11
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	5.9E-06	N/A	1.1E-09
METHYLENE CHLORIDE	3.3E-08	N/A	6.1E-12
TRICHLOROETHENE	4.9E-06	N/A	9.1E-10
ANTIMONY	1.3E-03	N/A	2.5E-07
ARSENIC	1.0E-02	1.0E-02	1.9E-06
BARIUM	1.5E-03	N/A	2.8E-05
SILVER	4.7E-04	N/A	8.7E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Groundwater Exposure

RME

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 26 is 3.6E-04 (ingestion). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is TCE (ingestion, 99 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 26 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future industrial receptor, the target organs, corresponding HIs, and principal COPCs are as follows: cardiovascular effects (16 - 1,2-DCE and TCE) and central nervous system (15 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 26 in Tables 10-12 and 10-13, respectively.

CTE

The estimated total cancer risk for the future industrial employee for exposure to COPCs in groundwater at Site 26 is 5.0E-06 (ingestion). The total groundwater cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the groundwater cancer risk are TCE (ingestion, 72 percent of the cancer risk for this pathway) and 1,1-DCE (ingestion, 22 percent or the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 26 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future industrial receptor, the target organs, corresponding HIs, and principal COPCs are as follows: cardiovascular effects (9.5- 1,2-DCE and TCE) and central nervous system (9.1 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

TABLE 10-12
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	1.0E-05	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
CARBON DISULFIDE	N/A	N/A
CARBON TETRACHLORIDE	9.1E-10	N/A
CHLOROFORM	2.1E-08	N/A
ETHYLBENZENE	N/A	N/A
METHYLENE CHLORIDE	2.1E-07	N/A
TETRACHLOROETHENE	2.3E-06	N/A
TRICHLOROETHENE	3.5E-04	N/A
SILVER	N/A	N/A
TOTAL RISK	3.6E-04	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-13
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATE INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	5.4E-03			5.4E-03	5.4E-03					N/A
1,2-DICHLOROETHENE (TOTAL)	7.2E-01	7.2E-01			7.2E-01					N/A
CARBON DISULFIDE	1.3E-03	1.3E-03	1.3E-03	1.3E-03	1.3E-03		1.3E-03		1.3E-03	N/A
CARBON TETRACHLORIDE	2.8E-05									N/A
CHLOROFORM	9.8E-04			9.8E-04	9.8E-04					N/A
ETHYLBENZENE	2.9E-04			2.9E-04	2.9E-04				2.9E-04	N/A
METHYLENE CHLORIDE	1.3E-03				1.3E-03					N/A
TETRACHLOROETHENE	1.2E-02				1.2E-02					N/A
TRICHLOROETHENE	1.5E+01	1.5E+01					1.5E+01			N/A
SILVER	6.0E-03		6.0E-03							N/A
	HI BY TARGET	1.6E+01	7.3E-03	8.0E-03	7.4E-01		1.5E+01		1.6E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 26 in Tables 10-14 and 10-15, respectively.

10.7.1.2 Future Residential Receptor

Subsurface Soil Exposure

RME

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 26 are 7.3E-05 (ingestion), 5.3E-05 (dermal contact), and 2.2E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 26 are less than 1.0 for the ingestion, dermal contact and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil at Site 26 in Tables 10-16 and 10-17, respectively.

CTE

The estimated total cancer risks for the future residential receptor for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 26 are 5.0E-06 (ingestion), 7.1E-06 (dermal contact), and 2.9E-10 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

TABLE 10-14
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	1.1E-06	N/A
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
CARBON DISULFIDE	N/A	N/A
CARBON TETRACHLORIDE	1.0E-10	N/A
CHLOROFORM	2.4E-09	N/A
ETHYLBENZENE	N/A	N/A
METHYLENE CHLORIDE	2.3E-08	N/A
TETRACHLOROETHENE	2.5E-07	N/A
TRICHLOROETHENE	3.6E-06	N/A
SILVER	N/A	N/A
TOTAL RISK	5.0E-06	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-15
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATE INGESTION	CARDIO- VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO- DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	3.3E-03			3.3E-03	3.3E-03					N/A
1,2-DICHLOROETHENE (TOTA	4.4E-01	4.4E-01			4.4E-01					N/A
CARBON DISULFIDE	8.1E-04									N/A
CARBON TETRACHLORIDE	1.7E-05									N/A
CHLOROFORM	6.0E-04			6.0E-04	6.0E-04					N/A
ETHYLBENZENE	1.8E-04									N/A
METHYLENE CHLORIDE	8.0E-04									N/A
TETRACHLOROETHENE	7.4E-03				7.4E-03					N/A
TRICHLOROETHENE	9.1E+00	9.1E+00					9.1E+00			N/A
SILVER	3.7E-03		3.7E-03							N/A
	HI BY TARGET	9.5E+00	3.7E-03	3.9E-03	4.5E-01		9.1E+00			

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-16
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCs IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOT	N/A	N/A	N/A
METHYLENE CHLORIDE	2.3E-11	N/A	6.2E-16
TRICHLOROETHENE	5.2E-10	N/A	1.5E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	7.3E-05	5.3E-05	2.2E-09
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	7.3E-05	5.3E-05	2.2E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-17
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL CHILD RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCs IN FUGITIVE DUST - CHILD
1,2-DICHLOROETHENE (TOTAL)	7.7E-05	N/A	1.1E-09
METHYLENE CHLORIDE	4.3E-07	N/A	6.5E-12
TRICHLOROETHENE	6.4E-05	N/A	9.6E-10
ANTIMONY	1.8E-02	N/A	2.6E-07
ARSENIC	1.3E-01	8.2E-02	2.0E-06
BARIUM	2.0E-02	N/A	2.9E-05
SILVER	6.1E-03	N/A	9.2E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated CTE carcinogenic risks are presented for future residential receptors exposed to subsurface soil at Site 26 in Table 10-18.

Groundwater Exposure

RME

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 26 is 1.5E-03 (ingestion) and 5.3E-04 (inhalation of VOCs during showering). The total groundwater cancer risk exceeds the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is TCE (ingestion, 99 percent of the cancer risk for this pathway and inhalation, 99 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in groundwater at Site 26 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: cardiovascular effects (100 - 1,2-DCE and TCE), liver (4.8 - 1,2-DCE), and central nervous system (97 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 26 in Tables 10-19 and 10-20, respectively.

CTE

The estimated total cancer risk for the future residential receptor for exposure to COPCs in groundwater at Site 26 is 4.8E-05 (ingestion) and 1.6E-04 (inhalation of VOCs during showering). The total groundwater cancer risk is at the upper end of the 10^{-4} to 10^{-6} target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPC contributing to the groundwater cancer risk is TCE (ingestion, 97 percent of the cancer risk for this pathway and inhalation, 99 percent or the cancer risk for this pathway).

TABLE 10-18
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCs IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
METHYLENE CHLORIDE	3.8E-12	N/A	1.9E-16
TRICHLOROETHENE	8.3E-11	N/A	4.5E-15
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.0E-06	7.1E-06	2.9E-10
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	5.0E-06	7.1E-06	2.9E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-19
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAs IN GW - ADULT
1,1-DICHLOROETHENE	4.5E-05	N/A	9.6E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
CARBON DISULFIDE	N/A	N/A	N/A
CARBON TETRACHLORIDE	3.9E-09	N/A	9.5E-10
CHLOROFORM	9.1E-08	N/A	7.8E-07
ETHYLBENZENE	N/A	N/A	N/A
METHYLENE CHLORIDE	8.9E-07	N/A	1.4E-07
TETRACHLOROETHENE	9.6E-06	N/A	2.2E-07
TRICHLOROETHENE	1.5E-03	N/A	5.2E-04
SILVER	N/A	N/A	N/A
TOTAL RISK	1.5E-03	N/A	5.3E-04

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-20
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN									
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAs IN GW - ADULT
1,1-DICHLOROETHENE	3.6E-02			3.6E-02	3.6E-02					N/A	N/A
1,2-DICHLOROETHENE (TOTAL)	4.7E+00	4.7E+00			4.7E+00					N/A	N/A
CARBON DISULFIDE	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03		8.6E-03		8.6E-03	N/A	2.4E-03
CARBON TETRACHLORIDE	1.8E-04									N/A	9.3E-05
CHLOROFORM	6.4E-03			6.4E-03	6.4E-03					N/A	N/A
ETHYLBENZENE	1.9E-03			1.9E-03	1.9E-03				1.9E-03	N/A	3.2E-04
METHYLENE CHLORIDE	8.5E-03				8.5E-03					N/A	3.0E-04
TETRACHLOROETHENE	7.9E-02				7.9E-02					N/A	N/A
TRICHLOROETHENE	9.7E+01	9.7E+01					9.7E+01			N/A	N/A
SILVER	3.9E-02		3.9E-02							N/A	N/A
	HI BY TARGET ORGAN	1.0E+02	4.8E-02	5.2E-02	4.8E+00		9.7E+01		1.1E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

101.841503

3.10E-03

The estimated noncarcinogenic HIs for the future residential receptor assuming exposure to COPCs in groundwater at Site 26 exceeded 1.0 for the ingestion exposure pathways. For groundwater ingestion by the future residential receptor, the target organs, corresponding HIs, and principal COPCs are as follows: cardiovascular effects (48 - 1,2-DCE and TCE), liver (2.3 - 1,2-DCE), and central nervous system (45 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0. Estimated CTE carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 26 in Tables 10-21 and 10-22, respectively.

10.7.2 Conclusions

Subsurface soil and groundwater were sampled at Site 26. The potential receptors for this site were future industrial and residential receptors.

The RME cancer risks associated with future residential (subsurface soil and groundwater) exposure scenarios exceeded the 10^{-4} to 10^{-6} target acceptable risk range. In addition, CTE cancer risks also exceeded the the 10^{-4} to 10^{-6} target acceptable risk range. TCE and 1,1-DCE (via groundwater ingestion and inhalation during showering) and arsenic (via ingestion of and dermal contact with soil) are the principal COPCs that contributed to the cancer risks for these exposure scenarios.

RME estimates for noncarcinogenic HIs associated with future industrial and future residential (groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse noncarcinogenic effects are not expected to occur. TCE and 1,2-DCE were the COPCs that exceeded 1.0 or contributed to the HI exceeding 1.0 for these exposure scenarios. In addition, CTE risk estimates for residential and industrial exposure to groundwater yielded HIs greater than 1.0; affected target organs include liver, cardiovascular system, and central nervous system.

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 26 in Table 10-23 for subsurface soil and groundwater. Table 10-24 presents the relevant central tendency risk estimates associated with potential receptors for subsurface soil and groundwater. The estimated RME cancer risk for the future industrial employee is at the upper end of the target acceptable risk range. The estimated RME cancer risk for the future residential receptor exceeds the target acceptable risk range, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds the target acceptable risk range, based mainly on ingestion of groundwater. The estimated RME noncancer HI for the future industrial employee and the future residential receptor exceeds 1.0, based

TABLE 10-21
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAs IN GW - ADULT
1,1-DICHLOROETHENE	2.3E-05	N/A	2.8E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
CARBON DISULFIDE	N/A	N/A	N/A
CARBON TETRACHLORIDE	1.8E-09	N/A	2.8E-10
CHLOROFORM	4.1E-08	N/A	2.8E-07
ETHYLBENZENE	N/A	N/A	N/A
METHYLENE CHLORIDE	4.1E-07	N/A	4.3E-08
TETRACHLOROETHENE	4.36E-06	N/A	6.5E-08
TRICHLOROETHENE	6.77E-04	N/A	1.5E-04
SILVER	N/A	N/A	N/A
TOTAL RISK	4.8E-05	N/A	1.6E-04

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-22
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAs IN GW - ADULT
1,1-DICHLOROETHENE	1.6E-02			1.6E-02	1.6E-02				N/A	N/A
1,2-DICHLOROETHENE (TOTAL)	2.2E+00	2.2E+00			2.2E+00				N/A	N/A
CARBON DISULFIDE	4.4E-03								N/A	7.1E-04
CARBON TETRACHLORIDE	2.6E-05								N/A	2.7E-05
CHLOROFORM	3.0E-03			3.0E-03	3.0E-03				N/A	N/A
ETHYLBENZENE	9.0E-04								N/A	9.3E-05
METHYLENE CHLORIDE	1.4E-03								N/A	8.8E-05
TETRACHLOROETHENE	3.7E-02				3.7E-02				N/A	N/A
TRICHLOROETHENE	4.5E+01	4.5E+01					4.5E+01		N/A	N/A
SILVER	1.8E-02		1.8E-02						N/A	N/A
	HI BY TARGET ORGAN	4.8E+01	1.8E-02	1.9E-02	2.3E+00		4.5E+01			

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 10-23
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreation Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreation Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dus	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.6E-05	7.3E-05	N/A	N/A	1.4E-02	1.8E-01	N/A	N/A
	Dermal Contact	N/A	1.6E-05	5.3E-05	N/A	N/A	1.0E-02	8.2E-02	N/A	N/A
	Inhalation of Fugitive Dus	N/A	3.6E-09	2.2E-09	N/A	N/A	3.0E-05	3.2E-05	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	3.6E-04^	1.5E-03	N/A	N/A	1.6E+00@	1.0E+02@	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	5.3E-04	N/A	N/A	N/A	N/A	3.1E-03	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	3.9E-04	2.2E-03	-	-	1.6E+00	1.0E+02	3.1E-03	-

N/A = Not applicable because this media is not associated with this potential receptor

N/S = Not sampled

* = During Showering, Adult Residents Only

*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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TABLE 10-24
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreation Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreation Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dus	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	5.0E-06	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	7.1E-06	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dus	N/A	N/R	2.9E-10	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	5.0E-06	7.2E-04	N/A	N/A	9.5E+00@	4.8E+01@	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	1.6E-04	N/A	N/A	N/A	N/A	9.2E-04	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	TOTAL	-	5.0E-06	8.9E-04	-	-	9.5E+00	4.8E+01	9.2E-04	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation is not required
N/S = Not sampled
* = During Showering, Adult Residents Only
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

mainly on ingestion of groundwater. The estimated CTE cancer risk for the future industrial employee and the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

TCE was detected in 43 out of 72 site-related groundwater samples at a range of 0.06 ug/l to 9100 ug/l. Other volatile organics have also impacted groundwater including 1,1-DCE, 1,2-DCE (total), and PCE. Several TCE hits in site-related samples were greater than 100 ug/l. TCE has impacted groundwater and is clearly elevated at Site 26. Arsenic in subsurface soil also was a driver for the human health risk assessment. Arsenic was detected in four out of six site-related subsurface soil samples at a range of 0.59 mg.kg to3.1 mg/kg. Arsenic in background subsurface soil samples was detected in all eight samples collected at a range of 1.35 mg/kg to 14.4 mg/kg. Arsenic was clearly within the range of background at Site 26 in site-related subsurface soils. Additionally, The average concentration of arsenic in site-related samples was lower than the background sample average concentrations.

10.8 EVALUATION SUMMARY

Significant concentrations of chlorinated compounds (notably TCE) are associated with soils near the process leach tank. These soils appear to be a continuing source of chlorinated VOC contamination to groundwater. Figure 10-10 shows the conceptual site model.

Chlorinated compounds, such as TCE, appear to have been disposed of in the process leach tank over a period of years, resulting in a wide area of contaminated groundwater. A fifteen to twenty foot-thick clayey silt/silty clay formation at a depth of approximately 25 feet bgs underlying the entire site appears to have acted as a barrier to free downward dispersal of the DNAPL. As a result, there now is a wide volume of chlorinated VOC contaminated groundwater migrating slowly in the formation above the clay layer.

The extent of groundwater that contains chlorinated compounds at Site 26 has largely been defined by RI Addendum activities. Vertically there is a limit at the clay layer. Horizontally the contaminant plume is as described in Figures 10-6 through 10-9. However, there is a gap in the definition of the horizontal extent of VOC contamination. Sample 26HP24, which is the farthest downgradient sample point, showed PCE at a concentration above regulatory limits.

11.0 BACKGROUND

Results of background samples collected during 1995 RI activities as well as results of RI Addendum background samples were used to evaluate the RI Addendum sampling data.

11.1 RI BACKGROUND SAMPLING

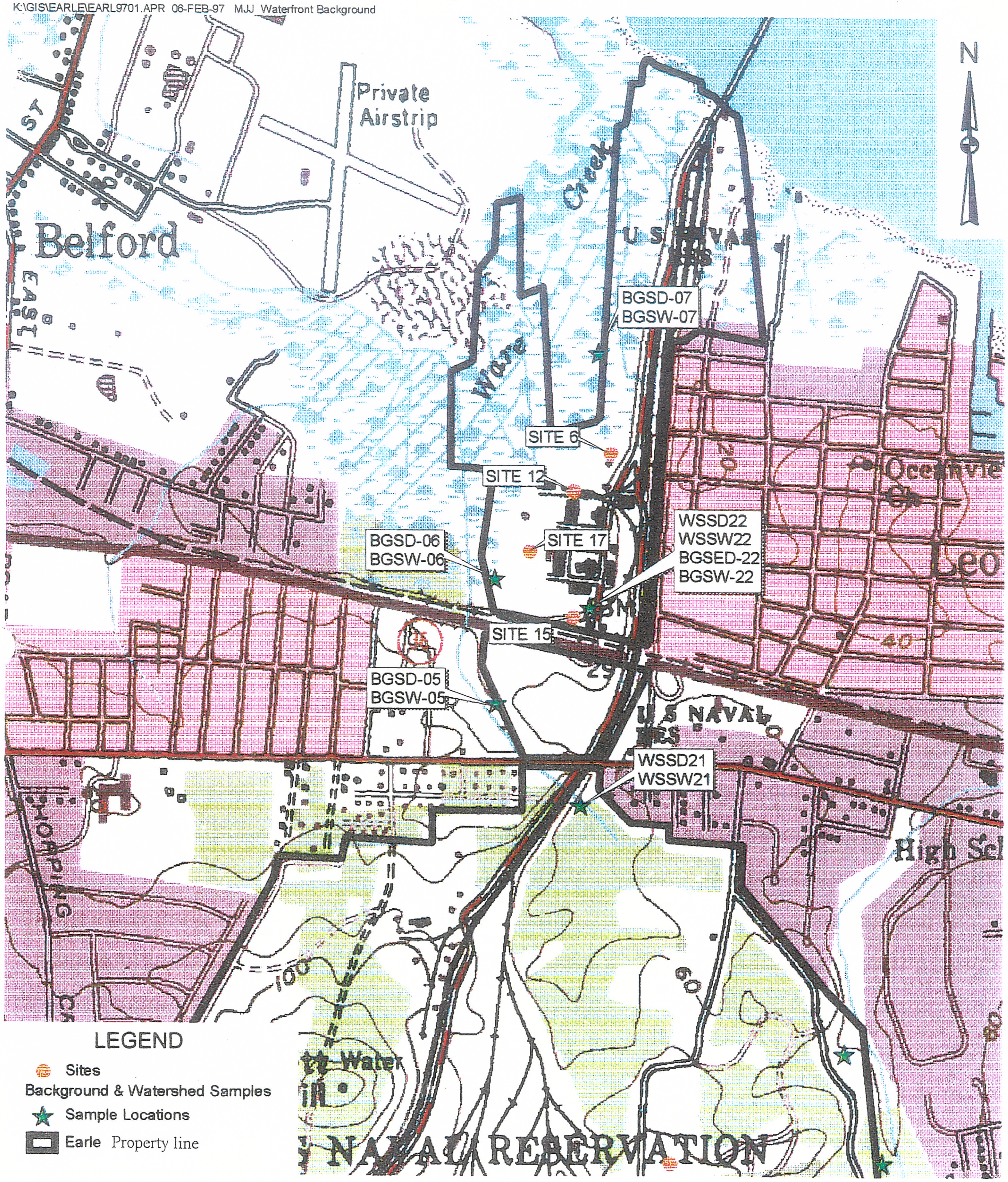
To determine the background level of chemicals present in and around NWS Earle, B&R Environmental collected samples during 1995 RI activities at locations that were known or suspected to not have been impacted by past or present operations. The field team collected samples of surface soil, subsurface soil, sediment, surface water, and groundwater. The samples were collected in areas hydraulically upgradient and, where possible, upwind of station areas where industrial operations or other potential sources of contaminant release may have occurred. The results of the background sampling were used for comparison with analytical results obtained from the sampling activities at the RI sites. A total of four background samples were collected for each of the five media. The BG-4 suite of background media was split between the Mainside (surface water and sediment) and Waterfront (groundwater and subsurface soils) areas because surface water and sediment were not available at the Waterfront BG-4 location.

Three background sampling locations were located on the Mainside (BG-1, BG-2, and BG-4) and two background sampling locations were located at the Waterfront area (BG-3 and BG-4). RI watershed and background sampling performed in 1995 are discussed in Section 30 and 31 of the July 1996 RI report for NWS Earle.

11.2 RI ADDENDUM BACKGROUND SAMPLING

Results of the RI indicated that additional background samples were required to properly evaluate the extent of contamination in the marsh wetlands at Sites 3, 6, and 17. Background samples were obtained from media similar in characteristics to on-site samples, but from areas outside the known or suspected areas of influence of the sites. Background samples should be considered as representative of site or facility background rather than New Jersey state-wide background. Figure 11-1 presents background samples obtained from the Ware Creek watershed and used for evaluating data from Sites 3, 6, and 17. In addition, compounds which may be related to railroad bed materials were detected at Site 12. It was determined that samples of railroad bed ballast material would be obtained to provide reference background levels for

K:\GIS\EARLE\EARL9701.APR 06-FEB-97 MJJ Waterfront Background



SAMPLE LOCATIONS
BACKGROUND SAMPLES

1000 0 1000 2000 Feet

FIGURE 11-1

Brown & Root Environmental

comparison to site data. Table 11-1 summarizes the locations and purpose of the background samples used for data evaluation in this RI Addendum.

11.2.1 Watershed Sampling Activities

During RI Addendum field activities, three surface water (BGSW05-OCT.96, BGSW06-OCT.96, and BGSW07) and associated sediment samples (BGSD05-OCT.96, BGSD06-OCT.96, and BGSD07) were obtained from Ware Creek marsh to provide reference data on which to evaluate potential impacts on the marsh area from the waterfront sites. Samples were analyzed by IEA Laboratories for TAL metals, TCL SVOCs, and TCL pesticides/PCBs.

Laboratory parameters for aqueous samples included TSS, alkalinity, hardness, BOD, COD, and TDS. Laboratory parameters for sediment samples included TOC, grain size, and percent moisture. Field parameters for aqueous samples included temperature, dissolved oxygen, pH, conductivity, salinity, and flow data. Field parameters for sediment samples included Eh, pH, conductivity and color.

11.2.2 Railroad Bed Ballast Sampling Activities

Two samples of railroad bed ballast materials (WFRRB02 was collected at the Waterfront area near the Route 36 underpass, and 19RRB01 was collected at Site 19) were collected from locations outside potential impacts from the NWS Earle sites. Samples were composites of three locations each. Sample analysis by IEA was for Synthetic Precipitation Leachate Procedure (SPLP) to evaluate the leachability of the ballast material.

11.3 RESULTS OF ANALYSIS

11.3.1 Background Samples

The analysis of samples BGSWO5, BGSW06, and BGSW07 are presented and discussed in Sections 5.0 and 9.0. The results have been used in the human health and ecological risk assessments.

TABLE 11-1

BACKGROUND SAMPLE LOCATIONS

SAMPLE	LOCATION	MEDIA	PURPOSE
BGSW05/BGSD05 (1)	Ware Creek Marsh	Surface water/sediment	Evaluate impacts on marsh from Sites 3, 6, and 17
BGSW06/BGSD06 (1)	Ware Creek Marsh	Surface water/sediment	Evaluate impacts on marsh from Sites 3, 6, and 17
BGSW07/BGSD07 (1)	Ware Creek Marsh	Surface water/sediment	Evaluate impacts on marsh from Sites 3, 6, and 17
19RRB01 (1)	Railroad bed ballast near Site 19	Ballast material	Evaluate contribution from metals leaching from railroad bed ballast material on Site 12.
WFRRB02 (1)	Railroad bed ballast from waterfront area	Ballast material	Evaluate contribution from metals leaching from railroad bed ballast material on Site 12.
BG-01 (2)	Northeastern portion of Mainside area.	Surface soil, subsurface soil, surface water and sediment, and groundwater	Comparison to site-related samples obtained from comparable media.
BG-02 (2)	North side of Hominy Hills- Mainside Area	Surface soil, subsurface soil, surface water and sediment, and groundwater	Comparison to site-related samples obtained from comparable media.
BG-03 (2)	Waterfront area	Surface soil, subsurface soil, and groundwater	Comparison to site-related samples obtained from comparable media.
BG-04 (2)	250 feet east of Site 15 - Waterfront area (groundwater and soils), and south side of Hominy Hills - Mainside area (surface water and sediment)	Surface soil, subsurface soil, surface water and sediment, and groundwater	Comparison to site-related samples obtained from comparable media.

(1) Samples collected during RI Addendum field activities
(2) Samples collected during Phase I RI activities (see 1995 RI, Section 31)

11.3.2 Railroad Bed Ballast Samples

Table 11-2 presents the results of the SPLP analysis of samples WFRRB02 and 19RRB01 and compares them to ARARs and TBCs. Concentrations of numerous metals were detected. Lead (14.1 ug/L) and thallium (6.5 ug/L) were found at concentrations greater than the NJDEP surface water criteria for protection of human health in the leachate from sample WFRRB02. Thallium was found at 3.2 ug/L (estimated) in the leachate from 19RRB01, also above the NJDEP surface water criteria for human health. These results represent a "worst-case" leaching scenario because of the mechanics of the SPLP analysis which includes grinding of the (ballast) sample before the leach process is applied. The grinding of the larger ballast pieces to smaller increases the surface area for leaching and exposes "new" surfaces (previously not exposed to rain and weather) to the leach solution.

11.4 EVALUATION SUMMARY

It is probable that runoff from any of the numerous railroad beds across the station could contain the metals (e.g., lead and thallium) found in the SPLP leachate, thereby contributing to metals concentration in surface water and groundwater.

Considering the relatively low levels of metals found in the SPLP leachate, (slightly above the limit of the NJDEP surface water criteria) and keeping in mind that the SPLP leaching procedure would exaggerate actual metals leaching rates (by dividing the particles), it is expected that the ballast material would contribute to surface water metals concentrations but would not alone result in leachates with metals concentrations greater than ARARS or TBCs.

TABLE 11-2

COMPARISON OF SPLP ANALYTICAL DATA TO ARARS AND TBCs

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19RRB01>65315	WFRRB02>6535	---	---	ARARS & TBCs				
LOCATION:	19RRB01	WFRRB02	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1996 RI	1996 RI							
SAMPLE DATE:	11/07/96	11/12/96							
INORGANICS	ug/L	ug/L			ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	956	274			-	-	-	-	-
barium	124	249			-	-	-	-	2000
beryllium	0.28 U	0.39			-	-	-	-	-
cadmium	0.22 U	0.56			1.10 +	-	-	-	-
calcium	17000	1380			-	-	-	-	-
cobalt	0.34 U	1.4			-	-	-	-	-
copper	2.0	5.7			11.0 +	-	-	-	-
iron	11.8 U	675			-	-	-	-	-
lead	1.4	14.1 E			3.20 +	-	-	-	5.00
magnesium	2170	319 U			-	-	-	-	-
manganese	1.6	4.4			-	-	-	-	-
nickel	0.60 U	3.0			160 +	610	4600	-	516
potassium	278	217			-	-	-	-	-
selenium	3.7 J	3.6 U			5.00	-	-	-	10.0
sodium	1760	4320			-	-	-	-	-
thallium	3.2 E J	6.5 E J			-	1.70	6.30	-	1.70
vanadium	2.0	2.5			-	-	-	-	-
zinc	56.3	27.2			101' +	-	-	-	-

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