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EPA Superfund
Record of Decision:

NAVAL WEAPONS STATION EARLE (SITE A)
EPA ID: NJ0170022172
OU 03
COLTS NECK, NJ
09/29/1998

EPA 541-R98-142
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RECORD OF DECISION

OPERABLE UNIT 3 (OU-3)
SITE 26

NAVAL WEAPONS STATION EARLE
Colts Neck, New Jersey

<IMG SRC 98142A>

Northern Division
Naval Facilities Engineering Command
Contract No. N62472-90-D-1298
Contract Task Order 279

AUGUST 1998

<IMG SRC 98142B>

DEPARTMENT OF THE NAVY
NAVAL WEAPONS STATION EARLE
201 HWY 34 SOUTH
COLTS NECK, NEW JERSEY 07722-5001

IN REPLY REFER TO
5090
Ser 043/231
September 18, 1998

Ms. Jessica Mollin
Remedial Project Manager
United States Environmental Protection Agency
290 Broadway, 20th Floor
New York, New York 10007

Dear Ms. Mollin:

The enclosed "Record of Decision for Operable Unit 3 (OU-3), Site 26" has been signed by the Commanding Officer of Naval Weapons Station Earle, Captain Robert M. Honey, and is enclosed for the signature of the Regional Administrator of the U. S. Environmental Protection Agency.

This Record of Decision confirms the Navy's commitment to implement air sparging/soil vapor extraction technology to recover solvent from groundwater at Site 26 (located adjacent to Naval Weapons Station Earle Building GB-1), as well as requisite groundwater monitoring.

If you require any further information regarding this document, please contact Mr. Gregory Goepfert, Environmental Engineer, at (732) 866-2515.

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Enclosure: 1. Record of Decision for Operable Unit 3 (OU-3), Site 26

Copy to: Northern Division, Naval Facilities Engineering Command, Code 18
New Jersey Department of Environmental Protection (R. Marcolina)
Monmouth County Health Department (L. Jargowsky)

RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 3

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OPERABLE UNIT 3 (SITE 26)

PART I - DECLARATION

I. SITE NAME AND LOCATION

Naval Weapons Station Earle
Colts Neck, Monmouth County, New Jersey

II. STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the remedial action alternative selected for Operable Unit 3 (OU-3) to address soil and groundwater contamination at the Naval Weapons Station (NWS) Earle Site, located in Colts Neck, New Jersey. OU-3 includes the portion of Site 26 comprised of the former process leach tank connected to Building GB-1 and associated soil and groundwater contamination apparently emanating from the tank.

This remedial action decision is in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedial action and is based on the Administrative Record for OU-3. Reports and other information used in the remedy selection process are part of the Administrative Record file for OU-3, which is available at the Monmouth County Library, Eastern Branch, Route 35, Shrewsbury, New Jersey.

The New Jersey Department of Environmental Protection (NJDEP) has commented on the selected remedy, and their comments have been incorporated into this ROD. A review of the public response to the Proposed Plan is included in the Responsiveness Summary (Part III) of this decision document.

III. ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from OU-3, as discussed in Section VI (Summary of Site Risks) of this ROD, if not addressed by implementing the remedial action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

IV. DESCRIPTION OF THE SELECTED REMEDY

The Department of the Navy (Navy) and the United States Environmental Protection Agency (EPA), in consultation with NJDEP, have selected the following remedy for OU-3: air sparging with soil vapor extraction, source removal, institutional controls, and long-term monitoring. The remedy addresses contaminated source materials (the process leach tank and associated soils which have been excavated and disposed) and contaminated groundwater in the vicinity downgradient of the process leach tank. The selected remedy for OU-3 consists of the following major components:

1. Excavate and dispose of the process leach tank and adjacent contaminated soils.

2. Treat residual soil and groundwater contamination through the use of air sparging/vapor extraction to remove the larger portion of solvent compounds present to the physically limiting endpoint, followed by monitored natural attenuation and periodic reviews of progress.

3. Establish a Classification Exception Area (CEA) immediately adjacent to Site 26 to bar the use of groundwater during the remediation period.

4. Provide long-term periodic groundwater monitoring.

While the remedial action objective (RAO) for groundwater protection would not be immediately achieved, risks would be reduced in relation to background by removal of source materials (the process leach tank and associated soils) and initiation of active remediation of contaminants in soil and groundwater using air sparging/soil vapor extraction and continued monitoring to evaluate contaminant trends. Preliminary remediation goals (largely based on NJDEP Groundwater Quality Standards) are presented in Table 13. Long-term periodic monitoring and analysis will be undertaken determine when the RAO is achieved.

V. STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment and is cost effective. The Navy and EPA believe that the selected remedy will comply with all federal and state requirements that are legally applicable or relevant and appropriate to the remedial action. The selected remedy utilizes a permanent solution to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on the site above health-based levels, a review by the Navy, EPA, and NJDEP will be conducted within 5 years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 3
SITE 26

PART II - DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

A. General

NWS Earle is located in Monmouth County, New Jersey, approximately 47 miles south of New York City. The station consists of two areas, the 10,248-acre Main Base (Mainside area), located inland, and the 706-acre Waterfront area (Figure 1). The two areas are connected by a Navy-controlled right-of-way.

The facility was commissioned in 1943, and its primary mission is to supply ammunition to the naval fleet. An estimated 2,500 people either work or live at the NWS Earle station.

The Mainside area is located approximately 10 miles inland from the Atlantic Ocean at Sandy Hook Bay in Colts Neck Township, which has a population of approximately 6,500 people. The surrounding area includes agricultural land, vacant land, and low-density housing. The Mainside area consists of a large, undeveloped portion associated with ordnance operations, production, and storage; this portion is encumbered by explosive safety quantity distance arcs. Other land use in the Mainside area consists of residences, offices, workshops, warehouses, recreational space, open space, and undeveloped land. The Waterfront area is located adjacent to Sandy Hook Bay in Middletown Township, which has a population of approximately 68,200 people. The Mainside and Waterfront areas are connected by a narrow strip of land that serves as a government-controlled right of way containing a road and railroad.

Operable Unit 3 (OU-3) includes the portion of Site 26 comprised of the former process leach tank connected to Building GB-1 and associated soil and groundwater apparently emanating from the tank. OU-3 is located in the Mainside area (Figure 2). A brief description of Site 26 follows.

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B. Site 26: Explosive "D" Washout Area

Site 26 is situated at the intersection of Macassar and Midway Roads (Figure 3). Two railway lines adjacent to the site run toward the northeast. The ground surface at the site is relatively flat, approximately 150 feet above mean sea level (MSL)

A percolation pit in the center of the site 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, thought to consist of a grease trap and a cesspool-type leach tank, was used for process waste disposal.

For one year in the late 1960s, the site was used for the removal and recovery of ammonium picrate (known as explosive D) from artillery shells. The water-soluble explosive was removed from the shells by a hot water wash. The resulting solution flowed into a cooling/settling tank inside the building. Upon cooling, the ammonium picrate precipitated and was collected for reuse or disposal. Overflow from the settling tank flowed into the tile-lined open pipe to the percolation pit.

GB-1 reportedly was used for the reconditioning of munition casings/shells. Solvents were used in the reconditioning process. Spent solvents and wash waters were discarded into an unknown receptacle, possibly a collection tray at the formerly used paint spray booth, which drained to the process leaching system. The GB-1 process leaching system appears to have been used for the disposal of trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), or related compounds.

II. SITE HISTORY AND ENFORCEMENT ACTIVITY

Potential hazardous substance releases at Site 26 were addressed in an Initial Assessment Study (IAS) in 1982, a Site Inspection Study (SI) in 1986, and a Phase I RI in 1993. These were preliminary investigations to determine the number of sources, compile histories of waste-handling and disposal practices at the site, and acquire data on the types of contaminants present and potential human health and/or environmental receptors. RI investigations at Site 26 included the installation and sampling of monitoring wells and collection and analysis of surface soils.
In 1990, NWS Earle was placed on the National Priorities List (NPL). This list includes sites where uncontrolled hazardous substance releases may potentially present serious threats to human health and the environment.

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Site 26 was subsequently addressed by Phase II RI activities to determine the nature and extent of contamination. Activities included a soil gas survey at 68 locations, installation and sampling of groundwater monitoring wells, soil sampling, "direct-push" groundwater sampling with on-site laboratory analysis, and cone penetrometer studies to delineate subsurface soil stratigraphy. The Phase II RI was initiated in 1995 and completed in 1996.

The results of the RI were used as the basis for performing a feasibility study (FS) of potential remedial alternatives. The Navy and EPA, in consultation with NJDEP, developed the proposed remedial action plan (Proposed Plan). The Proposed Plan is the basis for the selected remedial alternative presented in this ROD and is based on the alternatives developed during the FS.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The documents that the Navy and EPA used to develop, evaluate, and select a remedial alternative for OU-3 (the RI, FS, Proposed Plan, and community input summaries) have been maintained at the Monmouth County Library (Eastern Branch), Route 35, Shrewsbury, New Jersey.

The FS report, Proposed Plan, and other documents related to OU-3 were released to the public on December 19, 1997. The notice of availability of these documents was published in the Asbury Park Press on January 3, and January 4, 1998. A public comment period was held from December 19, 1997 to January 30, 1998.

A public meeting was held during the public comment period on January 22, 1998. At this meeting, representatives from the Navy and EPA were available to answer questions about OU-3 and the remedial altenatives under consideration. Results of the public comment period are included in the Responsiveness Summary, which is Part III of this ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION FOR OPERABLE UNIT 3

The Department of the Navy completed an RI, FS, and Proposed Plan for OU-3, addressing contamination associated with Site 26 at NWS Earle. These studies showed that soil contamination was evident in the immediate vicinity of the process leach tank. Groundwater contamination was also evident downgradient of the process leach tank. The final remedial action to address site contamination at Site 26 is described in this document.

V. SUMMARY OF SITE CHARACTERISTICS

A. General

NWS Earle is located in the coastal lowlands of Monmouth County, New Jersey, within the Atlantic Coastal Plain Physiographic Province. The Mainside area, which includes OU-3, lies in the outer Coastal Plain, approximately 10 miles inland from the Atlantic Ocean. The Mainside area is relatively flat, with elevations ranging from approximately 100 to 300 feet above mean sea level (MSL). The most significant topographic relief within the Mainside area is Hominy Hills, a northeast-southwest-trending group of low hills located near the center of the station.

The rivers and streams draining NWS Earle ultimately discharge to the Atlantic Ocean, which is approximately 9 or 10 miles east of the Mainside area. The headwaters and drainage basins of three major Coastal Plain rivers (Swimming, Manasquan, and Shark) originate on the Mainside area. The northern half of Mainside is in the drainage basin of the Swimming River, and tributaries include Mine Brook, Hockhockson Brook, and Pine Brook. The southwestern portion of the Mainside drains to the Manasquan River via either Marsh Bog Brook or Mingamahone Brook. The southeastern corner of the Mainside drains to the Shark River. Both the Swimming River and the Shark River supply water to reservoirs used for public water supplies.

NWS Earle is situated in the Coastal Plain Physiographic Province of New Jersey. The New Jersey Coastal Plain is a seaward-dipping wedge of unconsolidated Cretaceous to Quaternary sediments that were deposited on a pre-Cretaceous basement-bedrock complex. The Coastal Plain sediments are primarily composed of clay, silt, sand, and gravel and were deposited in continental, coastal, and marine environments. The sediments generally strike northeast-southwest and dip to the southeast at a rate of 10 to 60 feet per mile. The approximate thickness of these sediments beneath NWS Earle is 900 feet. The pre-Cretaceous complex consists mainly of PreCambrian and lower Paleozoic crystalline rocks and metamorphic schists and gneisses. The Cretaceous to Miocene Coastal Plain Formations are either exposed at the surface or subcrop in a banded pattern that roughly parallels the shoreline. The outcrop pattern is caused by the erosion truncation of the dipping sedimentary wedge. Where these formations are not exposed, they are covered by essentially flat-lying post-Miocene surficial deposits.

Groundwater classification areas were established in New Jersey under New Jersey Department of Environmental Projection (NJDEP) Water Technical Programs Groundwater Quality Standards in New Jersey Administrative Code (N.J.A.C.) 7:9-6. The Mainside area is 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 area, in general, the deeper aquifers are used for public water supplies and the shallower aquifers are used for domestic supplies.

OU-3 is situated in the recharge area of the Kirkwood-Cohansey aquifer system. 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 has been reported in previous investigations as being used for residential wells in the Mainside area. Along the coast, this aquifer system is underlain by thick diatomaceous clay beds of the Kirkwood Formation.

All facilities located in the Mainside Administration area are connected to a public water supply (New Jersey American Water Company). Building GB-1 is connected to the public water supply. Water for the public supply network comes from surface water intakes, reservoirs, and deep wells. No public water supply wells or surface water intakes are 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 facilities. There are a number of private wells located within a 1-mile radius of NWS Earle and several within the NWS Earle boundaries. The majority of these wells are used for potable supplies; previous testing for drinking water parameters indicates these wells have not been adversely impacted.

There is a rich diversity of ecological systems and habitats at NWS Earle. 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 endangered list, such as the swamp pink (Helonias bullata), may be present. An osprey has visited Mainside and may nest in another area at NWS Earle. The Mingamahone Brook supports bog turtles downstream of the Mainside area and provides an appropriate habitat for them at the Mainside area.

B. Surface Water Hydrology

Site 26 is surrounded by wooded upland areas. The upland areas are dominated by pitch pine, blackjack oak, blueberry, and Clethra sp. NJDEP Geographic Information System data initially indicated the presence of wetlands where the wooded upland areas are located. However, on-site inspection 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. The East Branch of Mingamahone Brook is located approximately 300 yards southwest of Site 26, and the site is in the Mingamahone Brook watershed. Depth to groundwater ranges approximately from 10 to 14 feet below ground surface at Site 26.

C. 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 cone penetrometer (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 approximate 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.

D. Hydrogeology

Groundwater in the Kirkwood aquifer beneath the site occurs under unconfined conditions. Groundwater contour maps are presented in Figure 4 (August 1995 levels) and Figure 5 (October 1995 levels). The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater measurements, is toward the southwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based on boring log descriptions, the wells are screened in the Kirkwood Formation. The hydraulic conductivity's 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 siltey 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 in groundwater samples indicated contaminant concentrations orders of magnitude lower below the postulated clay layer than above it, indicating that the clay layer is acting as an aquitard.

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E. Nature and Extent of Contamination

1. IAS and SI Results

Groundwater was analyzed for picric acid (the form of ammonium picrate found in groundwater) and pH. Picric acid was not detected and pH was within expected levels.

2. Phase I Remedial Investigation

Lead was detected at levels greater than background but below screening guidance levels in soil samples collected from the percolation pit. All other metals were within normal background ranges. Picric acid (the ammonium picrate analogue in soils) was detected in one sample. No other explosive compounds were detected.

Groundwater samples from all Site 26 wells were collected and analyzed for Target Compound List/Target Analyte List (TCL/TAL) analytes and explosive compounds. TCE was detected in one sample (MW26-01) at elevated levels (660 ug/L). The NJ groundwater groundwater quality standard is one ug/L. Other volatile organic compounds (VOCs), such as dichloroethenes (related to TCE as impurities or breakdown products), were also present. The source of TCE was speculated to be associated with the process leaching system of Building GB-1. Low concentrations of several explosive compounds were detected in samples from wells MW26-01 and MW26-04.

3. Phase II Remedial Investigation

Natural background levels of metals in local soils and groundwater were determined during the RI using samples obtained from locations chosen as being isolated from former or present industrial or military operations. In general, background sample locations were hydraulically upgradient or far removed from potential sources of contamination. In order to compare site-related groundwater metals concentrations found in a specific geologic formation to naturally occurring (background) levels found in the similar distinct geologic formation, some existing facility monitoring well sample results were selected for use as "background." All monitoring wells used in the calculation of background concentrations were deemed to have been installed in "background" locations (upgradient of RI sites). The Navy, EPA, and NJDEP collaborated in the selection of all background sample locations. The process of background concentration determination and statistical evaluation is presented in Section 31 of the RI report. Table 1 summarizes the range of background metals concentrations found in groundwater versus the range of concentrations found on site.

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 at levels greater than the concentration range associated with background samples but below the corresponding regulatory screening guidance level.

In soil borings taken near the process leach tank, TCE (up to 74.0 ug/kg) and 1,2-dichloroethene (total) (up to 140 ug/kg) were found at concentrations below the New Jersey Impact to Groundwater soil criteria for TCE (1,000 ug/kg) and for 1,2-dichloroethene (trans - 50,000 ug/kg, and cis- 1,000 ug/kg).

Groundwater samples were collected from monitoring wells and by direct-push groundwater sampling methods across Site 26. TCE, 1,2-DCE, and related compounds were encountered at significant concentrations in a wide plume (approximately 350 feet by 130 feet) of contaminated groundwater southwest of Building GB-1. Subsurface soil stratigraphy studies indicate the presence of a 15-feet-thick clay layer at a depth of approximately 25 to 40 feet below Site 26. Based on vertical profile sampling, the semi-confining clay layer appears to have limited the vertical migration of TCE and related compounds.

Figure 6 depicts the location and concentration of compounds that exceeded applicable or relevant and appropriate requirements (ARARs) and other guidance to be considered (TBCs). The type of contaminants detected and the configuration of the plume implicate the process leach tank as the source of groundwater contamination. Table 2 summarizes the results of samples taken from groundwater compared to applicable standards.

TABLE 1

COMPARISON OF SITE-RELATED METALS CONCENTRATION IN GROUNDWATER TO BACKGROUND CONCENTRATIONS - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

(Ig/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION
ALUMINUM	11/11	287-7870	2549	6/6	328-927	539.33
BARIUM	11/11	2.6-518	114.80	6/6	13.2-518	267.78
CADMIUM	5/11	0.6-1.9	0.61	4/6	0.42-4.4	1.04
CALCIUM	11/11	506-17200	4154	6/6	3540-17800	8440
CHROMIUM	9/11	1.3-43.5	14.68	3/6	1.2-1.4	0.89
COBALT	6/11	0.7-10.1	2.03	5/6	0.92-5.8	2.69
COPPER	9/11	0.79-13.5	3.27	6/6	0.81-13.8	6.22
IRON	11/11	153-7690	2099	6/6	90.8-4740	1172
LEAD	3/11	2.1-3	1.22	1/6	2.6-2.6	1.06
MAGNESIUM	11/11	273-27400	4225	6/6	636-2170	1416
MANGANESE	11/11	3.3-65	23.09	6/6	3.3-155	62.23
MERCURY	11/11	0.005-0.12	0.06	6/6	0.012-0.11	0.05
NICKEL	10/11	0.81-25.5	5.99	2/6	0.81-1	0.55
POTASSIUM	11/11	350-3245	1406	6/6	362-3640	1385
SILVER	NOT DETECTED	-	0.47	1/6	3.3-3.3	0.94
SODIUM	11/11	1850-11650	4225	6/6	2360-12500	4875
VANADIUM	10/11	0.69-42.25	8.24	3/6	0.81-1.6	0.71
ZINC	6/9	3.7-348	89.31	5/5	100-326	242.40

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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 at levels greater than the concentration range associated with background samples. Barium was found at elevated levels in two samples, and cadmium and silver were detected in one sample at levels greater than background ranges. However, soil sampling results show no evidence of a source area of these contaminants, there is no evidence that these metals were used at significant concentrations or disposed of at the site, detections of metals in groundwater were sporadic over time and by location, and the risk assessment did not show these compounds to be the risk drivers.

Explosives were analyzed for but not detected in groundwater samples collected at Site 26, indicating that the one low level of picric acid found in soil during Phase I investigations (1992-1993) had no impact on groundwater and most likely was an isolated occurrence.

VI. SUMMARY OF SITE RISKS

As part of the Phase II RI, a human health risk assessment and ecological risk screening were performed at OU-3. A four-step process was utilized to assess site-related human health risks for a reasonable maximum exposure scenario Hazard Identification identifies the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. Toxicity Assessment determines the types of adverse health affects associated with chemical exposures, and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks and includes a discussion of site-specific uncertainties associated with the site such as actual receptor pathways, and receptor activity patterns.

A. Human Health Risks

The human health risk assessment estimated the potential risks to human health posed by exposure to contaminated groundwater and subsurface soils at Site 26. To assess these risks, the exposure scenarios listed below were assumed:

- Ingestion of groundwater as a drinking water source.
- Inhalation of contaminants in groundwater (i.e., volatile compounds emitted during showering).
- Dermal exposure to contaminants in groundwater (i.e., showering, hand washing, bathing).
- Dermal contact from contaminated soils.
- Inhalation of contaminants in soil (i.e., fugitive dusts).
- Incidental ingestion of contaminated soils.

A current industrial employee is an adult who currently works at NWS Earle. This receptor is currently potentially exposed via ingestion of, dermal contact with, and inhalation of compounds in surface soil while at work.

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 compounds in subsurface soil (as future surface soil) and groundwater, dermal contact with compounds in subsurface soil (as future surface soil) and groundwater (hand washing/showering); and inhalation of compounds in subsurface soil (as future surface soil) while at work.

A future resident is a person who will live in a residence at or near NWS Earle in a hypothetical future scenario. This receptor is assumed to reside for 30 years (six years as a child and 24 years as an adult). This receptor is potentially exposed via ingestion of compounds in surface soil, subsurface soil (as future surface soil), and groundwater, dermal contact with compounds in surface soil, subsurface soil (as future surface soil), and groundwater (child during bathing; adult during showering); inhalation of compounds in airborne dust from surface soil and subsurface soil (as future surface soil); and inhalabon of compounds in groundwater vapors during showering (adult only, 24-year exposure).

A future residential child (ages six to 12) will live in a residence at or near NWS Earle. This hypothetical receptor will wade in surface water and stream sediments present. This receptor is potentially exposed via ingestion to and by dermal contact with compounds in sediment and surface water.

These scenarios were applied to various site use categories, including future industrial use and future lifetime resident.

Potential human health risks were categorized as carcinogenic or noncarcinogenic. A hypothetical carcinogenic risk increase from exposure should ideally fall below a risk range of 1 x 10 -6 (an increase of one case of cancer for one million people exposed) to 1 x 10 -4 (an increase of one case of cancer per 10,000 people exposed).

Noncarcinogenic risks were estimated using Hazard Indices (HI), where an HI exceeding one is considered an unacceptable health risk. Hazard Indices are the summation of individual chemical and pathway Hazard Quotients (HQ). An HQ is calculated as the lifetime average daily dose compared to (divided by) the Reference Dose (RfD) that is an estimate of a daily exposure level for the human population, including sensitive populations, that is likely to be without appreciable risk or harmful effects over a lifetime. These estimated noncarcinogenic risks are based on a continuous exposure to contaminants for the defined lifetime exposure of the receptor, however, detrimental health effects are often reversed if contact is removed.

In addition, results were compared to applicable federal and/or state standards such as federal Maximum Contaminant Levels (MCLs) for drinking water, NJDEP Groundwater Quality Standards (GWQS), or other published lists of reference values.

A human health risk characterization was derived for OU-3 from the risk assessment. Highlights of the risk assessment are provided below. The risk assessment was performed according to EPA guidance. Details such as assumptions used in certain calculations or uncertainty discussions can be obtained on the general procedures section (Section 2) of the RI Report or the site specific section (Setion 10) of the Addendum RI Report.

The cancer risks associated with future residential receptors exposed to groundwater exceeded 1E-04, the upper end of the target risk range (Tables 3 and 4) based mainly on ingestion of TCE and 1,1-DCE in groundwater and from inhalation of vapors while showering.

Estimates for noncancer risks 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. VOCs (TCE and DCE) are the primary risk drivers.

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Lead concentrations detected at the site during the RI were well below the EPA soil exposure guidelines for children (400 ppm) and are not expected to be associated with a significant increase in blood-lead levels.

B. Ecological Risks

The ecological risk assessment estimates the risk posed to ecological receptors, such as aquatic and terrestrial biota, from contamination at Site 26.

Site 26 is relatively small and consists of turfgrass or developed areas such as open storage or vehicle parking areas that provide little ecological habitat. Wooded uplands are present northwest of the site. These upland areas provide excellent habitat for a wide variety of terrestrial organisms. No wetlands, other sensitive habitats, or threatened or endangered species of any kind exist in the vicinity of

Site 26.

No significant contaminant migration pathways to the upland habitats exist at the site. Water in the process leach tank/grease trap area is hot expected to migrate via overland runoff to the upland areas since water tends to settle in this area, and the wooded areas are a few feet higher on grade than the area next to Building GB-1. Groundwater discharge of contaminants to surface water is also insignificant since no wetlands or other surface waters are present near the site.

VII. REMEDIAL ACTION OBJECTIVES (RAOs)

The overall objective for the remedy at OU-3 is to protect human health and the environment. The RAO to protect human health is to prevent human exposure to contaminated groundwater. The RAO for protection of the environment is to mitigate VOC contaminants in the groundwater.

VIII. DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The purpose of the alternative development and screening process is to assemble an appropriate range of possible remedial options to achieve the RAOs identified for OU-3. In this process, technically feasible technologies are combined to form remedial alternatives that provide varying levels of risk reduction that comply with federal (EPA) and state (NJDEP) guidelines for site remediation.

Engineering technologies capable of eliminating the unacceptable risks associated with exposure to site-related soils, sediments, or groundwater were identified, and those alternatives determined to best meet RAOs after screening were evaluated in detail. Table 5 presents the considered alternatives and the results of preliminary screening.

A. Detailed Summary of Alternatives

Summaries of the remedial alternatives developed for OU-3 are presented in this section.

1. Alternative 1: No Action

The no-action alternative was developed as a baseline to which other alternatives may be compared, as required by the NCP. No remedial actions would be taken to protect human health or the environment. The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the site in its present state. No measures would be implemented to remove or contain the suspected contaminant source (the process leach tank and associated soils), to prevent potential human exposure to site groundwater, or to mitigate contaminant migration in the environment. Periodic reviews of site conditions, typically every 5 years, and long-term monitoring of groundwater would be conducted under this alternative.

2. Alternative 2: Source Removal, Institutional Controls, and Long-Term Monitoring

Alternative 2 relies on source removal and institutional controls to limit exposures to hazardous substances. No engineered treatment or containment would be employed to address contaminated groundwater; however, the suspected contaminant source (the process leach tank and associated soils) would be removed to abet natural attenuation of groundwater contamination. Institutional controls would be used to preclude use of untreated groundwater. Long-term monitoring would be conducted to monitor natural attenuation effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every 5 years.

Alternative 2 would provide protection of human health through suspected source removal and use of institutonal controls to restrict consumption of contaminated groundwater until groundwater criteria are met. Groundwater contaminants would decrease through natural attenuation over time. The effectiveness of this protection would depend upon enforcement of institutional controls, because no actions would be taken to accelerate cleanup of contaminated groundwater. Using the data available and a best-case groundwater modeling approach, it is estimated that health risks would remain for a period of approximately 45 years, until contaminant concentrations decrease to acceptable levels through natural attenuation. During this time period, the plume will initially expand downgradient with groundwater flow. If groundwater use restrictions were not adequately enforced during the period of remediation, potential receptors could be exposed to site risks.

TABLE 5
SITE 26 - SCREENING OF REMEDIAL ALTERNATIVES
FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY

ALTERNATIVE	EFFECTIVENESS	IMPLEMENTABILITY	COST	COMMENTS
1 No Action: (Long-Term Monitoring and Five-Year Reviews)	Provides no additional protection of human health or the environment. Does not reduce potential for human exposure to contaminants in groundwater. Does not reduce contaminant migration in the environment. No reduction in toxicity, mobility, or volume of contaminants.	Readily implementable. No technical or administrative difficulties.	Capital: none O&M: low	Retained as baseline alternative in accordance with NCP.
2 Source Removal, Institutional Controls, Long-Term Monitoring, and Five-Year Reviews	Protects human health and the environment through institutional controls and natural attenuation. Groundwater use would be restricted. Would offer reduction of contaminant leaching to groundwater through source removal. Reduction in toxicity, mobility, or volume of contaminants through treatment of soils removed. Groundwater contaminants would naturally attentuate over time.	Readily implementable. No technical or administrative difficulties.	Capital: low O&M: low	Relative to Alt. 1, provides greater protectiveness in the long term. Would result in reduction of groundwater contaminant levels. Retained.
3 Reactive Wall Treatment (Source Removal, In-Situ Groundwater Treatment, Institutional Controls, and Long-Term Monitoring)	Protects human health and the environment by removing the suspected source of VOC contamination leaching to groundwater. Would prevent continuing migration of TCE plume until treatment and natural attenuation remediate the contaminants. Groundwater use would be restricted. Toxicity and volume of contaminants would be reduced through treatment only through source treatment.	Implementable. Reactive wall technology is innovative and is not well developed but offers potential for in-situ treatment with no ex-situ treatment residuals. No technical or administrative difficulties. Personnel and materials necessary to implement alternative are limited; currently, only one commercial firm is available to implement full-scale construction.	Capital: moderate - high O&M: moderate	This technology will likely degrade TCE in the subsurface. May offer comparable degree of protectiveness as Alt, 4. Retained

ALTERNATIVE	EFFECTIVENESS	IMPLEMENTABILITY	COST	COMMENTS
4 Pump-And-Treat: (Source Removal, Groundwater Extraction and Treatment, Institutional Controls, and Long-Term Monitoring)	Protects human health and the environment by removing suspected source of VOC contamination leaching to groundwater. Would actively reduce TCE concentrations in the plume and prevent continuing migration of the TCE plume until extraction/treatment and natural attenuation remediate the contaminants. Groundwater use would be restricted. Toxicity and volume of contaminants would be reduced through treatment.	Readily imptementable. Specialized treatment equipment is required but is available from several vendors. No technical or administrative difficulties. Personnel and materials necessary to implement alternative are widely available.	Capital: moderate O&M: moderate	Would employ well demonstrated treatment process options. Retained as representative treatment alternative.
5 Air Sparging Soil Vapor Extraction: (Source Removal, Institutional Controls, and Long-Term Monitoring)	Protects human health and the environment by removing suspected source of VOC contamination leaching to groundwater. Would actively reduce TCE concentrations in the plume and prevent continuing migration of the TCE plume until extraction/treatment and natural attenuation remediate the contaminants. Groundwater use would be restricted. Toxicity and volume would be reduced through treatment	Implementable technology is well proven and offers potential for active in-situ treatment, depending on actual site conditions. Pre-design and pilot studies would be required, but pilot system could easily be expanded to full-scale system in the field. System requires significant sampling and analysis to gauge impact across the wide volume of soil in the remediation zone.	Capital: moderate O&M moderate to high	This technology set offers the advantage of actively treating the large volume of contaminated media and could require less time than the passive treatment or capture and treatment of the plume at the leading plume edge. This technology requires substantial chemical and biological monitoring to control the process. Retain for further evaluation.

TABLE 5
SITE 26 - SCREENING OF REMEDIAL ALTERNATIVES
FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY

ALTERNATIVE	EFFECTIVENESS	IMPLEMENTABILITY	COST	COMMENTS
6 Engineered Bioremediation: (Source Removal, In-Situ Engineered Bioremediation, Institutional Controls, and Long-Term Monitoring)	Protects human health and the environment by removing the suspected source of VOC contamination leaching to groundwater. Would actively remediate the entire plume by engineered bioremediation. Groundwater use would be restricted until clean-up levels are achieved. Toxicity and volume of contamination would be reduced through treatment	Implementable, although technology is patented. Technology is innovative and has rarely been applied on a full scale but offers potential for in-situ treatment with no ex-situ treatment residuals. Personnel and materials necessary to implement are available; however, it is not clear how licensable the technology is.	Capital: moderate O&M: moderate	This technology has the potential to degrade chlorinated VOCs in the subsurface, in a shorter time frame of all alternatives but Alternative 5. However, technology development is limited, and is licensability is uncertain. Because there are two other retained innovative technologies and two active treatment technologies and the ultimate success of engineered bioremediation is uncertain, this technology is eliminated.

Periodic long-term monitoring would be conducted to assess contaminant status and potential threats to human health and the environment and to gauge the progress of anticipated natural attenuation. Site conditions and risks would be formally reviewed every 5 years to evaluate remedy progress.

Because site groundwater does not meet New Jersey groundwater quality standards, a classification exception area (CEA) pursuant to N.J.A.C. 7:9-6 would be established to provide the state official notice that the constituent standards will not be met for a specified duration and to ensure that use of groundwater in the affected area is suspended until standards are achieved.

If the excavated process leach tank and/or soils were determined to be hazardous wastes, their handling, management, and off-site transport would be conducted in accordance with RCRA hazardous waste generator and transporter requirements [40 CFR Parts 262 and 263] and New Jersey labeling, records, and transportation requirements [N.J.A.C. 7:26-7].

Under Alternative 2, if it is determined that soils are subject to RCRA Land Disposal Restrictions (LDRs) [40 CFR 268], the source materials would be treated off site prior to disposal, in accordance with these regulations. Any wastes determined to be subject to LDRs would be disposed off site at a RCRA Subtitle C facility.

3. Alternative 3: Reactive Wall Treatment (Source Removal, In-Situ Permeable Reactive Wall, Groundwater Treatment, Institutional Controls, and Long-Term Monitoring)

Alternative 3 employs suspected source removal, in-situ groundwater treatment, and institutional controls to protect human health and the environment. The suspected contaminant source (the process leach tank and associated VOC-contaminated soils) would be removed for disposal off station. Groundwater would be treated in situ using permeable reactive wall technology. Because of the relatively slow groundwater velocity, it is anticipated that a significant portion of the groundwater contaminants would naturally attenuate before they pass through the reactive wall. Institutional controls would be implemented to prevent exposure to contaminated groundwater for the duration of the groundwater treatment period, until GWQS are achieved. Long-term monitoring would be conducted for the duration of the remediation period to assess the effectiveness of the remedial action and to determine when the remediation is complete. Site conditions and risks would be reviewed every 5 years until the groundwater remediation is complete.

A principal component of Alternative 3 is in-situ permeable reactive wall groundwater treatment. This innovative technology utilizes granular iron to break down the chlorinated solvents as the groundwater plume passes through the wall. Since the plume would be treated in situ, no pumping would be required and the natural groundwater contours would not be disturbed. The potential for system failure would be minimized because no mechanical or electrical equipment would be used. An array of monitoring wells across the treatment zone would be used to evaluate the effectiveness of the treatment wall and to determine when maintenance is required.

Although this technology is innovative and its long-term track record is limited, several pilot studies have been conducted with impressive results. Full-scale implementation of the technology is underway at several locations. The feasibility study (FS) concluded that subsurface conditions at Site 26 are favorable for a reactive wall. The permeable treatment wall would act as a passive treatment barrier, which would effectively prevent off-site migration of contaminated groundwater. Therefore, upon completion of the treatment wall, downgradient receptors would be protected.

The treatment wall would not immediately protect potential receptors of contaminated groundwater beneath Site 26; long-term, permanent protecton would be achieved after a treatment duration of approximately 45 years, based on available data and groundwater modeling assuming passive treatment. In the interim, contaminants would be removed both by the treatment wall and natural attenuation.

In the interim period, until remediation goals for site groundwater have been achieved, human health would be protected through use of institutional controls that would restrict use of untreated contaminated groundwater as drinking water. The effectiveness of this interim protection would depend upon adequate enforcement. If groundwater use restrictions were not adequately enforced, existing health risks would remain until groundwater contaminant concentrations decreased to acceptable levels.

If the excavated process leach tank and/or soils were determined to be hazardous wastes, their handling, management, and off-sifte transport would be conducted in accordance with RCRA hazardous waste generator and transporter requirements [40 CFR Parts 262 and 263] and New Jersey labeling, records, and transportation requirements [N.J.A.C. 7:26-7).

Under Alternative 3, if it is determined that soils are subject to RCRA Land Disposal Restrictions [40 CFR 268], soils would be treated off site prior to disposal, in accordance with these regulations. Any wastes determined to be subject to LDRs would be disposed off site at a RCRA Subtitle C facility.

4. Alternative 4: Pump-And-Treat (Source Removal, Groundwater Extraction Groundwater Treatment by Air Stripping, Institutional Controls, and Long-Term Monitoring)

Alternative 4 employs suspected source removal, groundwater pumping and treatment, and institutional controls to protect human health and the environment. The suspected contaminant source (the process leach tank and associated VOC contaminated soils) would be removed for disposal off-station. A groundwater containment system consisting of groundwater extraction wells would be placed near the downgradient edge of the plume, and the groundwater would be extracted and treated above ground by air stripping. Additional groundwater extraction wells would be placed in the vicinity of the high-concentration plume area, also for groundwater pumping and above-ground treatment. Treated (clean) groundwater would be re-introduced to the aquifer via infiltration galleries downgradient of the extraction point. Preliminary estimates of the amount of solvents to be stripped indicate that air emissions treatment will not be required. Institutional controls would be implemented to prevent exposure to contaminated groundwater for the duration of the groundwater treatment period, until GWQS are achieved. Periodic long-term monitoring would be conducted for the duration of the remediation period to assess the effectiveness of the remedial action and to determine when the remediation is complete. Site conditions and risks would be formally reviewed every 5 years until the groundwater remediation is complete.

Alternative 4 would employ source removal and groundwater extraction and treatment to provide long-term protection of human health and the environment. The groundwater extraction system would be designed to prevent off-site migration of contaminated groundwater and to actively treat the VOC plume. Upon completion of the extraction system, downgradient receptors of contaminated groundwater would be protected. Potential users of contaminated groundwater beneath Site 26 would not ts protected by Alternative 4 until groundwater remediation goals were achieved throughout the plume. It is anticipated that long-term, permanent protection would be achieved after a treatment duration of less than 45 years. During this period, groundwater contaminants would be removed both by the extraction system and through natural attenuation. Additional treatment efficiency could be attained by increasing the number of pumping wells, but this benefit would be offset by increased capital and operating costs.

In the interim period, until remediation goals for site groundwater have been achieved human health would be protected through use of institutional controls that would restrict use of untreated contaminated groundwater as drinking water. The effectiveness of this interim protection would depend entirely upon adequate enforcement. If groundwater use restrictions were not adequately enforced, existing health risks would remain until groundwater contaminant concentrations decreased to acceptable levels.

If the excavated process leach tank and/or soils were determined to be hazardous wastes, their handling; management, and off-site transport would be conducted in accordance with RCRA hazardous waste generator and transporter requirements [40 CFR Parts 262 and 263] and New Jersey labeling, records, and transportation requirements [N.J.A.C. 7:26-7].

Under Alternative 4, if it is determined that the source materials are subject to RCRA Land Disposal Restrictions [40 CFR 268], the source materials would be treated off site prior to disposal, in accordance with these regulations. Any wastes determined to be subject to LDRs would be disposed off site at a RCRA Subtitle C facility.

5. Alternative 5. Air Sparging with Soil Vapor Extraction (Source Removal, Institutional

Controls, and Long-Term Monitoring)

Under Alternative 5, the suspected source of groundwater contaminants (the process leach tank and associated VOC-contaminated soils) would be removed, and the VOCs present in groundwater and saturated soils would be removed from the aquifer through a combination of air sparging and soil vapor extraction (AS/SVE), which comprises an active in-situ remediation process. Depending on the actual concentrations of VOCs in the gas stream, vapor phase activated carbon may be required to treat captured vapors above ground to meet applicable air emission standards. Preliminary estimates of the amount of solvents to be stripped indicate that air emissions treatment will not be required. Spent activated carbon would be sent off site for reuse, recycling, or destruction. Institutional controls would be implemented to prevent exposure to contaminated groundwater for the duration of the groundwater treatment period, until GWQC are achieved. Periodic long-term monitoring would be conducted for the duration of the remediation period to assess the effectiveness of the remedial action and to determine when the remediation is complete. Site conditions and risks would be formally reviewed every 5 years until the groundwater remediation is complete.

Using the AS/SVE system for mass transfer, it is anticipated that the greater part of the chlorinated VOCs would be removed from groundwater and soils. However, the continuous introduction of air into the subsurface maintains a high dissolved oxygen level in both the saturated and unsaturated zones. High dissolved oxygen conditions are not generally favorable to anaerobic biological activity of the chlorinated VOCs in situ. Biodegradation of VOCs by the indigenous microbe population generally requires anaerobic conditions. Therefore, it is proposed that any AS/SVE remediation scheme would consist of a preliminary active AS/SVE period to treat the areas of significant TCE concentration and remove the bulk of the mass of chlorinated hydrocarbons, followed by a period of long-term monitoring and natural attenuation of the chlorinated hydrocarbons in an anaerobic state.

Alternative 5 would employ suspected source removal and in-situ groundwater treatment to provide long-term protection of human health and the environment. The groundwater treatment system would be designed to reduce volume and concentration of contaminated groundwater; therefore, upon successful start-up of the treatment system (the plume area could actually widen during initial operations), downgradient receptors of contaminated groundwater would begin to be protected. However, potential users of contaminated groundwater beneath Site 26 would not be protected by Alternative 5 until groundwater remediation goals were achieved throughout the plume. It is anticipated that long-term, permanent protection would be achieved after a treatment duration of approximately 5 years. During this period, groundwater contaminants would be removed both by the AS/SVE, which comprises an active in-situ remediation process extraction system, and by natural attenuation.

In the interim, until remediation goals for site groundwater have been achieved, human health would be protected through the use of institutional controls that would restrict the use of untreated contaminated groundwater as drinking water. The effectiveness of this interim protection would depend entirely upon adequate enforcement. If groundwater use restrictions were not adequately enforced, existing health risks would remain until groundwater contaminant concentrations decreased to acceptable levels.

If the excavated process leach tank and/or soils were determined to be hazardous wastes, their handling, management, and off-site transport would be conducted in accordance with RCRA hazardous waste generator and transporter requirements [40 CFR Parts 262 and 263) and New Jersey labeling, records, and transportation requirements [N.J.A.C. 7:26-7].

Under Alternative 5, if it is determined that the source materials are subject to RCRA Land Disposal Restrictions [40 CFR 268], the source materials would be treated off site prior to disposal, in accordance with these regulations. Any wastes determined to be subject to LDRs would be disposed off site at a RCRA Subtitle C facility.

6. Alternative 6: Engineered Bioremediation (Source Removal, Engineered Bioremediation, Institutional Controls, and Long-Term Monitoring)

Under Alternative 6, the suspected source of groundwater contaminants (the process leach tank and associated VOC-contaminated soils) would be removed and the VOCs present in groundwater and saturated soils would be actively bioremediated in situ through engineered enhancement of natural processes. Institutional controls would be implemented to prevent exposure to contaminated groundwater for the duration of the groundwater treatment period, until GWQC are achieved. Long-term monitoring would be conducted for the duration of the remediation period to assess the effectiveness of the remedial action and to determine when the remediation is complete. Site conditions and risks would be reviewed every 5 years until the groundwater remediation is complete.

Alternative 6 would employ suspected source removal and in-situ groundwater treatment to provide long-term protection of human health and the environment. The groundwater treatment system would utilize bioremediation to reduce volume and concentration of contaminated groundwater; therefore, upon successful start-up of the bioremediation system, downgradient receptors of contaminated groundwater would begin to be protected. However, potential users of contaminated groundwater beneath Site 26 would not be protected by Alternative 6 until groundwater remediation goals were achieved throughout the plume. It is anticipated that long-term, permanent protection would be achieved after a treatment duration of approximately 5 years. During this period, groundwater contaminants would be removed both by enhanced bioremediation and natural attenuation.

In the interim, until remediation goals for site groundwater have been achieved, human health would be protected through the use of institutional controls that would restrict the use of untreated contaminated groundwater as drinking water. The effectiveness of this interim protection would depend entirely upon adequate enforcement. If groundwater use restrictions were not adequately enforced, existing health risks would remain until groundwater contaminant concentrations decreased to acceptable levels.

If the excavated process leach tank and/or soils were determined to be hazardous wastes, their handling, management, and off-site transport would be conducted in accordance with RCRA hazardous waste generator and transporter requirements [40 CFR Parts 262 and 263] and New Jersey labeling, records, and transportation requirements [N.J.A.C. 7:26-7].

Under Alternative 6, if it is determined that the source materials are subject to RCRA Land Disposal Restrictions [40 CFR 268], the source materials would be treated off site prior to disposal, in accordance with these regulations. Any wastes determined to be subject to LDRs would be disposed off site at a RCRA Subtitle C facility.

IX. SUMMARY AND COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial action alternatives described in Section VIII were evaluated using the following criteria, established by the NCP:

Threshold Criteria: Statutory requirements that each alternative must satisfy in order to be eligible for selection.

1. Overall protection of human health and the environment - draws on the assessments conducted under other evaluation criteria and considers how the alternative addresses site risks through treatment, engineering, or institutional controls.

2. Compliance with ARARs - evaluates the ability of an alternative to meet Applicable or Relevant and Appropriate Requirements (ARARs) established through federal and state statutes and/or provides the basis for invoking a waiver.

Primary Balancing Criteria: Technical criteria upon which the detailed analysis is primarily based.

3. Long-term effectiveness and permanence - evaluates the ability of an alternative to provide long-term protection of human health and the environment and the magnitude of residual risk posed by untreated wastes or treatment residuals.

4. Reduction of mobility, toxicity, or volume through treatment - evaluates an alternative's ability to reduce risks through treatment technology.

5. Short-term effectiveness - addresses the clean-up timeframe and any adverse impacts posed by the alternative during the construction and implementation phase, until clean-up goals achieved.

6. Implementability - is an evaluation of technical feasibility, administrative feasibility, and availability of services, and material required to implement the alternative.

7. Cost - includes an evaluation of capital costs and annual operation and maintenance (OW) costs.

Modifying Criteria: Criteria considered throughout the development of the preferred remedial alternative and formally assessed after the public comment period, which may modify the preferred alternative.

8. Agency acceptance indicates the EPA's and the state's response to the alternatives in terms of technical and administrative issues and concerns.

9. Community acceptance evaluates the issues and concerns the public may have regarding the alternatives.

The remedial alternatives were compared to one another based on the nine selection criteria, to identify differences among the alternatives and discuss how site contaminant threats are addressed.

Based on the initial screening of remedial alternatives, Alternatives 1,2,3,4, and 5 were retained for further consideration. A detailed review of Alternatives 1 through 5 is included in this section and summarized in Table 6. Alternative 6: Engineered Bioremediation was eliminated because of uncertainty regarding the current state of development of the technology and licensability questions.

A. Overall Protection of Human Health and the Environment

Because no actions would be conducted, Alternative 1 would not reduce contaminant migration from the source area to groundwater and groundwater contamination may increase with time. Although Alternative 2 would remove the source, groundwater contamination would continue to migrate unabated. Because no actions would be taken under Alternatives 1 and 2 to contain or remediate groundwater, potential health risks would remain for an extended period of time.

TABLE 6
SITE 26 - COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL EXTRACTION
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT					
Prevent Human Exposure to Contaminated Groundwater	Provides no additional protection against human exposure to contaminated groundwater. Carcinogenic and non-carcinogenic risks exceeding EPA's target risk range would remain. NO institutional controls implemented to restrict use of untreated contaminated groundwater for drinking water. No actions taken to reduce contaminant leaching to groundwater from process leach tank and associated contaminated soils. Time required for natural atenuation to reduce contaminants to levels that would not pose risk may be longer than In Alternative 2.	Institutional controls would minimize potential exposure to site groundwater by prohibiting its use as drinking water. Excavation and off-site disposal of the process leach tank and associated contaminated soils would reduce leaching of contaminants to groundwater, facilitating natural attenuation of contaminants. In time, contaminant concentrations would reach levels that would not pose excess risk.	The proposed in-situ system would immediately prevent exposure to downgradient receptors by treating the advancing plume while natural attenuation would ultimately reduce groundwater contaminant concentrations at the site to levels that would not pose excess risk. Institutional controls would minimize potential exposure to site groundwater during the treatment period by prohibiting its use as drinking water. Excavation and off-site disposal of the process leach tank and associated contaminated soils would reduce leaching of contaminants to groundwater, facilitating groundwater remediation.	Provides collection and ex-situ treatment of the advancing contaminant plume, which would immediately prevent exposure to downgradient receptors while natural attenuation ultimately reduces groundwater contaminant concentrations to levels that would not pose excess risk. Institutional controls would minimize potential exposure to site groundwater during the treatment period by prohibiting its use as drinking water. Excavation and off-site disposal of the process leach tank and associated contaminated soils would reduce leaching of contaminants to groundwater, facilitating groudwater remediation.	Air sparging and soil vapor extraction treatment processes, combined with enhanced biodegradation and natural attenuation would initially result in a wider plume volume/area but would actively reduce the concentration of contaminants in the entire plume. This treatment alternative would be expected to reduce overall contaminant concentration of the entire plume more quickly than other alternatives. Institutional controls wouid minimize potential exposure to site groundwater during the treatment period by prohibiting its use as drinking water. Excavation and off-site disposal of the process leach tank and associated contaminated soils would reduce leaching of contaminants to groundwater, facilitating groundwater remediation.
Mitigate Migration of VOC Contaminated Groundwater	No actions taken to reduce migration of contaminated groundwater. Relies on natural attenuation.	Same as Alternative 1.	The permeable reactive wall treatment system, installed immediately downgradient of the contaminant plume, would prevent further migration of contaminated groundwater by degrading dissolved contaminants as they migrate through the wall.	The groundwater extraction and treatment system would contain and treat the contaminant plume, preventing further migration of contaminated groundwater.	The groundwater plume would initially widen, but the overall treatment period would be shorter than other alternatives.

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
COMPLIANCE WITH ARARs					
Chemical-Specific ARARs	Would not comply with state groundwater quality standards or statutory requirements.	Groundwater contaminant concentrations would initially exceed state GWQC; over time GWQC would be achieved by natural attenuation. A classification exception area (CEA) would be established to provide the state official notification that standards would not be met for a specified duration. Alternative 2 would be implemented in compliance with RCRA Land Disposal Restrictions.	Groundwater contaminant concentrations would initially exceed GWQC; over time, treatment and natural attenuation would reduce contaminant levels below GWQC. A classification exception area (CEA) would be established to provide the state official notification that standards would not be met for a specified duration. Alternative 3 would be implemented in compliance with RCRA Land Disposal Restrictions	Same Alternative 3	Same as Alternative 3
Location-Specific ARARs	Not Applicable.	Not Applicable.	Not Applicable.	Not Applicable.	Not Applicable.
Action-Specific ARARs	Not Applicable.	If soils and sediments are determined to be hazardous, Alternative 2 would comply with federal and state ARARs for generation, transport and disposal of hazardous wastes.	Same as Alternative 2.	If soils and sediments are determined to be hazardous, Alternative 4 would comply with federal and state ARARs for transport of hazardous waste. The on-site treatment facility would be constructed and operated in accordance with federal and state hazardous waste facility regulations.	Same as Alternative 4

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk	Existing risks would remain. Future residential receptor of site groundwater: 1.7 x 10 -4 cardnogenic and HI > 1 non-cardnogenic risks for three target organs. Future industrial receptor of site groundwater: HI > 1 non-carcinogenic risks for three target organs.	Implementation and enforcement of institutional controls would reduce risks from exposure to site groundwater to less than 1 x 10 -6 and HI less than 1.0. Over time, natural attenuation would result in permanently reduced risks.	Groundwater treatment would result in permanent reduction of risks from exposure to site groundwater to less than 1 x 10 -6 and HI less than 1.0. In the interim, until groundwater remediation goals are achieved, implementation and enforcement of institutional controls would reduce risks from exposure to site groundwater to less than 1 x 10 -6 and HI less than 1.0.	Same as Alternative 3.	Same as Alternative 3.
Adequacy and Reliability of Controls	No new controls implemented.	Long-term enforcement of institutional controls would be required to ensure their effectiveness for preventing use of contaminated groundwater.	Permeable reactive wall treatment is a new and innovative process that has been demonstrated primarily in bench- and pilot-scale projects over the past 5 years. Although the technology shows promise, its long-term effectiveness is uncertain. Potential limitations include biofouling, coating of the reactive materials, or reduced permeability due to buildup of precipitated inorganics. The technology vendor recommends agitation of the reactive wall materials every 5 to 10 years to liberate deposited inorganic precipitates. If the wall became ineffective and could not be repaired, the reactive metal materials or the entire wall would have to be replaced. Regular process monitoring would effectively identify any changes in the effectiveness of the process. Long-term enforcement of institutional controls would be required to ensure their effectiveness for preventing use of contaminated groundwater.	Groundwater extraction and air stripping are widely used, effective technologies for the remediation of VOC contaminated groundwater. There is little uncertainty associated with long-term operation or maintenance of the system. The process would be easily monitored and maintained. Routine maintenance and replacement of system components could be accomplished with little interruption of system operation. Long-term enforcement of installation controls would be required to ensure their effectiveness for preventing use of contaminated groundwater.	Air sparging and soil vapor extraction are widely used, effective technologies for the remediation of VOC contaminated groundwater. There is little uncertainty associated with long-term operation or maintenance of the system. The process would be easily monitored and maintained. Routine maintenance and replacement of system components could be accomplished with little interruption of system operation. Regular process monitoring would effectively identify any changes in the effectiveness of the process. Long-term enforcement of institutional controls would be required to ensure their effectiveness for preventing use of contaminated groundwater.

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
Need for 5-Year Review	Review would be required since groundwater contaminants would be left in place.	Review would be required since groundwater contaminants would be left in place and institutional controls would be implemented.	Review would be required for the duration of the groundwater remediation period since groundwater contaminants would remain above remediation goals and institutional controls would be implemented.	Same as Alternative 3.	Same as Alternative 3.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Treatment Process Use	None.	None.	In-situ permeable reactive wall.	Air stripping with activated carbon polishing.	Air sparging/soil vapor extraction with air emissions control
Amount Treated or Destroyed	None.	None.	2 million gallons contaminated groundwater, containing 17,000 grams TCE plus other VOCs, remediated per year.	Same as Alternative 3.	Entire plume
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction, since no treatment would be employed.	Same as Alternative 1.	The In-situ treatment system would contain the contaminant plume and degrade the chlorinated VOCs to reduce the toxicity, mobility, and volume of contaminated groundwater. Over a period of approximately 45 years, the contaminants of concern in site groundwater would be reduced to acceptable levels.	The groundwater extraction and treatment system would contain the contaminant plume and remove the VOCs to reduce the toxicity, mobility, and volume of contaminated groundwater. Over a period of approximately 45 years, the contaminants of concern in site groundwater would be reduced to acceptable levels.	Toxicity is reduced by actively stripping VOCs from the plume volume. Mobility is not affected, although as remediation progresses, the plume edge is expected to retreat. The volume of the plume (contaminated with VOC above GWQC) is expected to grow during initial treatment, but to diminish with time.

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
Irreversible Treatment	Not Applicable	Not Applicable	Yes, contaminants are degraded to form non-toxic compounds.	Yes, contaminants are removed from groundwater.	Yes, contaminants are removed and/or treated to form non-toxic compounds.
Statutory Preference for Treatment	No	No	Yes	Yes	Yes
SHORT-TERM EFFECTIVENESS					
Community Protection	No risk to community anticipated.	No significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2
Worker Protection	No risk to workers anticipated if proper PPE is used during long-term monitoring.	No significant risk to workers anticipated it proper PPE is used during source removal and decontamination and long-term monitoring.	No significant risk to workers anticipated if proper PPE is used during source removal and decontamination, installation of the permeable reaction wall, and tong-term monitoring.	No significant risk to workers anticipated if proper PPE is used during source removal and decontamination, installation and operation of the groundwater extraction and treatment systems, and long-term monitoring.	No significant risk to workers anticipated if proper PPE is used during source removal and decontamination, installation and operation of the groundwater air sparging and soil vapor extraction systems, and long-term monitoring.
Environmental Impacts	No adverse impacts to the environment anticipated.	No adverse impacts to the environment anticipated. Engineering controls would be used during implementation to mitigate risks.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2

Time Until Action is Complete	Not applicable.	1 year until RAO for preventing exposure to site groundwater is achieved. Would not meet RAO for mitigating migration of VOC contaminated groundwater. 50 years until contaminants are reduced to acceptable concentrations by natural attenuation.	1 year until RAO for preventing exposure to site groundwater is achieved. 10 months until RAO for mitigating migration of VOC contaminated groundwater is achieved. 45 years until contaminants are reduced to acceptable concentrations by in-situ groundwater treatment.	1 year until RAO for preventing exposure to site groundwater is achieved. 7 months until RAO for mitigating migration of VOC contaminated groundwater is achieved. 45 years until contaminants are reduced to acceptable concentrations by extraction and treatment of groundwater.	1 year until RAO for preventing exposure to site groundwater is achieved through implementation of institutional controls. Approximately 5 years until RAO for mitigating migration of VOC contaminated groundwater is achieved. Approximately 5 years until contaminants are reduced to acceptable concentrations by air sparging/soil vapor extraction and biodegration in groundwater.

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
IMPLEMENTABILITY					
Ability to Construct and Operate	No construction or operation involved.	No construction or operational difficulties anticipated. Common construction techniques used for excavation and off-site disposal of the concrete block leach tank and associated contaminated soils.	No significant construction or operational difficulties anticipated Common construction equipment and somewhat specialized construction techniques used for installation of treatment wall. With vendor training and oversight, wall could be installed by non-specialized construction crews. Common construction techniques used for excavation and off-site disposal of the concrete block leach tank and associated contaminated soils.	No construction or operational difficulties anticipated. Common well installation and construction techniques and equipment used for installation of extraction system. Modular treatment system would be easily constructed. Common construction techniques used for excavation and off-site disposal of the concrete block leach tank and associated contaminated soils.	No construction or operational difficulties are anticipated. Common well installation and construction techniques and equipment used for installation of treatment system. Modular treatment system would be easily constructed. Common construction techniques used for excavation and off-site disposal of the concrete block leach tank and associated contaminated soils.
Ease of Doing More Action if Needed	Additional actions would be easily implemented if required.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Ability to Monitor Effectiveness	Groundwater monitoring would provide assessment of contaminant presence, migration, and changes in site conditions.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination for 5-year reviews may be required and would be obtainable.	Coordination for 5-year reviews may be required and would be obtainable. Coordination with the state would be required to establish a CEA and would be obtainable. Permits would be required and obtainable for off-base transportation and disposal of contaminated source area soils. Permits would not be required for on-base disposal.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

TABLE 6
SITE 26 - COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
FEASIBILITY STUDY - NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: NATURAL ATTENUATION	ALTERNATIVE 3: REACTIVE WALL	ALTERNATIVE 4: PUMP-AND-TREAT	ALTERNATIVE 5: AIR SPARGING SOIL VAPOR EXTRACTION
Ability of Treatment, Storage Capacities, and Disposal Services	None required.	Alt. 2A: Sufficient commercial landfill capacity available for materials requiring disposal. Alt. 2B: Sufficient area available for disposal of materials at both on-base landfills.	Alt. 3A: Sufficient commercial landfill capacity available for materials requiring disposal. Alt. 3B: Sufficient area available for disposal of materials at both on-base landfills.	Alt. 4A: Sufficient commercial landfill capacity available for materials requiring disposal. Alt. 4B: Sufficient area available for disposal of materials at both on-base landfills.	Alt. 5A: Sufficient commercial landfill capacity available for materials requiring disposal. Alt. 5B: Sufficient area available for disposal of materials at both on-base landfills.
Availability of Equipment Specialists, and Materials	Personnel and equipment available for implementation of long-term monitoring and 5-year reviews.	Ample availability of companies with trained personnel, equipment, and materials to perform source removal, long-term monitoring, and 5-year reviews.	Ample availability of companies with trained personnel, equipment, and materials to perform source removal, treatment system installation and operation, long-term monitoring, and 5-year reviews.	Ample availability of companies with trained personnel, equipment, and materials to perform source removal, extraction and treatment system installation and operation, long-term monitoring, and 5-year reviews.	Ample availability of companies with trained personnel, equipment, and materials to perform source removal, AS/SVE treatment system installation and operation, long-term monitoring, and 5-year reviews.
Availability of Technology	Not required.	Not required.	Reactive wall technology only available from one vendor, but the equipment, materials, and personnel required to construct treatment system are available from several vendors/companies.	Groundwater extraction and air stripping are widely used, conventional technologies available from a variety of companies.	AS/SVE is a widely used readily available combination of equipment/techniques provided by a variety of companies.
COST					
		2A / 2B	3A / 3B	4A / 4B	5A / 5B
Capital Cost	$14,100	$157,000 / $140,000	$1,637,000 / $1,620,000	$712,000 / $695,000	$1,698,000 / $1,680,000
First-Year Annual O&M Cost	$12,700	$12,700	$60,100	$215,700 / $214,900	$499,000 (average year)
Five-Year Reviews	$ 15,500	$15,500	$28,500	$15,500	$15,500
Present-Worth Cost*	$204,000 $204,000	$348,000 / $331,000 $348,000 / $331,000	$2,386,000 / $2,369,000	$3,100,000 / $3,073,000	$3,755,000 / $3,738,000

*Present worth cost is based on discount rate of 7%

Alternatives 3, 4, and 5 would provide protection of both human health and the environment through treatment of contaminated groundwater and implementation of institutional controls. Removal of the suspected source of groundwater contamination should facilitate the remediation of contaminated groundwater. The effectiveness of this alternative for interim protection of human health (until groundwater remediation is complete) is dependent on enforcement of institutional controls.

B. Compliance with ARARs

Implementation of Alternatives 2, 3, 4, and 5 would comply with all ARARs and TBCs identified in the FS, with the exception of the New Jersey GWQS [N.J.A.C. 7:9-6]. None of the alternatives would initially comply with these state ARARs for attainment of groundwater quality criteria; however, Alternatives 2, 3, 4, and 5 would include a provision to seek a temporary exemption (CEA) from these requirements until the GWQS are achieved through natural attenuation (Alternative 2 only) or treatment. Alternative 1 would not comply with these standards or include a provision to seek temporary exemption. Five-year reviews would be necessary until ARARs are met.

C. Long-Term Effectiveness and Permanence

Only Alternatives 3, 4, and 5 offer long-term protection of both human health and the environment. All three alternatives would result in permanent reduction of risks from exposure to site groundwater in a reasonable timeframe. Alternative 2 includes source removal and provides protection of human health through use of institutional controls. Alternative 1 does not provide any additional protection of human health or the environment.

Alternatives 3, 4, and 5 all employ groundwater treatment, institutional controls, and removal of the suspected source of groundwater contaminants to protect human health and the environment. All three would result in permanent reduction in risks from exposure to site groundwater to less than EPA guideline limits.

Alternatives 3 and 4 initially would provide identical protectiveness: downgradient receptors and the environment would be protected upon installation and start-up of the treatment systems. In the initial stages of implementation of Alternative 5, the solvent plume would continue to spread with the flow of groundwater, with minimal, if any, impact on receptors. After operational start-up, Alternative 5 has the potential to remove a greater volume of the contamination in a shorter period than Alternatives 3 and 4. Protection of downgradient receptors would be expected to be achieved in a shorter period for Alternatives 4 and 5, as compared with Alternative 3.

Under all these alternatives, the effectiveness of the interim protection would depend upon enforcement of institutional controls; if groundwater use restrictions were not enforced, protection of human health would not be achieved until the groundwater remediation is complete.

Alternative 3 employs an innovative in-situ technology to treat contaminated groundwater. The technology shows great promise for treating contaminated groundwater, but it has not been demonstrated in long-term full-scale projects. The reliability of Alternatives 4 and 5 is expected to be high; both employ treatment systems that have been widely demonstrated for remediation of VOC-contaminated groundwater.

Long-term monitoring and 5-year reviews would be required for all five alternatives until groundwater contaminant concentrations decrease to acceptable levels through treatment or natural attenuation. Regular monitoring would allow the responsible agency to assess remediation progress or changes in contaminant status and identify potential impacts to downgradient receptors.

D. Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 would not reduce the toxicity, mobility, or volume of contaminants through treatment.

Alternative 2 may reduce the toxicity, mobility, and volume of source area contaminants through treatment of the suspected source materials prior to disposal; it would not reduce groundwater contamination through treatment.

Alternatives 3, 4, and 5 would reduce the toxicity, mobility, and volume of contaminants through treatment of contaminated groundwater and possibly through treatment of the suspected source materials prior to disposal. All three treatment alternatives would be designed to address the same mass of contaminants: the entire groundwater contaminant plume and any source area materials requiring treatment.

E. Short-Term Effectiveness

The short-term effectiveness of all five alternatives would be similar since the use of appropriate engineering controls and personal protective equipment (PPE) would be expected to minimize adverse impacts to base residents and personnel, the local community, and workers during implementation.

Long-term monitoring, the only on-site action proposed under Alternative 1, would provide little opportunity for short-term impact to the local community or the environment.

Alternative 2 would present a somewhat greater opportunity for short-term impacts to human health and the environment due to excavation, handling, and decontamination of contaminated materials from the suspected source area. Alternatives 3, 4, and 5 would present the greatest opportunity for short-term impacts due to installation and operation of the groundwater treatment systems.

In all cases, short-term risks posed to base personnel, site workers, and the environment would be mitigated through use of engineering controls, transportation planning, and appropriate PPE. No permanent adverse impacts to the human health or the environment are anticipated to result from implementation of Alternatives 2, 3, 4, or 5.

Alternative 1 would not achieve any of the RAOs. Alternative 2 would achieve all RAOs within approximately 50 years. Alternative 3 would achieve all RAOs within approximately 45 years. Alternative 4, with extraction wells removing groundwater from the concentrated center of the plume, would require less than 45 years to achieve all RAOs. Alternative 5 would achieve all RAOs within approximately 5 years.

F. Implementability

Each of the alternatives would be implementable. Alternative 1 is the most easily implemented since the only activities proposed are long-term monitoring and 5-year reviews.

Alternative 2 would be the next easiest to implement because it involves only excavation and off-site transport and disposal. There are a sufficient number of companies available with the trained personnel, equipment, and materials to perform excavation, disposal, and long-term monitoring. Sufficient commercial landfill capacity is available to handle the small volume of contaminated materials (approximately 30 cubic yards) that would require off-base disposal under Alternative 2.

Alternative 3 may be somewhat more difficult to implement because it would require installation and operation of a new and innovative in-situ treatment technology. Reactive wall technology is available from only one vendor, but the equipment, materials, and personnel required to construct the system are available from several sources.

Alternatives 4 and 5 would be somewhat more difficult to implement because both would require installation and operation of an on-site treatment system. However, no difficulties are anticipated in implementing either alternative because both alternatives include demonstrated technologies that employ relatively common equipment and materials. Several vendors are available that could provide the necessary equipment, materials, and services.

If additional actions are warranted, they could be easily implemented under any of the alternatives.

G. Cost

The total present-worth cost associated with each alternative is provided below for comparison. Alternative

1, no action, would be the least expensive to implement and Alternative 5 would be the most expensive to implement.

Alternative 1	$ 204,000
Alternative 2	$ 348,000
Alternative 3	$2,386,000
Alternative 4	$3,100,000
Alternative 5	$3,755,000

H. Agency Acceptance

NJDEP has had the opportunity to review and comment on all the documents in the Administrative Record and has had the opportunity to comment on the Proposed Plan. Comments received from the NJDEP have been incorporated into the Proposed Plan.

I. Community Acceptance

The community has had the opportunity to review and comment on documents in the Administrative Record and has participated in regularly scheduled Restoration Advisory Board (RAB) meetings convened to encourage community involvement. A public meeting was held to provide the community an opportunity to learn about the Proposed Plan. The community has not indicated objections to the alternatives selected in this ROD. Part III, Responsiveness Summary, of this ROD presents an overview of community involvement and input to the selected alternative.

X. THE SELECTED REMEDY

The Navy, with the support of EPA and in consultation with NJDEP, has selected Alternative 5: Air Sparging with Soil Vapor Extraction, Source Removal, Institutional Controls, and Long-Term Monitoring as the preferred alternative. This alternative is in compliance with ARARs and includes a CEA as required by the state groundwater quality protection criteria. It would actively mitigate the potential exposure scenarios, which are direct exposure and consumption of contaminated groundwater from the site, and would be protective of human health and the environment.

By utilizing air sparging with soil vapor extraction, active removal of contaminants from the soil and groundwater would be achieved. Residual VOCs, remaining after AS/SVE treatment reaches its physically limiting endpoint would be permitted to naturally attenuate under anaerobic conditions in-situ. Removal of the suspected source area would eliminate the potential for direct exposure.

Although the preferred alternative employs an active treatment technology, groundwater within the plume may not attain state groundwater criteria for approximately 5 or more years. Therefore, a classification exception area (CEA) would need to be established in the vicinity immediately adjacent and (approximately 800-1,000 feet) downgradient of the plume area of OU-3. A formal CEA would preclude use of site groundwater during the remediation period. Long-term monitoring would determine when criteria have been met and would also evaluate the effectiveness of the remedial action. Long-term monitoring will be quarterly until such time as EPA and the Navy agree on a reduced schedule. The Navy would periodically review remediation progress with EPA and NJDEP.

The preferred alternative is believed to provide the best balance of protection among the alternatives with respect to response criteria. It utilizes a proven technology that has shown encouraging results in similar situations.

Based on available information, the Navy and EPA believe the preferred alternative would be protective of human health and the environment, would be cost effective, and would be in compliance with all statutory requirements of EPA, the state, and the local community.

XI. STATUTORY DETERMINATIONS

The remedy selected for OU-3 satisfies the remedy selection requirements of CERCLA and the NCP. The remedy is expected to be protective of human health and the environment, complies with ARARs, and is cost effective. The following sections discuss how the selected remedial action addresses these statutory requirements.

A. Protection of Human Health and the Environment

Alternative 5 would be protective of both human health and the environment through treatment of contaminated groundwater and implementation of institutional controls. Removal of the suspected source of groundwater contamination should facilitate the remediation of contaminated groundwater. The effectiveness of this alternative for interim protection of human health (until groundwater remediation is complete) is dependent on enforcement of institutional controls.

B. Compliance With and Attainment of ARARs

The selected remedy for OU-3 will comply with all applicable or relevant and appropriate chemical-specific, location-specific, and action-specific ARARs. Tables 7 through 12 summarize ARARs and TBCs applicable to OU-3.

1. Chemical-Specific ARARs

Potential federal and state chemical-specific ARARs are listed in Tables 7 and 8, respectively. Implementation of Alternative 5 would comply with the ARARs identified in Tables 7 and 8.

2. Location-Specific ARARs

Potential federal and state location-specific ARARs are listed in Tables 9 and 10, respectively. It is expected that Alternative 5 will comply with these ARARs.

3. Action-Specific ARARs

Potential federal and state action-specific ARARs are listed in Tables 11 and 12, respectively. It is expected that Alternative 5 will comply with these ARARs.

TABLE 7
POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
Safe Drinking Water Act (SDWA)- Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16)	Potentially Relevant and Appropriate	MCLs have been promulgated for a number of common organic and inorganic contaminants to regulate the concentration of contaminants in public drinking water supply systems. MCLs may be relevant and appropriate for groundwater because the aquifer beneath the site is a potential drinking water supply.	MCLs may be used to establish clean-up levels for the portion of the aquifer underlying OU-3. MCLs can be used to derive potential soil clean-up levels by the use of modeling, and possibly sampling, to determine the potential leachability of the compound to groundwater.
Resource Conservation and Recovery Act (RCRA)- Groundwater Protection Standard (40 CFR 264.94)	Potentially Relevant and Appropriate	The RCRA groundwater protection standard is established for groundwater monitoring of RCRA permitted treatment, storage or disposal facilities. The standard is set at either an existing or proposed RCRA-MCL, background concentration, or an alternate concentration limit (ACL) protective of human health and the environment.	RCRA-MCLs may be used or ACLs may be developed to identify levels of contamination in the aquifer above which human health and the environment are at risk and to provide an indicator when corrective action is necessary.
RCRA Land Disposal Restrictions (40 CFR 268)	Potentially Applicable	These regulations identify hazardous wastes that are restricted from land disposal and establish waste analysis and recordkeeping requirements and "treatment standards" (concentration levels or methods of treatment) that wastes must meet in order to be eligible for land disposal.	Contaminated soil must be analyzed and disposed in accordance with the requirements of these regulations. If necessary, soils will be treated to attain applicable "treatment standards" prior to placement in a landfill, or other land disposal facility. This requirement would be considered for alternatives involving land disposal.
Clean Water Act - Ambient Water Quality Criteria (AWQC)	To Be Considered	AWQC are non-promulgated health-based surface water quality criteria that have been developed for carcinogenic and noo-carcinogenic compounds for the protection of human health. AWQC have also been developed for the protection of aquatic orqanisms.	AWQC may be used to assess the need for remediation of discharges to surface water or to use as benchmarks during long-term monitoring.

TABLE 7
POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
SDWA Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50 and 141.51)	To Be Considered	MCLGS are health-based limits for contaminant concentrations in drinking water. MCLGs are established at levels at which no known or anticipated adverse effects on human health are anticipated and that allow for an adequate margin of safety. MCLGs are set without regard for cost or feasibility.	Non-zero MCLGs may be used as clean-up levels if conditions at the site justify setting clean-up levels lower than MCLs.
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (OSWER Directive No. 9355.4-12)(July 1994)	To Be Considered	This OSWER Directive recommends a lead soil screening level of 400 ppm for residential land use based on the IEUBK model. The screening value may be used to determine whether sites or portions of sites warrant further evaluation and evaluations of risks.	If any part of the OU-3 site is to be considered for eventual residential use, then the screening value may be used to assess whether site-specific lead levels require further evaluation and possible remediation.
EPA Groundwater Protection Strategy	To Be Considered	Provides classification and restoration goals for groundwater based on its vulnerability, use, and value.	This strategy was considered in conjunction with the Federal SDWA and State Groundwater Protection Rules in order to determine groundwater clean-up levels.
Risk Based Concentration (RBC)	To Be Considered	RBCs are developed based on estimating a concentration in a specific media (i.e. air water or soil) that is associated with specific exposure assumptions and a specific risk level (i.e., Hazard Quotient of or a Cancer Risk of 1 x 10 E-6). The selection of specific exposure parameters and risk levels also contribute to the calculated concentration.	RBCs may be used developed clean-up goals based on human health criteria.

TABLE 7
POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
EPA Health Advisories and Acceptable Intake Health Assessment Documents	To Be Considered	Intended for use in qualitative human health evaluation of remedial alternatives.	These advisories and health assessment documents were used to assess health risks from contaminants present at the site.
Clean Air Act - Standards for Air Emissions from Municipal Solid Waste Landfills (40 CFR 60.752 and 60.753)	Potentially Relevant and Appropriate	Active landfills with design capacities equal to or greater than 2.5 million cubic meters are required to have landfill gas collection and control systems if greater than 50 megagrams of non-methane organic compounds are expected to be emitted. The collection system shall be operated so that the methane concentration is less than 500 ppm above background at the surface of the landfill.	Both Sites 4 and 5 landfills are estimated to be much less than 2 million cubic feet in capacity. However, soil gas studies and measurement of methane concentrations at the landfill surfaces need to be conducted during the pre-design phase to determine whether landfill gas controls need to be included as part of the control systems.

TABLE 8
POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
New Jersey Ground Water Quality Standards (GWQS)(N.J.A.C. 7:9-6)	Applicable	This regulation establishes the rules to protect ambient groundwater quality through establishment of groundwater protection and clean-up standards and setting of numerical criteria limits for discharges to groundwater. The Ground Water Criteria (GWQC)(N.J.A.C. 7:9-6.7) are the maximum allowable pollutant concentrations in groundwater that are protective of human health. This regulation also prohibits the discharge to groundwater subsequently discharging to surface water that do not comply the Surface Water Quality Standards (SWQS).	Because contaminated groundwater is present underneath OU-3 in excess of GWQS, these regulations will be considered in determining groundwater action levels. Application for Classification Exception Area (CEA) may be required if GWQS will not be met during the term of proposed remediation. The CEA procedure ensures that designated groundwater uses at remediation sites are suspended for the term of the CEA.
New Jersey Surface Water Quality Standards (SWQS)(N.J.A.C. 7:9B)	Applicable	These standards establish rules to protect and enhance surface water resources, define surface water classifications and uses, and establish water-quality-based criteria and effluent discharge limitations. The Surface Water Criteria (SWQC)(N.J.A.C. 7:9B-14) are the maximum allowable pollutant concentrations in surface water for the designated use.	For alternatives where surface water may be affected, remedial measures may be needed so that the SWQC are attained in the long term. Remedial alternatives shall consider action to mitigate the continued contamination of surface waters.
New Jersey Safe Drinking Water Act (N.J.A.C. 7:10)	Potentially Relevant and Appropriate	These regulations were promulgated to assure the provision of safe drinking water to consumers in public community water systems. Maximum Contaminant Levels (MCLs)(N.J.A.C. 7:10-16) have been established to regulate the concentration of organic and metal contaminants in water supplies. MCLs may be relevant and appropriate for groundwater because the aquifer beneath the site is a potential drinking water supply.	MCLs may be used to establish clean-up levels for the portion of the aquifer underlying the NWS Earle sites. MCLs can be used to derive potential soil clean-up levels.

TABLE 8
POTENTIAL STATE CHEMICAL-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
New Jersey Soil Cleanup	To Be Considered	These are non-promulgated soils clean-up criteria for residential direct contact, non-residential direct contact and impact to groundwater (through leaching).	These criteria will be considered in the development of soil clean-up goals.

TABLE 9
POTENTIAL FEDERAL LOCATION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
Wetlands Executive Order (E.O. 11990)& 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Potentially Applicable	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and preserve and enhance natural and beneficial values of wetlands.	Remedial alternatives that involve excavation or deposition of materials will include all practicable means of minimizing harm to the wetlands adjacent to OU-3. Wetlands protection consideration will be incorporated into the planning, decision-making, and implementation of remedial alternatives.
Floodplains Executive Order (E.O. 11988) & 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Potentially Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial value of floodplains.	The potential effects on floodplains will be considered during the development and evaluation of remedial alternatives. All practicable measures will be taken to minimize adverse effects on floodplains.
Resource Conservation and Recovery Act (RCRA) Location Standards, Floodplains (40 CFR 264.18 (a))	Potentially Applicable	Any RCRA facility that treats, stores, or disposes of hazardous waste, if situated in a 100-year floodplain, must be designed, constructed, operated, and maintained to avoid washout.	Where possible, remedial alternatives that include construction of a treatment, storage, or disposal facility will be sited outside a 100-year floodplain.
Endangered Species Act of 1973 (16 USC 1531 et seq.); (50 CFR Part 200)	Potentially Applicable, if present	Actions shall be taken to conserve endangered or threatened species or to protect critical habitats. Consultation with the Departrnent of the Interior is required.	The RI determined that there were no sensitive habitats (except for wetlands), endangered or threatened species present at the NWS Earle sites.
Fish and Wildlife Coordination Act Of 1958 (16 U.S.C. 661) Protection of Wildlife Habitats	Potentially Applicable	This regulation requires that any federal agency that proposes to modify a body of water must consult with the U.S. Fish and Wildlife Service and requires that actions be taken to avoid adverse effects, minimize potential harm to fish or wildlife, and preserve natural and beneficial uses of the land.	During the evaluation of alternatives, potential remediation effects on the wetlands and floodplains are evaluated, if it is determined that an impact may occur, then the U.S. Fish and Wildlife Service, the NJDEP, and EPA would be consulted.

TABLE 9
POTENTIAL FEDERAL LOCATION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REOUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
National Historic Preservation Act of 1966 Section 106 (16 USC 470 et. seq.)	Potentially Applicable, if present	Action will be taken to recover and to preserve historic artifacts that may be threatened as the result of terrain alteration.	Potential ARAR if artifacts are encountered during the site remediation (e.g. excavation, consolidation, grading). To date, no such artifacts have been encountered at OU-3.
National Archeological and Historic; Preservation Act of 1974 (132 CFR 229)	Potentialty Applicable, if present	Action will be taken to recover and to preserve scientific, prehistoric, historic, or archaeologic artifacts that may be threatened as the result of terrain alteration.	Potential ARAR if artifacts are encountered during active site remediation (e.g. excavation, consolidation, grading). To date, no such artifacts have been encountered at OU-3.

TABLE 10
POTENTIAL STATE LOCATION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
New Jersey Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A)	Potentially Applicable	Regulate activities that result in the disturbance in and around fresh water wetland areas induding removing or dredging wetand sods, disturbing the water level or water table, driving piles, placing of obstructions, destroying plant life, and discharging dredged or fill materials into open water.	Remedial alternatives will be developed to avoid activities that would be detrimental to the wetlands located adjacent to OU-3.
New Jersey Freshwater Wetlands Protection Act Rules, Mitigation (N.J.A.C. 7:7A-14)	Potentially Applicable	This regulation requires mitigation of the disturbed wetlands or filled open water. Generally requires the restoration, creation, or enhancement of area, or donations to the Mitigation Bank, of equal ecological value.	If a remedial attentative action results in the loss of wetlands through dredging, filling, or construction activities, then mitigation measures will need to be incorporated into the alternative's design.
New Jersey Flood Hazard Area Control (N.J.A.C. 7:14)	Potentially Applicable	These regulations control development in floodplains and water courses that may adversely affect the flood-carrying capacity of these features, subject new facilities to flooding, increase storm water runoff, degrade water quality, or result in increased sedimentation, erosion, or environmental damage.	This requirement is applicable to remedial alternative actions that may adversely affect floodplains adjacent to OU-3.
New Jersey Siting Criteria for New Major Commercial Hazardous Waste Facilities (N.J.A.C. 7:26-13)	Potentially Relevant and Appropriate	These regulations specify siting requirements and limitations for commercial hazardous waste facilities including protection of nearby residents, surface water, groundwater, air, and environmentally sensitive areas.	If remedial alternatives employs an on-site or on base treatment of contaminated soils, sediments, or materials, then remediation activities will need to be consistent with these requirements.

TABLE 11
POTENTIAL FEDERAL ACTION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
Resource Conservation and Recovery Act (RCRA) - Hazardous Waste Generator and Transporter Requirements (40 CFR parts 262 and 263)	Potentially Applicable	These regulations establish the responsibilities of generators and transporters of hazardous waste in the handling, transportation, and management of waste. The regulations specify the packaging, labeling, recordkeeping, and manifest requirements.	Activities performed in connection with off-site transport of hazardous wastes will comply with the requirements of these regulations.
RCRA - General Facility Standards (40 CFR 265 Subpart B)	Potentially Applicable	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	If a remedial alternative includes the establishment of an on-base treatment facility for hazardous wastes (characteristic or listed), then this regulation will be considered. This regulation specifies TSD facilities construction, fencing, postings, and operations. All workers will be property trained. Process wastes will be evaluated for the characteristics of hazardous wastes to assess further handling requirements.
RCRA - Preparedness and Prevention (40 CFR 265 Subpart C)	Potentially Applicable	Outlines requirements for safety equipment and spill control.	If a remedial alternative includes treatment, storage, or disposal of hazardous wastes, then this regulation will be considered. Safety and communication equipment will be maintained at the site. Local authorities will be familiarized with the site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 265 Subpart D)	Potentially Applicable	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	If the alternative includes treatment, storage, or disposal of hazardous wastes, then contingency plans will be developed. Copies of the plans will be kept onsite.
RCRA - Manifesting Recordkeeping, and Reporting (40 CFR 265 Subpart E)	Potentially Applicable	Specifies the recordkeeping and reporting requirements for RCRA facilities.	If the alternative includes treatment, storage, or disposal of hazardous wastes, then records of facility activities will be developed and maintained during remedial actions.

TABLE 11
POTENTIAL FEDERAL ACTTION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
RCRA - Closure and Post-Closure (40 CFR 258, Subpart F)	Potentially Relevant and Appropriate	Details specific requirements for closure and post-closure of municipal solid waste landfills. Final cover requirements that address minimizing infiltration and erosion are identified in this regulation. Following closure, post-closure requirements include preparing a post-closure plan, maintaining integrity and effectiveness of the final cover, groundwater monitoring, and maintaining and operating a gas collection system.	If an alternative includes closure of a solid waste landfill, then these requirements will be considered in formulating the alternative.
RCRA - Land Treatment (40 CFR 265 Subpart M)	Potentially Applicable	These regulations detail the requirements for conducting land treatment of RCRA hazardous waste.	Alternatives that involve on-site treatment of hazardous wastes (contaminated soil or sediments) will comply with these regulations.
RCRA - Thermal Treatmnent(40 CFR 265 Subpart P)	Potentially Applicable	This regulation details operating requirements and performance standards for thermal treatment of hazardous wastes.	Alternatives that include thermal or catalytic oxidation of offgases would be designed and operated in compliance with this regulation.
RCRA - Miscellaneous Treatment Units (40 CFR 264 Subpart X)	Potentially Applicable	This regulation details design and operating standards for units in which hazardous waste is treated,	Hazardous waste treatment units used for on-site or on-base treatment of contaminated media must meet these requirements.
RCRA - Air Emission Standards for Process Vents (40 CFR 265 Subpart AA)	Potentially Applicable	This regulation contains air pollutant emission standards fix process vents, dosed-vent systems, and control devices at hazardous waste TSD facilities. This subpart applies to equipment associated with solvent extraction or air/steam stripping operations that treat wastes that are identified or listed RCRA hazardous wastes and have a total organics concentration of 10 ppm or greater.	These standards will be considered during the development and design of alternatives that include treatment of VOC-contaminated soils. Air emissions from treatment units will be monitored to ensure compliance with this ARAR.

TABLE 12
POTENTIAL STATE ACTION-SPECIFIC ARARs AND TBCs
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
New Jersey Labeling, Records, and Transportation Requirements (N.J.A.C. 7:26-7)	Potentially Applicable	These regulations establish the responsibilities of generators and transporters of hazardous waste in the handling, transportation, and management of waste. The regulations specify the packaging, labeling, recordkeeping, and manifest requirements.	Activities performed in connection with off-site transport of hazardous wastes will comply with the requirements of these regulations.
New Jersey Requirements for Hazardous Waste Facilities (N.J.A.C. 7:26-9)	Potentially Applicable	These regulations identify requirements for facilities in general, groundwater monitoring, preparedness and prevention, contingency and emergency procedures, and general closure and post-closure.	If a remedial alternative includes the establishment of an on-base treatment facility for contaminated soils and materials, then this regulation will be compiled with during implementation.
New Jersey Closure and Post-Closure Care of Sanitary Landfills Regulations (N.J.A.C. 7:26-2A.9)	Potentially Relevant and Appropriate	Details specific requirements for closure and post-closure of municipal solid waste landfills. Final cover requirements that address minimizing infiltration and erosion are identified in this regulation. Following closure, post-closure requirements include preparing a post-closure plan, maintaining integrity and effectiveness of final cover, groundwater monitoring, and maintaining and operating a gas collection system.	If an alternative includes closure of a solid waste landfill, then these requirements will be considered in formulating the alternative.
New Jersey Thermal Treatment Regulations (N.J.A.C. 7:26-11.6)	Potentially Applicable	These regulations detail operating requirements, waste analyses and monitoring of treatment conditions, performance standards, and closure of existing facilities that thermally treat hazardous wastes.	Alternatives that include thermal treatment of contaminated soils, sediments, and materials would be designed and operated in consistent with this regulation.

TABLE 12
POTENTIAL STATE ACTION-SPECIFIC ARARS AND TBCS
FEASIBILITY STUDY
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	COMMENTS
New Jersey Chemical, Physical, and Biological Treatment Regulations (N.J.A.C. 7:26-11.7)	Potentially Applicable	These regulations detail operating requirements, waste analyses and monitoring of treatment conditions, and closure of existing facilities that physically, chemically, or biologically treat hazardous wastes. Also governs handling and compatibility of wastes in treatment processes.	Alternatives that include physical, chemical, or biological treatment of contaminated soils, sediments, and materials would be designed and operated in consistent with this regulation.
New Jersey Control and Prohibition of Air Pollution by Toxic Substances (NJAC. 7:27-17)	Potentially Applicable if emissions greater than 45.4 g/hr (0.1 lb/hr)	These regulations govern the emission of Group I and Group II toxic volatile organic compounds (TXS) to the ambient air. Group I TXS would be addressed through adequate stack height or prevention of aerodynamic downwash. Group II TXS would be addressed through reasonably available control technology.	Alternatives that my result in the release of Group I or Group II TXS to the ambient air, exceeding 0.1 lb/hr, would incorporate appropriate vapor control measure to comply with these requirements.

4. To Be Considered (TBC) Standards

Tables 7 through 12 summarize TBCs applicable to OU-3. It is expected that Alternative 5 will comply with these TBCs. The most stringent requirements among the TBCs are found in the GWQSs, MCLs, or risk-based criteria. In the case where a risk-based criterion is selected as a remediation goal, multiple routes of exposure (ie., exposure from ingestion of drinking water and inhalation of vapors while showering) and adjustments appropriate to reflect exposure to multiple chemicals with the same effect must be considered. Table 13 presents the preliminary remediation goals (PRGs) for Site 26.

C. Cost-Effectiveness

The Navy and EPA have determined that the selected remedy for OU-3 is cost effective in that it mitigates the risks posed by the site-related contaminants, meets all other requirements of CERCLA, and affords overall effectiveness proportionate to the cost. The capital costs for Alternative 5 total $1,698,000. The average annual O&M costs are $499,000, and 5-year reviews cost $15,500 per event. Over a 30-year period, the net present-worth cost is $3,755,000 (at a seven percent discount rate).

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Navy and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized in a cost-effective manner at OU-3.

E. Preference for Treatment as a Principal Element

The Navy and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at OU-3.

TABLE 13
SITE 26 GROUNDWATER PRELIMINARY REMEDIATION GOALS (µg/L)
NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

Contaminant of Concern	ARARS NJ GWQS	SDWA MCLs	PRG (2) Based on Risk = 1E-6 [carcinogen]	PRG (2) Based on HI = 0.1 [non-carcinogen]	Maximum Background Concentration	Maximum Detected Site Conc.
Trichloroethene	1	5	3.65	8.45	BDL	4800 (1)
1,1-Dichloroethen	10	7	0.11	--	BDL	5 (1)
1,2-Dichloroethene (cis/trans)	70/100	70/100	--	13.3	BDL	2000
Benzene	0.2	5	--	--	BDL	11 (1)
Carbon tetrachloride	0.4	5	--	--	BDL	2 (1)
Tetrachloroethene	1	5	--	--	BDL	5 (1)
Cadmium	4	5	--	--	1.9	4.4(3)

Notes:
- New Jersey State Ground Water Quality Standards (GWQS) are ARARs.
- Safe Drinking Water Act (SDWA) Maximum Contaminant Levels regulate organic and Inorganic constituents in public drinking water supplies, and are presented here only for comparison purposes.
- -- not a COC under this parameter.
- BDL Below derection limit.

(1) Based on direct push sampling with field GC analysis.
(2) PRG numerical values for carcinogens and non-carcinogens are based on exposure scenarios and factors applied in the NWS Earle human health risk assessment.
(3) Cadmium maximum site detected concentration of 4.4 (average site-related concentration of 1.04) is statistically considered to be equal to the PRG.

RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 3

PART III - RESPONSIVENESS SUMMARY

The purpose of this Responsiveness Summary is to review public response to the Proposed Plan for OU-3. It also documents the consideration of comments during the decision-making process and provides answers to any comments raised during the public comment period.

The Responsiveness Summary for OU-3 is divided into the following sections:

- Overview - This section briefly describes the remedial alternative recommended in the Proposed Plan and any impacts on the Proposed Plan due to public comment.

- Background on Community Involvement - This section describes community relations activities conducted with respect to the area of concern.

- Summary of Major Questions and Comments - This section summarizes verbal and written comments received during the public meeting and public comment period.

I. OVERVIEW

This Responsiveness Summary addresses public response to the Proposed Plan. The Proposed Plan and other supporting information were maintained for public review in the Administrative Record file for OU-3, which was maintained at the Monmouth County Library (Eastern Branch) in Shrewsbury, New Jersey.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

Throughout the investigation period, EPA and NJDEP reviewed work plans and reports and provided comments and recommendations that were incorporated into appropriate documents. A Technical Review Committee (TRC), consisting of representatives from the Navy, EPA, NJDEP, the Monmouth County Health Department, and other agencies and local groups surrounding NWS Earle, was formed. The TRC later was transformed into the Restoration Advisory Board (RAB) to include community members as well as the original officials from the TRC. The RAB has been holding periodic meetings to maintain open lines of communication with the community and to inform all parties of current activities.

On January 3, 1998 and January 4, 1998, a newspaper notification inviting public comment on the Proposed Plan appeared in the Asbury Park Press. The public notice summarized the Proposed Plan and the preferred alternative. The announcement also identified the time and location of the public meeting and specified a public comment period as well as the address to which written comments could be sent. Public comments were accepted from December 19, 1997 to January 30, 1998. The newspaper notification also identified the Monmouth County Library as the location of the Administrative Record.

The public meeting was held on January 22, 1998 from 7:00 p.m. in Building C-54 at NWS Earle, Colts Neck, New Jersey. At this meeting, representatives from the Navy, EPA, and the NJDEP were available to answer questions concerning OU-3 and the preferred alternative. The complete attendance list is included in Appendix B.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS

A. Written Comments

During the public comment period from December 19, 1997 to January 30, 1998, no written comments were received from the public pertaining to OU-3. No new comments were received from the NJDEP or EPA.

B. Public Meeting Comments

Numerous comments concerning OU-3 were received at the joint RAB meeting and public meeting to discuss the OU-3 Proposed Plan held on January 22, 1998. The following is a summary of comments/questions and government response.

Greg Goepfert and John Mayhew initiated discussion by giving a summary of site conditions and the proposed plan of remediation.

QUESTION: Ben Forest asked, Do the wells go across the water table?

REPSPONSE: Currently, all wells terminate above the clay layer.

As part of the remedial investigation, a narrow diameter sampling tool was used to obtain samples from beneath the clay layer. Contaminant concentrations in these samples were orders of magnitude lower than above the clay layer. All of the narrow diameter punch holes made through the clay layer during remedial investigation were sealed after sample collection, using low-permeability material (bentonite/cement grout) to avoid the possibility of leaving a conduit for contamination to spread to below the clay layer.

The conceptual design for remediation is for the air sparge injection wells to terminate above the clay layer. There is no plan to install wells through the barrier clay layer. Since the highest concentrations are directly above the clay, the sparge well screens will intersect the top of the clay.

QUESTION: Lester Jargowsky asked, Are there vapor treatment units? What kind of technology do we have there?

RESPONSE: Right now, the Navy anticipates that vapor treatment for air sparging gases will be needed. These systems vary in design, and partially will depend on the level of natural degradation that may occur in the ground after the system is installed and running.

COMMENT: Lester Jargowsky stated, Air sparging is not a new technology. There are leaking underground storage tank sites in the county where this technology is currently used.

RESPONSE: Agree.

QUESTION: Larry Harris asked, What is the radius of effectiveness?

RESPONSE: The first step, before full-scale design, is to install a couple of sparge points to measure the radius of influence by analyzing soil characteristics and measuring pressure changes. This "pilot" operation will provide the design parameters needed to extend the system based on measured criteria rather than by trial and error. The Navy anticipates that the sandy soil will result in a fairly wide radius of influence.

QUESTION: Kevin Bova asked, Is the injected air tempered?

RESPONSE: Designs vary. No decision on tempering the sparge air has been made.

QUESTION: Ben Forest asked, Is the Navy committed to operating this base for a long-term basis? There has been talk of base closing.

RESPONSE: The NWS Earle Commanding Officer stated that there is no discussion of shutting down NWS Earle at any time that involves our lifetime.

QUESTION: Ben Forest asked, Has there been any testing done outside of the base to see if there's been migration of contaminants outside the base into Colts Neck?

RESPONSE: As part of the remedial investigation, at the request of EPA, every stream leaving NWS Earle was sampled. Surface water and sediments were sampled and analyzed. Also, no sites were found with chlorinated solvents in groundwater moving off site.

QUESTION: Ben Forest said, More specifically, when we read that report, we didn't see any reference to groundwater, well water (off-station).

RESPONSE: Some off-station groundwater studies in wells have been made by the health department (with no detection of compounds thought to originate at Earle). In general, of all the sites at NWS Earle, at only a few of them have we seen solvent contamination. At this site (Site 26), surely the area of most significant impact found in this remedial investigation, the extent of the contamination plume in groundwater was found by going in with the hydropunch sampling tool which allows for a high degree of pinpointing the sample location (and hence the contaminant gradient). Using the hydropunch technique we followed the migration pathway of the contamination plume to the leading edge, the area where the concentration falls off to non-detect. There is no reason to believe that the contaminant plume would or could extend beyond where the concentration in the leading edge of the plume falls off to non-detect. The leading edge of the Site 26 contaminant plume is thousands of feet from the nearest NWS Earle property boundary. The remedial investigation generally concentrated on obtaining information at areas of known impact and was expanded to define the extent of impact. The streams leaving the base were then sampled to see if any of the compounds from any site were migrating with groundwater to surface water. The stream sample results were at non-detect levels (for these compounds).

COMMENT: Lester Jargowsky said, Early in the remedial investigation, we (the RAB or it's predecessor the Technical Review Committee [TRC]) asked the Navy to start off by performing a full analysis of water and sediment on every stream leaving the base. We wanted to be comfortable from the beginning that nobody was being harmed. The results were very favorable. However, a hazardous waste site unrelated to the base, a furniture stripping business using solvents, is located near NWS Earle. This site is really close to Earle but it has nothing to do with Earle.

RESPONSE: Comment noted.

COMMENT: Ben Forest said he had some comments but they weren't written for submission.

RESPONSE: Comments can be taken as part of the meeting minutes. That is the reason for the meeting tonight.

COMMENT: Ben Forest said, I would say that we were basically pleased with what we saw there (in the Site 26 Proposed Plan). Bear in mind that we're laymen on this, not engineers, but we noticed that you went for the most comprehensive option, alternative five as I remember. Basically, I'm sure everyone would agree, we're also concerned whether Earle stays open or not. Maybe things beyond your control may change things, who knows? We're pleased that you're going with the most aggressive approach to that (Site 26 remediation).

The other thoughts. We were just really surprised. To be honest with you, I'm cynical after dealing with the government, good and bad experiences. I was expecting that you would go for alternative two or the less aggressive approaches. I was very pleased to see that you went with the most aggressive approach, and I thought it was unusual and was very happy to see it.

RESPONSE: The Navy originally was looking at the reactive wall alternative. Everything we looked at said it (the reactive wall alternative) would be protective of the surrounding environment. The immediate area would remain impacted for 30 or 40 years although the surrounding environment would be protected. The EPA, in particular, had some concerns about the lengthy time frame. With air sparging (alternative five), we can go in and get a lot of VOC mass removal rapidly. There may still be 30 or 40 years before there is no impact from the site, but the advantage is that much of the volume of the VOC contamination can be removed early in the period. So, through some discussions with EPA, and having brought it up at a couple of RAB meetings, we changed our decision on how we wanted to treat this site, and went with the air sparging approach.

One of EPA's concerns was that Earle could close down and some other (less controlled) use may be desired. Base closure is not anticipated, but once something (waste contamination) is removed, we don't have to worry about it any longer.

COMMENT: Ben Forest said, You said that you did some testing below the clay line. We would like to see that done as a precaution. It certainly sounds like it is not necessary.

REPLY: Agree. That testing has been done as we discussed earlier. Our approach in taking these samples below the confining clay layer, when there was something (VOCs) above the clay layer with a chance for leakage right at well points, was to avoid having any permanent intrusion through the clay layer. That is why we are trying to focus on top of the clay layer once we took initial samples showing it (the area below the clay layer) wasn't already impacted.

COMMENT: Ben Forest said, The other thought (was), we didn't see anything in the Proposed Plan about testing beyond the borders of the base, although I gather there has been some testing done in regards to the various issues at Earle. You know, just as a precaution.

REPLY: Agree. The base-wide stream sampling program discussed earlier was performed to help cover this concern, and site-related contamination was investigated to the limits of migration as discussed earlier.

COMMENT: Ben Forest said, Thank you for your patience.

REPLY: NWS Earle Commanding Officer, Captain Honey, said, The Navy is very committed to the remediation process at all of our sites. I think you'll see that in some of the other site remediations we've done, or are in the process of doing, the extent to which we go. We don't take short cuts in the process. It's a quality effort all around.

QUESTION: Sharon Brown asked, What is the duration of the soil vapor extraction phase?

REPLY: Every year the progress will be evaluated.

QUESTION: Sharon Brown clarified the question, I mean the anticipated duration.

REPLY: The proposed plan estimated that five years may be required for the active air sparging phase. When we put together the estimates, we don't want to be too optimistic because time estimates affect the total cost that may be needed for funding. However, we think that the time frame may be much less than five years because we have conditions that are favorable to air sparging. In order to make a fair comparison among the different options, we want to say this process could take up to five years. It is very unlikely it would take longer than that. There is a good chance it will take a shorter duration.

Appendix A
TERMS USED IN THE RECORD OF DECISION

1,2-Dichloroethene (1,2-DCE): Common volatile organic solvent formerly used for cleaning, degreasing, or other useds in commerce and industry.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state requirements that a selected remedy must attain. These requirements may vary among sites and remedial activities.

Administrative Record: An official compilation of site-related documents, data, reports, and other information that are considered important to the status of and decisions made relative to a Superfund site. The public has access to this material.

Carcinogenic: A type of risk resulting from exposure to chemicals that may cause cancer in one or more organs.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Act created a trust fund, known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous substance facilities.

Feasibility Study (FS): Report identifying and evaluating alternatives for addressing the contamination present at a site or group of sites.

Groundwater Quality Standards (GWQS): New-Jersey-promulgated groundwater quality requirements, N.J.A.C. 7:9-6.

Hazard Index (HI): The sum of chemical-specific Hazard Quotients. A Hazard Index of greater than 1 is associated with an increased level of concern about adverse non-cancer health effects.

Hazard Quotient (HQ): A comparison of the level of exposure to a substance in contact with the body per unit time to a chemical-specific Reference Dose to evaluate potential non-cancer health effects. Exceedence of a Hazard Quotient of 1 is associated with an increased level of concern about adverse non-cancer health effects.

Initial Assessment Study (IAS): Preliminary investigation usually consisting of review of available data and information of a site, interviews, and a non-sampling site visit to observe areas of potential waste disposal and migration pathways.

Land Disposal Restrictions (LDRs): A set of EPA-prescribed limit concentrations with associated treatment standards regulating disposal in landfills.

Maximum Contaminant Level (MCL): EPA-published (promulgated as law) maximum concentration level for compounds found in water in a public water supply system.

Noncarcinogenic: A type of risk resulting from the exposure to chemicals that may cause systemic human health effects.

National Contingency Plan (NCP): The basis for the nationwide environmental restoration program known as Superfund; administered by EPA under the direction of the U.S. Congress.

National Priorities List (NPL): EPA's list of the nation's top-priority hazardous substance disposal facilities that may be eligible to receive federal (EPA) money for response under CERCLA. As a federal facility, NWS Earle is not eligible for EPA funding.

RCRA Subtitle D facility: Municipal-type waste disposal facility (landfill) regulated by the Resource Conservation and Recovery Act (RCRA).

Record of Decision (ROD): A legal document that describes the remedy selected for a Superfund facility, why the remedial actions were chosen and others not, how much they are expected to cost, and how the public responded.

Reference Dose (RD): An estimate (with an uncertainty spanning 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.

Remedial Action Objective (RAO): An objective selected in the FS, against which all potential remedial actions are judged.

Remedial Investigation (RI): Study that determines the nature and extent of contamination at a site.

Site Inspection (SI): Sampling investigation with the goal of identifying potential sources of contamination, types of contaminants, and potential migration of contaminants. The SI is conducted prior to the RI.

Semivolatile Organic Compounds (SVOCs): Organic chemicals [e.g., phthalates or polycyclic aromatic hydrocarbons (PAHs)] that do not readily evaporate under atmospheric conditions.

Target Compound List/Target Analyte List (TCL/TAL): List of routine organic compounds (TCL) or metals (TAL) included in the EPA Contract Laboratory Program.

Toxicity Characteristic Leaching Procedure (TCLP): Analytical test prescribed by EPA to determine potential leachate toxicity in materials; commonly used to determine the suitability of a waste for disposal in a landfill.

Trichloroethene (TCE): Common volatile organic solvent formerly used for cleaning, degreasing, or other uses in commerce and industry.

Volatile Organic Compounds (VOCs): Organic liquids [e.g., vinyl chloride or trichloroethene (TCE)] that readily evaporate under atmospheric conditions.

APPENDIX B
ATTENDANCE LIST
JANUARY 22,1998 PUBLIC MEETING

NAME	ORGANIZATION
Robert M. Honey	Commanding Officer, NWS Earle
Gregory J. Goepfert	NWS Earle
John Kolicius	Naval Facilities Engineering Command
Gus Hermanni	NWS Earle
Kevin M. Bova	NWS Earle
Dennis Blazak	NWS Earle
Deborah Sciascia	NWS Earle
Mike Brady	NWS Earle
Robert Jones	COMSUBGRU II (U. S. Navy)
Russell Turner	Brown & Root Environmental
Sharon Jaffess	USEPA Region II
Robert Marcolina	NJDEP
John Mayhew	Naval Facilities Engineering Command
Ben Forest	Monmouth Co. Friends of Clear Water
Lester Jargowsky	Monmouth County Health Department
Greta Deirocini	Naval Facilities Engineering Command
Sharon Brown	Resident, Tinton Falls
Tim Kinsella	Birdsall Engineering
Zach Lewis	Birdsall Engineering
Jeff Stem	Monmouth Co. Environmental Coalition
Mary Lanko	Resident, Howell Township
Larry Harris	Colts Neck Board of Health
Marilyn Boak	Colts Neck Board of Health
Mike Heffron	Foster Wheeler Corporation
Will Stephan	Resident, Howell Township
Janet Coakley	Resident, Howell Township
Carl Tippman	Foster Wheeler Corporation

<IMG SRC 98124Q>

ROD FACT SHEET

SITE
Name : Naval Weapons Station Earle
Location/State : 201 Highway 34 South, Col ts Neck, NJ
EPA Region : Region II
HRS Score (date): 37.21 (8/30/90)
Site ID # : NJ070022172

ROD
Date Signed: 9/29/98
Remedy/ies: air sparging with soil vapor extraction
Operating Unit Number: OU-3
Capital cost: $1,698,000 (in 1999 dollars)
Construction Completion: Est. Oct. 2003
O & M per year: $ 499,000 (in 1999 dollars)
Present worth: $3,755,000 (7% discount rate and 5 years 0 & M assumed)

LEAD
EPA Enforcement*
Primary contact: Jessica Mollin (212-637-3921)
Secondary contact: Bob Wing (212-637-4332)
Main PRP(s): Naval Weapons Station Earle (NWSE)
PRP Contact: John Kolicius (610-595-0567 ext. 157)

*Note: NWSE is the remediation lead since they are a federal facility

WASTE
Type: Solvents
Medium: soil and groundwater
Origin: dumping and spills
Est. quantity: unknown