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EPA

Superfund Record of Decision:

Waldick Aerospace Devices, NJ

50272-101

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16. Abstract (Limit: 200 words)

The 1.72-acre Waldick Aerospace Devices site is a former aerospace parts manufacturing facility in Wall Township, Monmouth County, New Jersey. Land use in the area is predominantly commercial and industrial, with residential properties located to the east. Hannabrand Brook flows within 900 feet of the site before it merges with another stream that eventually drains into the Atlantic Ocean. The site overlies a sandy silt/sand aquifer system that is a potential source of drinking water. From 1979 to 1983, Waldick Aerospace Devices, Inc., used the site to manufacture electroplated quick-release pins for the aerospace industry. For at least the first 3 years of operation, wastewater containing metals and organic solvents was discharged directly onto the ground. In addition, used machine oil was allowed to drain out of perforated drums onto the ground. As a result of State and local inspections, a number of investigations were conducted by EPA, which revealed VOCs, organics, and metals in soil and ground water in excess of MCLs. In 1985, EPA conducted a removal action that involved disposing of all manufacturing-related chemicals from the facility offsite. A 1987 Record of Decision (ROD) provided a source control remedy for soil that included in-situ air stripping to remove VOCs,

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Waldick Aerospace Devices, NJ
Second Remedial Action
Contaminated Media: soil, gw
Key Contaminants: VOCs (PCE, TCE, toluene), other organics, metals (chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 66
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Waldick Aerospace Devices, NJ
Second Remedial Action

Abstract (Continued)

excavation and offsite disposal of an area of metal-contaminated soil, and decontamination or demolition of onsite buildings. This ROD addresses both a final remedy for soil as a modification of the 1987 ROD, and an interim remedial action for ground water to prevent further ground water contaminant migration. The modification to the 1987 source remedy is a result of additional investigations, which revealed that metals were widespread throughout the site, and that the volume of contaminated soil was less than half of the previously estimated amount. In addition, tests during remedial design revealed that in-situ air stripping was inappropriate for the site. A future ROD will address a final remedy for the ground water contamination. The primary contaminants of concern affecting the soil and ground water are VOCs including PCE, TCE, and toluene; other organics; and metals including chromium and lead.

The selected modified remedy for the source contamination at this site includes excavating 8,000 cubic yards of contaminated soil; using onsite thermal treatment to remove organics; treating inorganic contaminated soil using solidification/stabilization; and backfilling or offsite disposal of the treated soil. The selected interim remedial action for ground water includes installing four ground water extraction wells in the zone of highest contaminant concentration; using chemical precipitation to remove inorganics, and disposing of the resultant sludge offsite; using air stripping to remove organics; reinjecting or infiltrating treated ground water into the aquifer, or discharging it to wetland areas to help offset any dewatering effects caused by ground water extraction, if appropriate; and ground water monitoring. The estimated cost of the soil remediation is $3,420,000 to $5,913,569 depending on whether treated material is disposed of onsite or offsite, respectively. The estimated present worth cost for the ground water remedial action is $5,923,372, which includes an annual O&M cost of $705,625.

PERFORMANCE STANDARDS OR GOALS: Ground water will be treated to achieve MCLs and non-zero MCLGs as part of the final remedial action. Chemical-specific clean-up levels, therefore, were not established.

ROD FACT SHEET

SITE

Name:	Waldick Aerospace Devices
Location:	Wall Township, Middlesex County, New Jersey
EPA Region:	II
HRS Score:	44.85
NPL Rank:	308

ROD

Date Signed: March 29, 1991

Selected Remedy

Source Control: Modification of 1987 ROD Remedy - excavation of contaminated soil with on-site thermal treatment to remove organic contaminants, off-site solidification/stabilization of inorganic contaminated soil prior to off-site disposal.

Ground Water: Extraction of contaminated ground water from the zone of highest contaminant concentrations, on-site treatment and reinjection of the treated ground water, with additional ground water monitoring and investigation to further characterize the overal contaminant plume and to evaluate the effectiveness of the remedial measures.

	Source Control	Ground Water
Capital Cost:	$ 5,913,569	$ 1,381,152
O & M:		$ 705,625
Present Worth:	$ 5,913,569	$ 5,923,372

LEAD

Agency:	Federal Remedial Lead
Primary Contact:	Mr. John Prince (212) 264-1213
State Contact:	Mr. Frank Richardson (609) 292-4070

WASTE

Type: VOCs, PAHs, heavy metals

Medium: Soil, ground water

Origin: Waldick Aerospace Devices, Inc., operated a manufacturing and electroplating operation at the site from 1979 to 1984.

DECLARATION STATEMENT

RECORD OF DECISION

WALDICK AEROSPACE DEVICES

Site Name and Location

Waldick Aerospace Devices
Wall Township, Monmouth County, New Jersey

Statement of Basis and Purpose

This decision document presents the selected interim remedial action for groundwater at the Waldick Aerospace Devices site, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This document also modifies the September 29, 1987 Record of Decision developed for the first remedial action at the Waldick Aerospace Devices site. This decision is based on the administrative record for the site.

The State of New Jersey concurs with the selected remedy and the modifications to the 1987 Record of Decision.

Assessment of the Site

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The remedy described in this document addresses the threats to human health and the environment associated with the contaminated groundwater resulting from the Waldick Aerospace Devices site. A previous Record of Decision, signed on September 29, 1987, selected a remedy for the source of this groundwater contamination. This decision document addresses both the contaminated groundwater and modifications to the 1987 Record of Decision. The goals of this groundwater remedial action are: to prevent further migration of the highly contaminated portion of the groundwater; to reduce contaminant concentrations in the groundwater; and to evaluate the response of the aquifer system to the remedial measures.

The major components of the selected interim groundwater remedy include:

- Extraction of contaminated groundwater from the zone of highest contaminant concentrations;
- On-site treatment of the extracted groundwater;
- Reinjection of the treated groundwater; and
- Additional groundwater monitoring and investigation to further characterize the overall contaminant plume and to evaluate the effectiveness of the above remedial measures.

As modified by this decision, the major components of the source control remedy (originally selected in the 1987 Record of Decision) include:

- Excavation of contaminated soil;
- On-site thermal treatment to remove organic contaminants;
- Solidification/stabilization treatment for inorganic-contaminated soil; and
- Backfilling or off-site disposal of the treated soil, as appropriate.

Statutory Determinations

This selected interim groundwater remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, given the limited scope of the action. Although this action does not constitute the final remedy for the operable unit, the remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Subsequent actions are planned to fully address the non-principal threats posed by the contaminated groundwater.

The selected modifications to the 1987 Record of Decision are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. These modifications utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfy the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as a principal element.

Constantine Sidamon-Eristoff
Regional Administrator

3/29/91
Date

Let's protect our earth

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
SCOTT A. WEINER, COMMISSIONER
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To JOHN FRISCO	From TONY FARRO
Co.	Co.
Dept.	Phone #
Fax #	Fax #

March 28, 1991

Mr. Constantine Sidimon-Eristoff
Regional Administrator, USEPA - Region II
Jacob K. Javits Federal Building
New York, NY 10278

Dear Mr. Eristoff:

The Department of Environmental Protection has evaluated and concurs with the selected interim remedy for the Waldick Aerospace Devices Superfund Site in Wall Township, Monmouth County, New Jersey. The selected interim remedy is as follows:

"The remedy described in this document addresses the threats to human health and the environment associated with the contaminated groundwater resulting from the Waldick Aerospace Devices Site. A previous Record of Decision, signed on September 29, 1987, selected a remedy for the source of this groundwater contamination. This decision document addresses both the contaminated groundwater and modifications to the 1987 Record of Decision. The goals of this groundwater remedial action are: to prevent further migration of the highly contaminated portion of the groundwater; to reduce contaminant concentrations in the groundwater; and to evaluate the response of the aquifer system to the remedial measures.

The major components of the selected interim groundwater remedy include:

- Extraction of contaminated groundwater from the zone of highest contaminant concentrations;
- On-site treatment of the extracted groundwater;
- Reinjection of the treated groundwater; and
- Additional groundwater monitoring and investigation to further characterize the overall contaminant plume and to evaluate the effectiveness of the above remedial measures.

The major components of the selected modifications to the 1987 Record of Decision include:

- Excavation of contaminated soil;
- On-site thermal treatment to remove organic contaminants;
- Solidification/Stabilization treatment for inorganic contaminated soil; and
- Backfilling or off-site disposal of the treated soil, as appropriate."

In accordance with the NCP regulations 300.515(e)(2)(i) and 300.515(h)(3), this serves as the NJDEP's letter of concurrence for the selected interim remedy of this EPA lead project.

Very Truly Yours,

Scott A. Weiner
Commissioner

DECISION SUMMARY

RECORD OF DECISION

WALDICK AEROSPACE DEVICES

SITE NAME, LOCATION, AND DESCRIPTION

The Waldick Aerospace Devices site is located at 2121 State Route 35, in the Sea Girt section of Wall Township, Monmouth County, New Jersey. The 1.72-acre site is bordered to the east by Route 35, to the south by commercial property, and to the north and west by undeveloped woodland.

Three buildings are located near the northern, western, and southern borders of the site. Most of the industrial operations occurred in the main (southern) building. The northern building, which was not used by the Waldick Company, was operated as a separate storefront, and has been used for several different retail businesses. It is isolated from the main building by a stockade fence. The western building was used by the Waldick Company for the storage of chemicals. The site location is shown on Figure 1.

East of Route 35, most properties are residential. The nearest residence to the site is approximately one-quarter mile away. The geology beneath the site is segregated into lower (characterized as a sandy silt) and upper (characterized as medium-fine sand) portions, both of which are saturated and part of the Kirkwood-Cohansey Aquifer System. The nearest drinking water well is on a residential property approximately three-eighths of a mile hydraulically upgradient, or north of the site. Groundwater generally flows in a southerly direction in the vicinity of the site. A public system supplies potable water to residents living downgradient of the Waldick site. This system draws water from a well located approximately two miles to the west-southwest. No current exposures to contaminated groundwater resulting from the Waldick site are known to exist. Groundwater in the area of the site is Class II, indicating that it is a current or potential source of drinking water.

Hannabrand Brook flows approximately 900 feet south of the site. It merges with a smaller stream northeast of the site and flows eastward into Wreck Pond, which drains into the Atlantic Ocean.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Waldick site was originally purchased and developed in the mid-1950s. For approximately 25 years, the site's main and auxiliary buildings were used primarily for storage and handling of plumbing supplies, as well as for office space. In 1979, the property was leased to Waldick Aerospace Devices, Inc., a company

that manufactured and electroplated quick-release pins for the aerospace industry. For at least the first three years of operation, wastewater containing heavy metals and organic solvents was discharged directly onto the ground on either side of the southern corner of the main building. In addition, used machine oil was allowed to drain out of perforated drums onto the ground at the rear (western side) of the main building.

Periodic inspections and sampling efforts, conducted from June 1982 through October 1984, by the Monmouth County Division of Criminal Justice, the Monmouth County Board of Health and the New Jersey Department of Environmental Protection (NJDEP) documented groundwater and soil contamination at the site. On March 9, 1983, Waldick Aerospace Devices petitioned for bankruptcy under Chapter 11 of the United States Bankruptcy Code. In 1984 the case was converted to a liquidation under Chapter 7 of the Code. The company vacated the property in Late 1984. The site was proposed for inclusion on the Environmental Protection Agency's (EPA's) National Priorities List (NPL) of Superfund sites in October 1984, and was finalized on the NPL in June 1986.

EPA began a remedial investigation and feasibility study (RI/FS) in April 1985 to determine the nature and extent of contamination at the site. The results of the RI revealed that, although all contaminated media (e.g., soil, surface water, groundwater, buildings) were studied, only soils and buildings had been characterized sufficiently enough to proceed with an FS to develop and evaluate remedial alternatives. Accordingly, EPA decided to address these defined contaminated media first, and more fully characterize potential groundwater, surface water, and stream sediment contamination in a supplemental RI/FS. The RI/FS determined that the contaminated soil was divided into two discrete areas according to the presence or absence of metals. Both areas contained volatile organic compounds (VOCs) and petroleum hydrocarbons (PHCs); however, the soils in one area also had high levels of cadmium and chromium. The two areas were estimated to have a total volume of 8,000 cubic yards of contaminated soil.

EPA's investigation of the on-site buildings revealed a container of cyanide in the western building, as well as a range of chemicals in poorly sealed or unsealed containers. Some of these chemicals were incompatible compounds stored in close proximity to one another. EPA inventoried all materials present in and around the main and western buildings, tested these materials for composition and compatibility, separated or bulked the materials as appropriate, and repacked them or overpacked the original containers. All materials were disposed of off-site at an appropriately permitted facility as part of a removal action.

Following a public meeting and a 30-day public comment period, EPA issued a Record of Decision (ROD) on September 29, 1987, which selected a source control remedy. This remedy included the reduction of VOC and PHC levels in the soil by in-situ air stripping. The in-situ air stripping was to be followed by selective excavation and off-site disposal of the one area containing metals-contaminated soil, along with any residually contaminated soil. The remedy also included appropriate remediation of on-site buildings by decontamination or demolition, depending on the volume of soils beneath the main building requiring excavation; installation of additional groundwater monitoring wells; establishment of an environmental monitoring program; complete fencing of the site to restrict access; and well restrictions.

Additionally, the ROD called for the preparation of a supplemental RI/FS to more fully characterize the nature and extent of contamination in the groundwater, surface water, and stream sediments.

The potentially responsible parties (PRPs) identified for the site include Waldick Aerospace Devices, Inc.; the former owners and officers of Waldick; and the site owner, KDD Realty Corporation (KDD). EPA sent Notice Letters to all of these parties giving them the opportunity to perform the initial RI/FS under EPA supervision. However, none of the parties offered to participate. Notice Letters were sent again to these PRPs in September 1987 to provide an update on the site and give the PRPs the opportunity to perform the source control remedial design and implementation. Again, none of the parties offered to participate.

A financial assessment/private investigation indicated that Waldick Aerospace Devices, Inc. apparently has no assets left. KDD's only significant asset is the former Waldick property itself. EPA is continuing its investigation into the financial assets and business relationships of other PRPs.

At the request of EPA, on September 28, 1990, the U.S. Department of Justice sued KDD in the U.S. District Court for the District of New Jersey to recover costs incurred.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan was developed to ensure the public opportunities for involvement in site-related decisions, including site analysis and characterization, alternatives analysis, and remedy selection; to determine, based on community interviews, activities to ensure public involvement; and to provide opportunities for the community to learn about the site.

EPA held a meeting in December 1985 to explain the initial RI/FS to the public and to report on progress being made at the site. The results of the RI/FS were presented in a public meeting held on July 23, 1987. A ROD, which selected a source control remedy, was signed on September 29, 1987.

In August 1988, EPA issued a document to provide residents and local officials with an update on past activities conducted by EPA, to describe the soil remediation planned for the near future, and to discuss the upcoming supplemental RI/FS to examine the groundwater contamination.

The supplemental RI and FS reports, which addressed the groundwater contamination, were released to the public on February 15, 1991. A Proposed Plan, that identified EPA's preferred groundwater remedial alternative, and discussed modifications to the source control remedy selected in September 1987, was released on February 15, 1991. The documents were made available to the public at information repositories maintained at the Wall Township Municipal Building and the Wall Township Public Library. A public comment period was held from February 15 through March 17, 1991. A public meeting was held on February 28, 1991, to present the findings of all previous studies and the Proposed Plan, and to solicit public input. The issues raised at the public meeting and during the public comment period are addressed in the Responsiveness Summary, which is part of this Record of Decision. This decision document presents the selected remedial action for the Waldick Aerospace Devices site, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for this site is based on the administrative record.

SCOPE AND ROLE OF ACTION

As discussed above, the 1987 ROD selected a remedy to address the source of the contamination found at the Waldick site. After the ROD was signed, a supplemental RI/FS was conducted to more fully characterize the presence and extent of contamination in groundwater, surface water, and stream sediments. The remediation of the groundwater contamination is complicated by a complex hydrogeology. Consequently, the feasibility of complete restoration of the contaminated groundwater cannot be fully assessed at this time, based on the hydrogeologic information presently available and the known extent of groundwater contamination. Therefore, this operable unit selects an interim remedy intended to prevent further groundwater contaminant migration and to initiate the first phase of groundwater restoration. Specifically, the highly contaminated portion of the overall groundwater contaminant plume will be pumped through

several groundwater extraction wells, treated on the site, and reinjected into the groundwater system. The treated groundwater would be reinjected into the groundwater system in locations which would not increase the vertical or horizontal spread of contamination. This interim action is intended to prevent further migration of the highly contaminated portion of the groundwater while evaluating the effectiveness of groundwater extraction and treatment measures for this aquifer system. A final remedy for the groundwater contamination will be determined after collecting additional groundwater sampling information and evaluating the effectiveness of the interim remedy.

This ROD also documents modifications to the source control remedy selected in September 1987.

MODIFICATIONS TO REMEDY SELECTED IN THE SEPTEMBER 29, 1987 ROD

EPA and the U.S. Army Corps of Engineers are currently performing the design of the source control remedy. The scope of the design has been modified as a result of the following:

- Federal land disposal restrictions, which were promulgated after the 1987 ROD was signed, require that all contaminated soil will be treated prior to disposal.

- Although the original RI/FS indicated that the VOC- and PHC-contaminated soil was divided into two discrete areas according to the presence or absence of metals, sampling performed during the remedial design found that both areas contained metals contamination. Further, the design determined that the volume of contaminated soil at the site is actually less than half of the volume estimated in the ROD. Finally, tests conducted during the remedial design determined that remediation of PHC-contaminated soil through in-place air stripping is not appropriate for this site.

As a result, the source control design has been restructured such that contaminated soil will be excavated and thermally treated to remove organic contaminants. Treatment technologies for the removal of metals contamination, evaluated during the source control FS, were found to be inappropriate for site conditions. Therefore, the thermally treated soil will be further treated to stabilize metals contamination prior to disposal. If it is determined during the remedial design that the thermally treated soil will be stabilized on-site, and if it is determined that the stabilized material conforms with New Jersey Solid Waste Regulations and other applicable or relevant and appropriate requirements (ARARs), then the stabilized material would be replaced on the site. Otherwise, the stabilized material would be disposed of off-site at an appropriately permitted landfill.

SUMMARY OF SITE CHARACTERISTICS

The results of the supplemental RI/FS, which addressed groundwater, surface water, and sediments, are discussed below.

Groundwater

To characterize the groundwater contamination, 11 additional groundwater monitoring wells were installed. Groundwater samples were collected from the 11 new wells, in addition to the nine wells that were installed during the first RI/FS. The results of groundwater sampling of the shallow, intermediate, and deep portions of the Kirkwood-Cohansey Aquifer System demonstrated that the groundwater is contaminated with VOCs and metals in a plume emanating from the area formerly occupied by Waldick Aerospace Devices. The groundwater sampling also revealed that the contaminant plume contains a distinct portion that is much more highly contaminated than the remainder of the plume.

Contaminants of potential concern detected in the groundwater include bis (2-ethylhexyl) phthalate, 2-butanone, chloroform, trichloroethene, tetrachloroethene, toluene, cadmium, chromium, copper, lead, nickel and zinc. Concentrations of many of the contaminants exceeded the Maximum Contaminant Levels (MCLs) which have been devised to protect drinking water. [MCLs are enforceable standards based on health risks associated with an individual's consumption of two liters of water per day over a 70-year period.]

As noted above, a highly contaminated portion of the plume, with concentrations of total VOCs exceeding 400 ppb, was also identified. For example, trichloroethene was detected at concentrations as high as 33 parts per billion (ppb) in intermediate depth groundwater monitoring wells, and tetrachloroethene was detected at concentrations up to 470 ppb in shallow wells. The New Jersey Safe Drinking Water Act MCL for both of these contaminants is 1 ppb. Similarly, concentrations of cadmium were found as high as 144 ppb. The MCL for cadmium is 10 ppb. This portion of the plume was found to have concentrations of contaminants present from the water table down to a depth of approximately 70 feet, and an areal extent approximately 600 feet long by 200 feet wide.

It is assumed that contaminants may be present in the overall plume down to a depth of 120 feet, and that the areal extent of the overall plume is approximately 1,140 feet long by 600 feet wide. Because the site is complicated by a complex hydrogeology, the actual horizontal and vertical boundaries of the overall contaminant plume have not yet been fully defined. VOCs in the groundwater at shallow and intermediate depths are believed to discharge into Hannabrand Brook; however, downgradient VOC contamination may extend beyond the brook, especially in the

deeper portions of the aquifer system. The highest levels of metals contamination were detected in the intermediate depth monitoring wells; it is believed that the migration of metals is slowed in that zone. Metals may migrate farther in the upper, more permeable zone.

Figures 2 and 3 show the locations of the monitoring wells and the extent of groundwater contamination. Tables 1 through 3 show the concentrations of each of the major contaminants found in the groundwater during the supplemental RI.

Surface Water and Sediments

Surface water and sediment sampling investigations were also conducted to determine the presence and extent of contamination. Seven stream sampling locations were selected in Hannabrand Brook. These locations ranged from approximately 450 feet west of Route 35 to 2,300 feet east of Route 35, as shown on Figure 4. Volatile organic compounds, bis (2-ethylhexyl) phthalate, and metals, including aluminum, copper, and zinc, were detected in surface water and sediment samples. Volatile organic compounds were detected in surface water samples taken at the two farthest downstream sampling locations. Toluene, the only volatile organic compound detected in sediment samples, was found at two different sampling locations. Metals were found at all surface water and sediment sampling locations. Background levels were determined from concentrations detected at the farthest upstream sampling location. Aluminum, copper and zinc were detected in the surface water samples at concentrations slightly above the background range. Most of the metals detected in the sediment samples were within the background range. All organic contaminants detected in downstream sediment samples, except for toluene, were detected at similar concentrations in the background samples.

Tables 4 and 5 summarize the results of the surface water and sediment sampling.

SUMMARY OF SITE RISKS

Human Health Risks

EPA conducted a Public Health Evaluation (PHE) of the "no action" alternative to evaluate the potential risks to human health and the environment associated with the Waldick site in its current state. It focused on the contaminants which are likely to pose the most significant risks to human health and the environment (chemicals of potential concern). These "chemicals of potential concern" in site media are shown in Table 6. Because the remedy selected in the 1987 ROD included remediation of the source of contamination at the site, the potential impacts associated with

contaminants in the source of contamination were not assessed in the PHE.

Contaminants of potential concern were identified in the groundwater, subsurface soil, surface water, and sediments. Volatile organic contaminants (primarily tetrachloroethene) were identified as contaminants of potential concern in groundwater, surface water and subsurface soil. Bis (2-ethylhexyl) phthalate, a semi-volatile contaminant, was identified as a contaminant of potential concern in subsurface soil, surface water and groundwater. Organic chemicals in sediment may represent background levels. In addition, metals were identified as chemicals of potential concern in all media.

The PHE evaluated the exposure pathways believed to be associated with the greatest potential exposures. These exposure pathways are:

1. Future use of groundwater with the following routes of exposure:

   (a) ingestion;

   (b) inhalation of volatile compounds released while showering;

   (c) inhalation of volatile compounds while lawn watering;

   (d) dermal exposure while swimming; and

   (e) ingestion of vegetables that have taken up inorganic compounds from irrigation with groundwater.

2. Dermal absorption by children while wading in Hannabrand Brook.

3. Potential exposure to aquatic life in Hannabrand Brook.

Because the irrigation wells identified during the RI are outside the known area of groundwater contamination, and no current groundwater exposures are known to exist, the PHE did not consider current use of groundwater as a complete exposure pathway.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and noncarcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual indicator compounds were

summed to indicate the potential risks associated with mixtures of potential carcinogens and noncarcinogens, respectively. The Health Effects Criteria for the chemicals of potential concern are presented in Table 7.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of milligrams per kilogram per day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular media. The hazard index is obtained by adding the hazard quotients for all compounds across all media. A hazard index greater than 1 indicates that the potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Potential carcinogenic risks were evaluated using the cancer potency factors developed by EPA for the indicator compounds. Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes the underestimation of the risk highly unlikely.

For known or suspected carcinogens, EPA considers excess upper-bound individual lifetime cancer risks of between 1×10^{-4} to 1×10^{-6} to be acceptable. This level indicates that an individual has no greater than a one in ten thousand to one in a million chance of developing cancer as a result of exposure to site conditions.

The hazard indices and cancer risks associated with the potential exposure pathways at the Waldick site are presented in Tables 8 through 17. Inhalation of VOCs released while showering, and ingestion of contaminated groundwater, evaluated under a hypothetical future use scenario, were the only pathways of exposure considered potentially hazardous to humans in the PHE.

If contaminated groundwater were ingested, and VOCs were inhaled while showering, under the scenario evaluated in the PHE, the maximum estimation for carcinogenic risk would be 2×10^{-4}, and the Hazard Index would be 34.9. While the maximum estimation for carcinogenic risk is close to the range of acceptable exposure levels, the Hazard Index exceeds one. To EPA's knowledge, no one is currently utilizing the contaminated aquifers as a source of potable water or for showering. However, cleanup is warranted because, as discussed earlier, groundwater contaminants are present at concentrations exceeding MCLs, and because of the desire to restore the groundwater to its beneficial use as a potential drinking water source in the future.

Environmental Risks

Potential impacts associated with the contaminants of concern were also assessed for nonhuman exposures for the Waldick site. The concentrations of many of the contaminants found in Hannabrand Brook significantly decrease downstream due to dilution; therefore, aquatic organisms in these areas would not be significantly impacted. In addition, modeled future surface water concentrations of chemicals of potential concern currently present in the shallow aquifer did not appear to present a significant threat to the wetland ecosystem. Further, none of the chemicals of potential concern are likely to significantly bioaccumulate in an aquatic ecosystem. Therefore, aquatic life may not be at significantly increased risk (currently or in the future) from exposure to wetland areas near the site relative to areas upstream of the site.

Uncertainties in the PHE

As in any risk assessment, the estimates of risk for the Waldick site have some uncertainties. As a result of these uncertainties, the risk assessment should not be construed as presenting an absolute estimate of risks to human or environmental populations. Rather, it is a conservative analysis intended to indicate the potential for adverse impacts to occur.

Conclusion

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

The goals of this interim groundwater remedy are: to prevent further migration of the highly contaminated portion of the groundwater contaminant plume; to reduce the contaminant concentrations; and to evaluate the aquifer's response to the

extraction and treatment measures. If the evaluation of the interim remedy shows it to be potentially feasible, the goal of a final remedial action for the cleanup of the groundwater contamination at the Waldick site would be to restore the groundwater to the Maximum Contaminant Level Goals (MCLGs), established under the Safe Drinking Water Act, that are set at levels above zero. Where the MCLG for a contaminant has been set at a level of zero, the more stringent of the Federal or State MCLs for that contaminant would be used.

Although the goal of this interim remedy is not to restore the groundwater to drinkable levels, the extracted groundwater will be treated to achieve MCLG concentrations, or the more stringent of the Federal or State MCL concentrations where the MCLG has been set at zero, prior to its reinjection into the groundwater system.

DESCRIPTION OF ALTERNATIVES

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by SARA, requires that each selected site remedy be protective of human health and the environment, comply with applicable or relevant and appropriate requirements, utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and be cost effective.

The supplemental RI identified the groundwater itself as the principal environmental medium affected by contamination. The source of the groundwater contamination is addressed by the 1987 ROD.

The supplemental FS evaluated, in detail, four alternatives for remediating the groundwater. Alternatives 3 and 4 have been further separated into three components. A brief description of the alternatives, as well as an estimate of their costs and implementation timeframes, follows.

Alternative 1: No Further Action

Implementation Period:	None
Capital Cost:	0
Operation & Maintenance (O&M) Costs:	$30,250
Present Worth:	$18,782

The "no action" alternative is developed and evaluated to establish a baseline for comparison of alternatives. Under this alternative, EPA would plan to take no further remedial action to address the groundwater contamination. However, a review would be conducted after five years to determine whether or not the

contamination has spread. If necessary, appropriate action would be considered at that time.

Alternative 2: Limited Action

Implementation Period:	30 years
Capital Cost:	$114,840
Annual O&M Costs:	$ 63,800
Present Worth:	$716,276

Under this alternative, no further active remedial measures would be taken. However, existing and new monitoring wells at the site would be used to conduct a long-term groundwater monitoring program which would track the migration and the concentrations of contaminants. Periodic monitoring of surface water and sediments would also be performed. The implementation period for this alternative was based on a 30-year monitoring program.

Alternative 3: Remediation of the Zone of Highest Contaminant Concentration

3(a) Groundwater Extraction/Precipitation/Air Stripping/Reinjection

Implementation Period:	10 years
Capital Cost:	$1,381,152
Annual O&M Costs:	$ 705,625
Present Worth:	$5,923,372

3(b) Groundwater Extraction/Precipitation/Chemical Oxidation enhanced with Ultraviolet (UV) Photolysis/Reinjection

Implementation Period:	10 years
Capital Cost:	$1,482,131
Annual O&M Costs:	$ 707,500
Present Worth:	$6,035,872

3(c) Groundwater Extraction/Precipitation/Carbon Adsorption/Reinjection

Implementation Period:	10 years
Capital Cost:	$1,318,408
Annual O&M Costs:	$ 703,250
Present Worth:	$5,846,035

Under this alternative, an interim action would be pursued in conjunction with additional investigation. The major features of the interim action include groundwater extraction, collection, treatment, discharge of treated groundwater via reinjection into the aquifer, and a performance monitoring program.

As evaluated in the FS, this alternative involves the use of four groundwater extraction wells, placed in the zone of highest groundwater contaminant concentration, pumping at a rate of approximately 120 gallons per minute (gpm). The approximate pumping rate to achieve the desired capture of contaminants for this alternative was determined by considering several factors, including the number and locations of extraction wells, aquifer system hydrogeology, and possible impact to wetland areas. The exact location and number of extraction wells would be determined during the remedial design of the remedy. Based on the concentrations of contaminants found in the groundwater, and the known hydrogeologic characteristics, the FS determined that the removal of 12 pore volumes (for this concentrated zone, a pore volume is approximately 47 million gallons) of groundwater would be required to extract the highly contaminated portion of the contaminant plume. It was estimated that this would take 10 years to accomplish; however, actual aquifer conditions encountered during remediation may affect this duration.

Treatment of the extracted groundwater would consist of chemical precipitation to remove inorganic compounds. The resultant sludge would be disposed of off-site in compliance with ARARs. Chemical precipitation would be followed by either air stripping (Alternative 3[a]), chemical oxidation enhanced by ultraviolet photolysis (Alternative 3[b]), or carbon adsorption (Alternative 3[c]) to remove organic contaminants from the groundwater. The treated groundwater would be reinjected into the aquifer using an estimated three injection wells. The exact location and number of injection wells would also be determined during the remedial design phase. An option of utilizing infiltration galleries would also be evaluated. Although the FS evaluated the option of discharging treated groundwater to Hannabrand Brook, because Hannabrand Brook is a fairly small stream, and discharging a large amount of water into it could significantly alter its flow, this option was eliminated from consideration as a remedial technology.

An assessment would be made during the design of the remedy to ensure that any adverse impacts to wetland areas would be mitigated. If appropriate, some of the treated groundwater could be discharged to wetland areas to help offset any dewatering effects created by the groundwater extraction.

Additional groundwater monitoring would be performed under this alternative to evaluate the aquifer system's response to extraction measures, and to further characterize the contaminant plume.

Alternative 4 Remediation of the Assumed Plume

4(a) Groundwater Extraction/Precipitation/Air Stripping/Reinjection

Implementation Period:	30 years
Capital Cost:	$1,618,403
Annual O&M Costs:	$ 734,375
Present Worth:	$8,541,283

4(b) Groundwater Extraction/Precipitation/Chemical Oxidation enhanced with UV Photolysis/Reinjection

Implementation Period:	30 years
Capital Cost:	$1,719,382
Annual O&M Costs:	$ 736,250
Present Worth:	$8,659,937

4(c) Groundwater Extraction/Precipitation/Carbon Adsorption/Reinjection

Implementation Period:	30 years
Capital Cost:	$1,555,659
Annual O&M Costs:	$ 732,000
Present Worth:	$8,456,150

Because the actual horizontal and vertical boundaries of the overall contaminant plume were not fully defined by the RI, Alternative 4 was developed in the FS by using various assumptions regarding the extent of the groundwater contamination. These assumptions were based on the known extent of contamination and the hydrogeologic characteristics of the aquifer system.

The components and subalternatives of Alternative 4 are the same as those described in Alternative 3. However, the configuration of components for Alternative 4 were developed to extract, treat, and discharge a greater volume of contaminated groundwater. For instance, extraction and reinjection wells would be placed outside of the zone of highest groundwater contaminant concentration. Six extraction wells, pumping at a rate of approximately 120 gpm, would be required. It is estimated that approximately 1.67 billion gallons of groundwater would need to be removed for groundwater restoration. Consequently, because of the greater volume of contaminated groundwater associated with the assumed plume, an estimated 30 years would be required for aquifer restoration.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Evaluation Criteria

Three of the four alternatives noted above were evaluated using criteria derived from the NCP and SARA. These criteria relate directly to factors mandated by SARA in Section 121, including Section 121(b)(1)(A-G). The criteria are as follows:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume via treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

Comparisons

As previously noted, the remediation of the groundwater contamination is difficult due to the complex hydrogeology of this site. Furthermore, the feasibility of complete restoration of the contaminated groundwater cannot be fully assessed at this time, based on the hydrogeologic information presently available and the known extent of groundwater contamination. Therefore, Alternative 4 was not considered as an option for the site at this time.

A comparative discussion of the major components of the remaining groundwater alternatives, and the modifications to the source control remedy selected in September 1987, using the evaluation criteria, follows.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the central mandate of CERCLA, as amended by SARA. Protection is achieved by reducing health and environmental threats and by taking appropriate action to ensure that, in the future, there would be no unacceptable risks to human health and the environment through any exposure pathway.

Groundwater Remedial Alternatives

Alternative 1 would not provide any additional protection of human health and the environment than that which will be provided through the implementation of the remedy selected in the 1987 ROD. No treatment would be provided, and only natural processes would attenuate the groundwater contamination. Alternative 2 would provide only minimally more protection than Alternative 1 through the monitoring of contamination and the potential for providing a warning against the use of contaminated groundwater. Alternative 3(a), as well as 3(b) and 3(c) provide a significant degree of protection of human health and the environment by preventing the further migration of the most highly contaminated portion of the groundwater contaminant plume and by reducing the overall contaminant concentrations. Because Alternatives 1 and 2 are not considered protective, they are not considered further in this analysis as options for the site. As previously noted, Alternative 4 was not considered as an option for the site at this time.

Source Control Remedy Modifications

The modifications to the source control remedy selected in the 1987 ROD provide protection of human health and the environment by eliminating, reducing and controlling risk through treatment and engineering controls. Organic contaminants would be removed from the soil through treatment, thereby eliminating long-term risks due to dermal contact, ingestion, and inhalation. The remaining contaminants would be stabilized to minimize their potential release into the environment.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended by SARA, requires that remedies for Superfund sites comply with Federal and State laws that are directly applicable and, therefore, legally enforceable. Remedies must also comply with the requirements of laws and regulations that are not applicable, but are relevant and appropriate; in other words, requirements that pertain to situations sufficiently similar to those encountered at a Superfund site such that their use is well suited to the site. Combined, these are referred to as "applicable or relevant and appropriate requirements".

Groundwater Remedial Alternatives

Alternative 3(a), as well as 3(b) and 3(c), are interim remedies to prevent further migration of the most highly contaminated portion of the contaminant plume, and are not intended to restore the quality of the groundwater to drinkable conditions. Therefore, although the MCLGs and MCLs are ARARs, they need not

be achieved in groundwater at this time. However, the MCLGs, or the more stringent of the Federal or State MCLs, where the MCLG has been set at zero, will be used if a final remedial action intended to restore the groundwater to beneficial use as a drinking water source is implemented.

Although the goal of this interim remedy is not to restore the groundwater to drinkable levels, the extracted groundwater will be treated to achieve MCLG concentrations, or the more stringent of the Federal or State MCL concentrations where the MCLG has been set at zero, prior to its reinjection into the groundwater system.

Residuals generated as a result of groundwater treatment will be disposed of off-site in compliance with ARARs.

To ensure compliance with the National Historic Preservation Act, a cultural resources survey will be prepared during remedial design.

The Waldick site lies within the coastal zone as designated by the State of New Jersey under the Coastal Zone Management Act. Accordingly, a review was performed and the remedial alternatives were determined to be consistent with the New Jersey State Coastal Management Program.

Source Control Remedy Modifications

The source control remedy would meet ARARs. Any residuals generated as a result of controlling emissions from the on-site thermal treatment unit will be disposed of off-site in compliance with ARARs. If it is determined during the remedial design that the thermally treated soil will be stabilized on-site, and if it is determined that the stabilized material conforms with New Jersey Solid Waste Regulations and other ARARs, then the stabilized material would be replaced on the site. Otherwise, the stabilized material would be disposed of off-site at an appropriately permitted landfill.

No waiver from ARARs is necessary to implement the modifications to the source control remedy.

Reduction of Toxicity, Mobility, or Volume via Treatment

This evaluation criteria relates to the performance of a technology or remedial alternative in terms of eliminating or controlling risks posed by the toxicity, mobility, or volume of hazardous substances.

Groundwater Remedial Alternatives

Alternatives 3(a), 3(b) and 3(c) would reduce the toxicity, mobility, and volume of the contaminants present in the groundwater through the use of extraction and treatment methods. Sludge resulting from treatment for metals removal would be disposed of off-site, and spent carbon from the removal of VOCs (under Alternative 3[c]) would be regenerated or disposed of off-site. The treatment provided under Alternatives 3(a), 3(b), and 3(c) would be irreversible.

Source Control Remedy Modifications

The remedy utilizes thermal treatment and solidification/ stabilization to remediate the contaminated soil at the site. The toxicity, mobility, and volume of soil contaminants would be reduced. The process would be irreversible for organic contaminants, and expected to be irreversible for inorganic contaminants. Immobilized inorganic contaminants, at concentrations above the previously established soil cleanup objectives, would remain in the soil if the solidified material is replaced on the site.

Short-term Effectiveness

Short-term effectiveness measures how well an alternative is expected to perform, the time to achieve performance, and the potential adverse impacts of its implementation.

Groundwater Remedial Alternatives

It is expected that each of the three subalternatives of Alternative 3 would be effective at containing the spread of the highly contaminated portion of the contaminant plume in the short-term. A monitoring program would be implemented on a regular basis throughout the duration of the interim remedy to assess its effectiveness and determine the need for modifications.

An assessment would be made during the design of the remedy to ensure that any adverse impacts to wetland areas would be mitigated. If appropriate, some of the treated groundwater could be discharged to wetland areas to help offset any dewatering effects created by the groundwater extraction.

None of the three subalternatives of Alternative 3 would create any significant short-term, health-related concerns for the public beyond those posed by normal construction activities. A relatively minor increase in traffic during construction and transportation of treatment residuals is expected.

Source Control Remedy Modifications

It is estimated that the source control remedy would take six months to complete once excavation has begun.

The potential for erosion and transport of contaminated soil into surface water or off-site areas would be minimized by standard erosion control methods. Dust suppression techniques would be used to minimize or eliminate fugitive emissions. Appropriate personnel protection equipment would be used to minimize risks to workers.

The source control remedy does present a slight risk increase resulting from emissions; these, however, can be minimized through careful management of the thermal treatment unit. The actual thermal treatment should take about three months. If it is determined that the solidified material will be disposed of off-site, there is also a risk associated with the transport of the solidified material to the appropriately permitted landfill.

Long-term Effectiveness and Permanence

Long-term effectiveness and permanence address the long-term protection and reliability that an alternative affords.

Groundwater Remedial Alternatives

The potential for residual risk remaining at the site after completion of a remedial action cannot be fully assessed at this time. The implementation of an interim extraction and treatment remedy, along with additional field investigation, provides the best opportunity for assessing final groundwater remedies at the site.

Source Control Remedy Modifications

Implementation of the remedy would result in the reduction of risks to within an acceptable range. Most of the organic contaminants would be removed by the thermal treatment process. The solidified material would be disposed of either on-site or off-site. If the solidified material were disposed of on-site, the risk of future groundwater contamination would be minimal because the inorganic contaminants would be immobilized and a vegetative cover would be placed over them.

Implementability

Implementability considerations address how easy or difficult, feasible or infeasible, it would be to carry out a given alternative from design through construction and operation and maintenance.

Groundwater Remedial Alternatives

Each of the three subalternatives of Alternative 3 is technically feasible to implement. Alternatives 3(a) and 3(c) employ conventional treatment technologies and are commonly used to treat contaminated water. Alternative 3(c) might require a bench-scale treatability study to determine optimum operating parameters. For 3(b), a pilot-scale treatability study would be required to establish operating parameters for chemical oxidation enhanced with UV photolysis. Technological improvements in the extraction/treatment/discharge system for each of the three alternatives could be implemented during the interim remedy, as information on the progress of the operation becomes available.

Source Control Remedy Modifications

The source control remedy has few associated administrative difficulties which could delay implementation. The technologies have been used successfully to address similar contaminants at other Superfund sites, and the skilled workers needed to implement the remedies are readily available in the area. The on-site thermal treatment unit will meet substantial permit equivalent requirements.

Cost

Costs are evaluated in terms of remedial action capital costs, operation and maintenance costs, and present worth.

Groundwater Remedial Alternatives

The estimated present worth of Alternative 3(a) is $5,923,372. The lowest cost alternative is 3(c), at $5,846,035. The highest cost alternative is 3(b), at $6,035,872.

Source Control Remedy Modifications

The estimated cost of the soil remediation is $5,913,569. This cost estimate assumes that the solidified material will be disposed of off-site. If the solidified material is disposed of on-site, the estimated cost of the soil remediation is $3,420,000.

State Acceptance

The State Acceptance factor addresses whether the State of New Jersey supports, opposes, or has no comment on the preferred alternative.

Groundwater Remedial Alternatives

The State of New Jersey supports the remedial action called for by the selected remedy.

Source Control Remedy Modifications

The State of New Jersey supports the modifications to the source control remedy.

Community Acceptance

This evaluation factor addresses public reaction to the remedial alternatives which were considered, and the preferred alternative.

Issues raised during the public comment period and at the public meeting held on February 28, 1991, are addressed in the Responsiveness Summary Section of this ROD.

SELECTED REMEDY

Section 121(b) of CERCLA, as amended, requires EPA to select remedial actions which utilize permanent solutions and alternative treatment technologies or resource recovery options to the maximum extent practicable. In addition, EPA prefers remedial actions that permanently and significantly reduce the mobility, toxicity, or volume of site wastes.

After careful review and evaluation of the alternatives evaluated in detail in the supplemental feasibility study, and consideration of all evaluation criteria, EPA presented Alternative 3(a), Groundwater Extraction from the Zone of Highest Contaminant Concentration/Precipitation/Air Stripping/ Reinjection, to the public as the preferred remedy for the groundwater contamination at the Waldick Aerospace Devices site. Additionally, EPA presented modifications to the remedy selected in the September 29, 1987 ROD. The modified source control remedy included excavation of all contaminated soil, on-site thermal treatment, and solidification/stabilization of the thermally treated soil prior to disposal.

The input received during the public comment period, consisting primarily of questions and statements submitted at the public meeting held on February 28, 1991, is presented in the attached Responsiveness Summary. Public comments did not necessitate any changes to the preferred alternative or the 1987 ROD modifications for the site. Accordingly, the preferred alternative and the modifications to the 1987 ROD have been selected by EPA as the remedial solutions for the site.

The goals of this interim groundwater remedy are to prevent further migration of the highly contaminated portion of the groundwater contaminant plume and to evaluate the aquifer's response to extraction and treatment measures. If the evaluation of the interim remedy shows it to be potentially feasible, the goal of a final remedial action for the cleanup of the groundwater contamination at the Waldick site would be to restore the groundwater to the MCLGs that are set at levels above zero. Where the MCLG for a contaminant has been set at a level of zero, the more stringent of the Federal or State MCLs for that contaminant would be used. A final remedy for groundwater will be determined after collecting additional information on the extent of groundwater contamination, and evaluating the effectiveness of the interim remedy.

Some additional activities will be performed during the remedial design and remedial action phases for the two operable units. These activities are described below.

The aquifer system will be periodically monitored during the remedial design and remedial action phases, as well as following the completion of the interim remedial action. During the remedial design, studies will be undertaken to further delineate the extent of contamination and groundwater flow patterns, and to determine if remediation of the groundwater contamination can be accelerated by optimizing the extraction system.

An assessment will be made during the design of the interim remedy to ensure that any adverse impacts to wetland areas would be mitigated. If appropriate, some of the treated groundwater could be discharged to wetland areas to help offset any dewatering effects created by the groundwater extraction.

A cultural resources survey will be prepared to ensure compliance of the interim groundwater remedy with the National Historic Preservation Act.

STATUTORY DETERMINATIONS

Superfund remedy selection is based on the Superfund Amendments and Reauthorization Act of 1986 and the regulations contained in the NCP. EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. Additionally, several other statutory requirements and preferences have been established. These specify that, when complete, the selected remedy must comply with ARARs, unless a statutory waiver is justified. The remedy must also be cost-effective and utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. Finally, there

is a preference for remedies which employ treatment that permanently and significantly reduce the toxicity, mobility, or volume of hazardous wastes as their principal element. The following sections discuss how the selected interim groundwater remedy and the modifications to the previously selected source control remedy for the Waldick Aerospace Devices site meet these requirements and preferences.

Protection of Human Health and the Environment

The selected groundwater remedy protects human health and the environment through the extraction and treatment of contaminated groundwater. The modifications made to the previously selected source control remedy protect human health and the environment through the excavation, on-site thermal treatment, and solidification/stabilization of the treated soil.

The extraction and treatment of the contaminated groundwater will significantly reduce the threat of potential exposure to contaminated groundwater. The potential carcinogenic risk estimated under a future use scenario in the PHE, is 2×10^{-4} and the Hazard Index is 34.9. In addition, groundwater at the site is contaminated at levels exceeding MCLs. The goals of the interim remedy are to prevent further migration of the highly contaminated portion of the groundwater contaminant plume, to reduce contaminant concentrations, and to evaluate the aquifer system's response to extraction and treatment measures. If the evaluation of the interim remedy shows it to be potentially feasible, the goal of a final remedial action for the cleanup of groundwater contamination at the Waldick site would be to restore the groundwater to the MCLGs that are set at levels above zero. Where the MCLG for a contaminant has been set at a level of zero, the more stringent of the Federal or State MCLs for that contaminant would be used.

The source control remedy will eliminate the threat of exposure from direct contact to contaminants, and effectively eliminate the potential for migration of contaminants from the source to the aquifer system at the site.

There are no short-term adverse impacts associated with either the interim groundwater remedy or the source control remedy which cannot be readily controlled. In addition, no cross-media impacts are expected from either the interim groundwater remedy or the source control remedy.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected groundwater remedy will attain ARARs directly associated with the action. The modifications to the source control remedy will comply with all ARARs. The ARARs are presented below.

Action-Specific

Although the goal of the interim groundwater remedy is not to restore the groundwater to drinkable levels, the extracted groundwater will be treated to achieve non-zero MCLG or MCL concentrations prior to its reinjection into the groundwater system.

The modifications to the source control remedy will comply with action-specific ARARs. Soil with contaminant concentrations above the soil cleanup objectives (COs) established in the first ROD will be excavated. These COs are: 1 part per million (ppm) for VOCs; 100 ppm for PHCs; 3 ppm for cadmium; and 100 ppm for total chromium. Organic contaminants will be removed by thermal treatment. The treated soil will be solidified and stabilized. Although the solidified mass may contain inorganic contaminants at concentrations above the soil cleanup objectives, it will be tested for leachability prior to disposal.

RCRA action-specific ARARs are triggered by the source control remedy, since the soil contains electroplating/F007 listed waste. Therefore, the RCRA Land Disposal Restrictions which call for concentration-based treatment standards for Second Third wastes, in effect since July 8, 1989, apply.

Emissions from the thermal treatment unit would conform with the provisions of the Clean Air Act. This will be accomplished through the installation of appropriate air pollution control equipment. Occupational Safety and Health Administration requirements would be complied with during implementation of the source control remedy.

With respect to State action-specific ARARs, the thermal treatment unit, solidification units, air stripper, and any other regulated equipment will be designed, constructed, and operated to meet the Air Pollution Control and the Noise Pollution Control Act requirements and regulations.

Contaminant-Specific

The extracted groundwater will be treated to achieve non-zero MCLG or MCL concentrations prior to its reinjection into the groundwater system. However, the goal of the interim action is not to restore the groundwater to the non-zero MCLGs or MCLs.

The soil cleanup objectives established in the first ROD will be used.

Location-Specific

The groundwater at the site is within the coastal zone as defined by the State of New Jersey. A review was performed and the selected groundwater remedy was determined to be consistent with the New Jersey State Coastal Management Program. Additionally, there are no Federally designated wild and scenic rivers and there are no significant agricultural lands in the vicinity of the site. The project area may be sensitive for the discovery of cultural resources. Therefore, as discussed earlier, a cultural resources survey will be prepared during remedial design. Additionally, a wetlands assessment will be performed at that time to determine the presence of and potential impacts on wetland areas, as well as to allow a determination of mitigative measures.

Utilization of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

EPA and the State of New Jersey have determined that the interim groundwater remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, given the limited scope of the action.

EPA and the State of New Jersey have determined that the modifications which have been made to the source control remedy represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the Waldick Aerospace Devices site.

The modifications to the source control remedy present a slight short-term risk increase resulting from emissions during remedial action; however, these will be minimized through careful management of the thermal treatment unit and air monitoring throughout remediation.

Cost Effectiveness

The selected alternative is determined to be cost-effective because it provides the highest degree of protectiveness among the alternatives evaluated at reasonable cost. Also, the modifications to the source control remedy provide a high degree of protectiveness at reasonable cost.

Preference for Treatment as a Principal Element

By extracting and treating the contaminated groundwater, the selected remedy addresses the threats posed by the site through the use of treatment technologies. However, the statutory preference for treatment will be addressed in the final ROD addressing groundwater at the site.

By thermally treating the contaminated soil, and solidifying the treated soil prior to disposal, the modifications to the source control remedy address the threats posed by the source of contamination through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

FIG 1

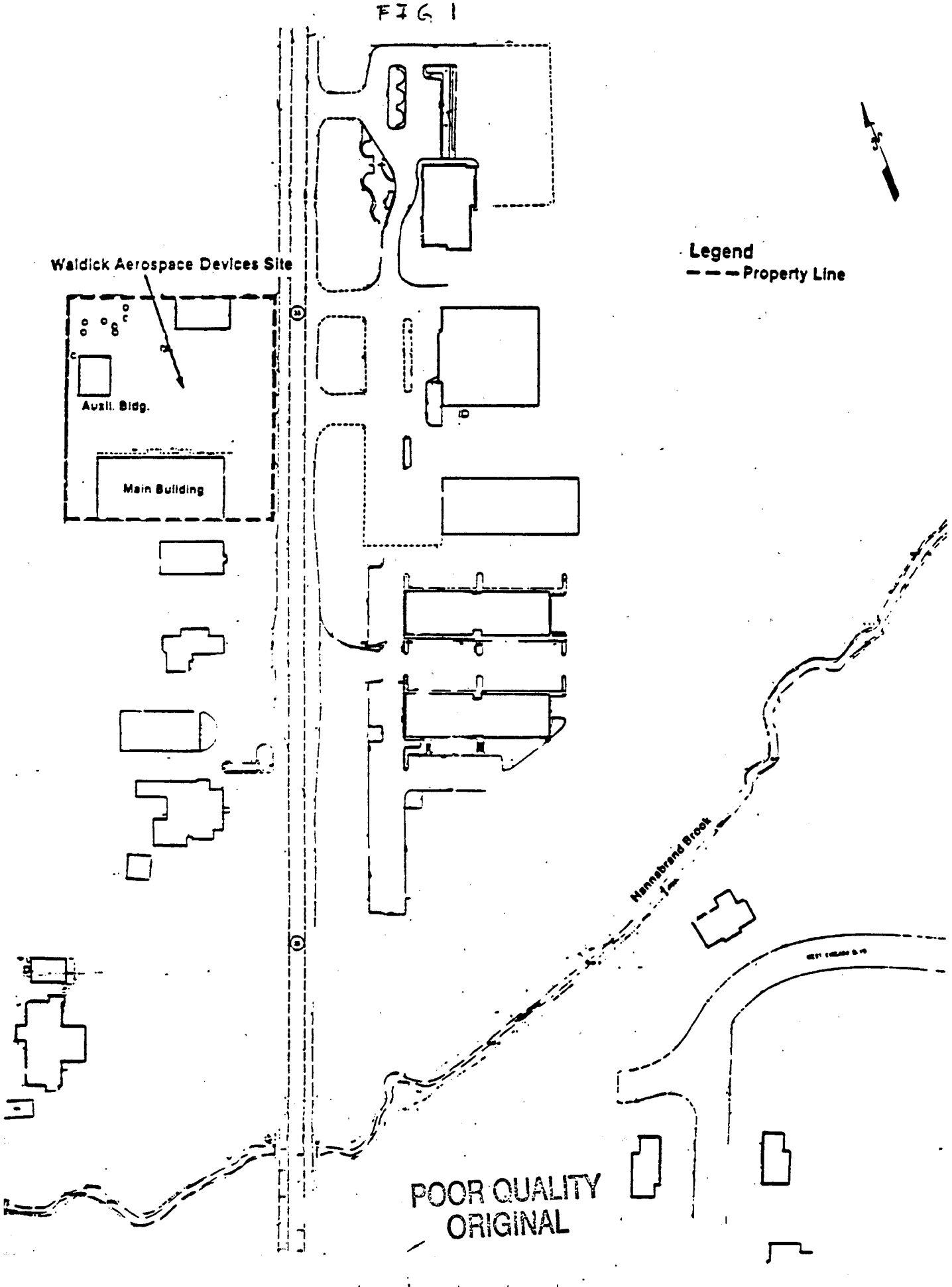

FIG 2

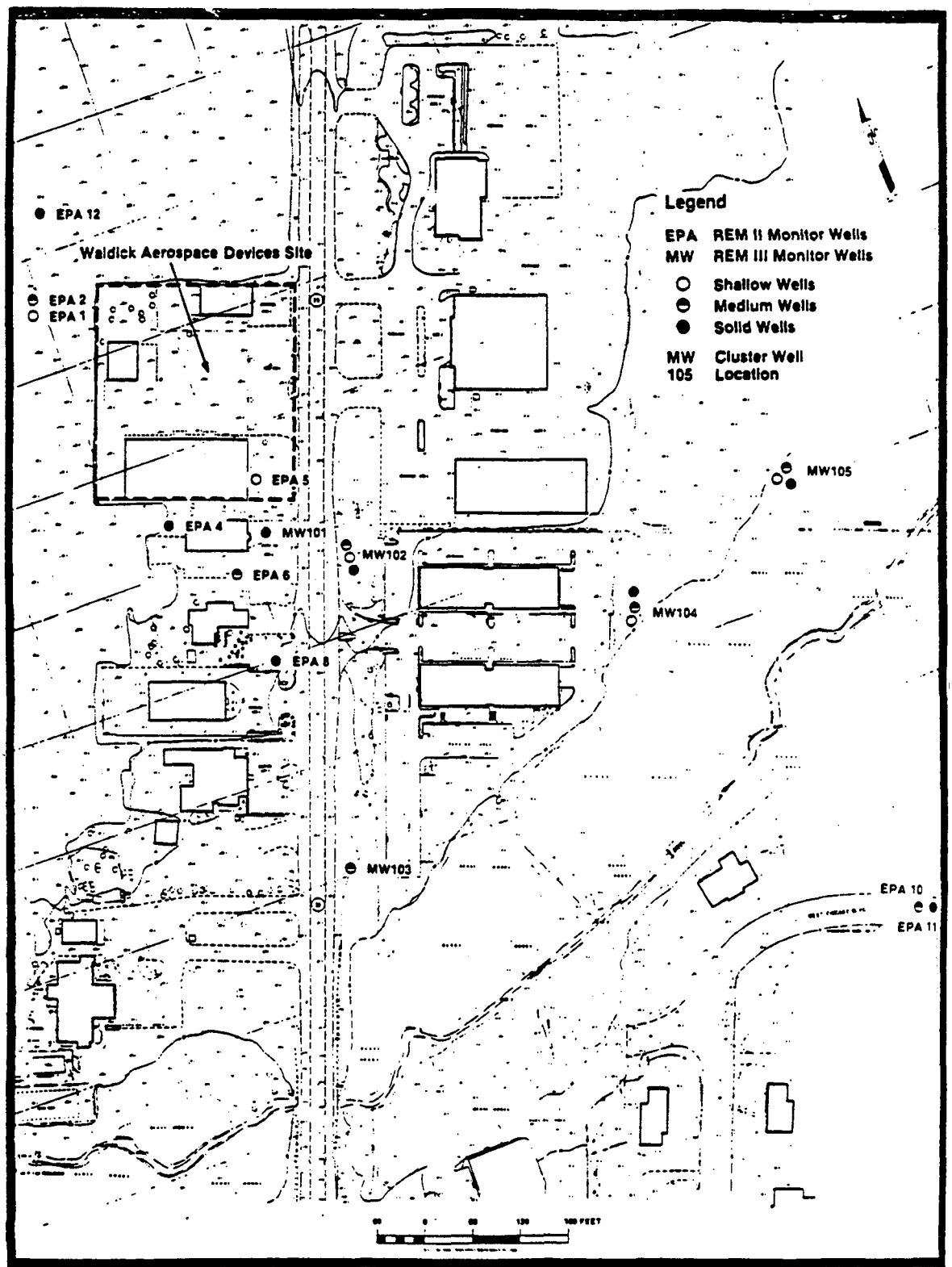

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Figure 2-4
Location of Existing REM II and REM III Wells

Waldick Aerospace Devices Site, Wall Township, Monmouth County, New Jersey

Figure 2-4

FIG 3

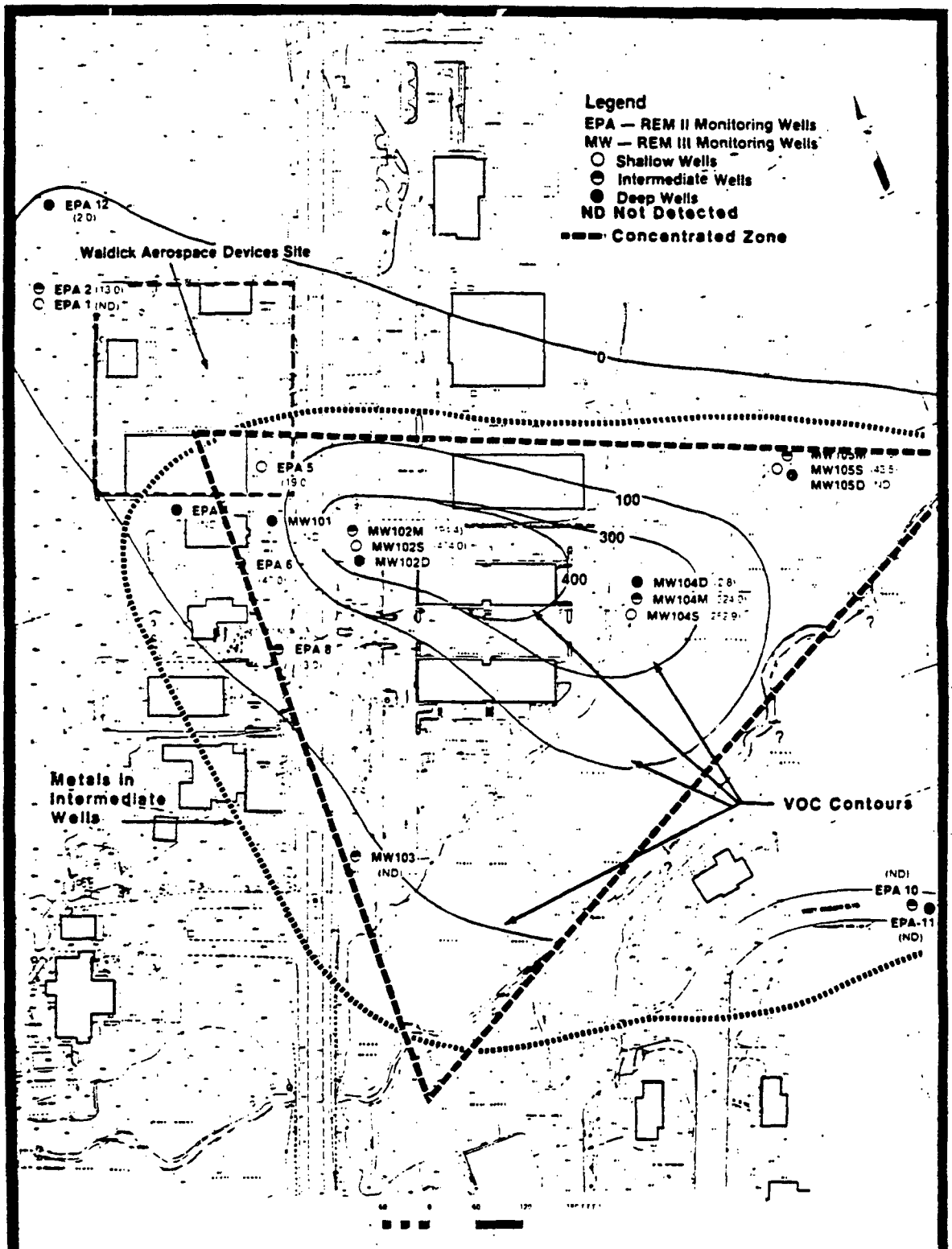

Figure 2-1

Plan View of Concentrated Zone

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Figure 2-1

FIG 4

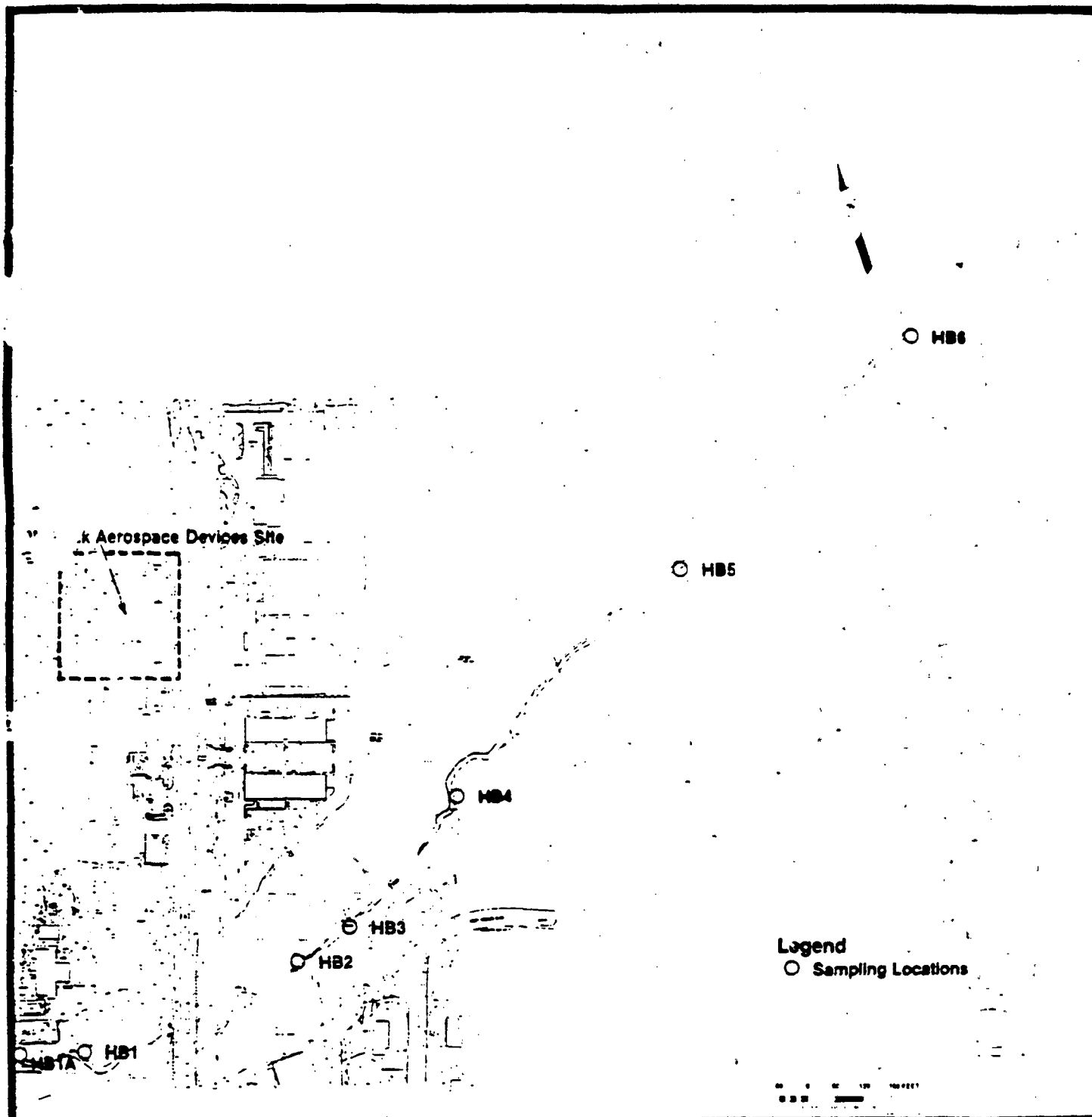

Figure 2-5
REM III Surface Water and Sediment Sample Locations

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Table 1

TABLE 4-3

ANALYTICAL RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM DEEP MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Volatile Organic Compounds

Round 1

Monitor Well Locations and Concentrations (PPB)

Compound	EPA-12	EPA-4	EPA-11	101-D	101-D DUP	102-D	104-D	105-D
Carbon disulfide	0.8	0.6		0.6		0.2		1.5
Trichloroethylene		0.6						
Toluene				0.2	0.2			0.3
Ethyl Benzene								0.3
TOTAL	0.8	1.2	ND	0.8	0.2	0.2	ND	2.1

Round 2

Carbon disulfide							0.8	
Toluene	2.0					5.0	2.0	
TOTAL	2.0	ND	ND	ND	ND	5.0	2.8	ND

Base Neutral and Acid Extractable Compounds

Round 1

None	ND	ND	ND	ND	ND	ND	ND	ND

Round 2

Bis (2-ethylhexyl) phthalate	31.0		31.0					
Phenol			2.0					
TOTAL	31.0	ND	33.0	ND	ND	ND	ND	ND

ND/Blank Spaces - Not Detected PPB - Parts Per Billion DUP - Duplicate Sample

Table 1 (continued)

TABLE 4-3 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM DEEP MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 1

Monitor Well Locations and Concentrations (PPB)

Metal		EPA-12	EPA-4	EPA-11	101-D	101-D DUP	102-D	104-D	105-D
Arsenic	DISSOLVED								
	TOTAL				R 5	7.7	1.7	4 >	
Beryllium	DISSOLVED								
	TOTAL				1.>	1.6	1.1	3.5	1.1
Cadmium	DISSOLVED								
	TOTAL				5.5	4.7			
Chromium	DISSOLVED			5.2	7.2			7.2	12.6
	TOTAL	7.2		78.6	168.0	158.0	38.5	604.0	503.0
Copper	DISSOLVED	R	R	R	R	R		4.2	31.2
	TOTAL	R	4.8	R	72.1	R	22.9	56.7	32.7
Lead	DISSOLVED	R	R	R		R	R	2.0	3.2
	TOTAL	R	R	R	117.0	120.0	11.2	22.6	3.5
Nickel	DISSOLVED			13.7		25.2	8.1	21.2	R
	TOTAL			12.6	83.6	79.6	24.9	454.0	346.0
Zinc	DISSOLVED	R	R	R	R	R	R	225.0	96.8
	TOTAL	R	315.0	R	159.0	R	45.1	295.0	158.0

PPB - Parts Per Billion R - Rejected DUP - Duplicate Sample Blank Spaces - Not Detected

Table 1 (continued)

TABLE 4-3 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM DEEP MONITOR WELLS
WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 2

Metal		Monitor Well Locations and Concentrations (PPB)						
		EPA-12	EPA-4	EPA-11	101-D	102-D	104-D	105-D
Arsenic	DISSOLVED					1.0		
	TOTAL				13.6	69.5	15.1	3.4
Beryllium	DISSOLVED							
	TOTAL				1.5	11.2	3.1	
Cadmium	DISSOLVED							
	TOTAL	5.2			7	29.5	7.1	
Chromium	DISSOLVED	9.6						
	TOTAL	20.4		31.0	49.2	329.0	137.0	323.0
Copper	DISSOLVED	R	R	R	R	R	R	R
	TOTAL	20.0	R	14.9	R	62.6	22.6	51.5
Lead	DISSOLVED	R		R			R	
	TOTAL	4.6		2.4	18.2	59.6	40.3	7.7
Mercury	DISSOLVED							
	TOTAL					0.9		
Nickel	DISSOLVED							31.7
	TOTAL				35.7	193.0	95.6	254.0
Selenium	DISSOLVED			2.0		0.8		
	TOTAL		0.8		8.7	11.7		1.8
Silver	DISSOLVED							
	TOTAL			9.4				
Zinc	DISSOLVED	R	R	R	R	R	R	R
	TOTAL	52.2	R	46.5	146.0	565.0	212.0	120.0

PPB - Parts Per Billion R - Rejected Blank Spaces - Not Detected

Table 2

TABLE 4-4

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM INTERMEDIATE MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Volatile Organic Compounds

Round 1

Compound	Monitor Well Locations and Concentrations (PPB)									
	EPA-2	EPA-6	EPA-8	EPA-10	102-M	103-M	104-M	104-M DUP	105-M	105-M DUP
Trans 1,2-dichloroethylene									14.0	
Chloroform					0.3		1.4	1.4		
Trichloroethylene							0.9	0.9	33.0	
Tetrachloroethylene		97.0			120.0		160.0	150.0	18.0	
Toluene						0.4				
TOTAL	ND	97.0	ND	ND	120.3	0.4	162.3	152.3	65.0	ND

Round 2

Trans 1,2-dichloroethylene									3.0	3.0
2-Butanone	11.0									
Trichloroethylene					0.4				5.0	4.0
Tetrachloroethylene		7.0			190.0		320.0		9.0	7.0
Toluene	2.0		3.0		4.0		4.0			
TOTAL	13.0	7.0	3.0	ND	194.4	ND	324.0	ND	17.0	14.0

PPB - Parts Per Billion ND/Blank Spaces - Not Detected, DUP - Duplicate Sample

Table 2 (continued)

TABLE 4-4 (Continued)

ANALYTICAL RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM INTERMEDIATE MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Base Neutral and Acid Extractable Compounds	Monitor Well Locations and Concentrations (PPB)							
Compound	EPA-2	EPA-6	EPA-8	EPA-10	102-M	103-M	104-M	105-M
Round 1								
Bis (2-ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Round 2								
Bis (2-ethylhexyl) phthalate	42.0	38.0	ND	36.0	ND	31.0	ND	ND

PPB - Parts Per Billion ND - Not Detected

Table 2 (continued)

TABLE 4-4 (Continued)

ANALYTICAL RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM INTERMEDIATE MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 1

Metal		Monitor Well Locations and Concentrations (PPB)								
		EPA-2	EPA-6	EPA-8	EPA-10	102-M	103-M	104-M	104-M DUP	105-M
Arsenic	DISSOLVED						6.1			
	TOTAL		2.3							
Cadmium	DISSOLVED		4.1			12.4		7.9	9.0	
	TOTAL		5.2	3.9		11.7		9.2	8.6	
Chromium	DISSOLVED					14.9	172.0	7.2	10.6	5.2
	TOTAL	12.6	159.0	382.0	105.0	77.5	1330.0	1320.0	1210.0	92.7
Copper	DISSOLVED	R	R	R	47.4	R	75.1	16.4	R	R
	TOTAL	R	R	9.0	R	R	84.4	59.0	R	R
Lead	DISSOLVED	R	R	R	6.3	R	R	3.0	5.0	4.2
	TOTAL	R	R		8.2	R	R	2.0	2.5	2.4
Nickel	DISSOLVED			26.3		20.1	146.0	12.2	13.0	
	TOTAL		93.7	18.5	8.1	52.5	817.0	879.0	808.0	49.2
Zinc	DISSOLVED	R	R	R	R	R	47.0	44.1	R	R
	TOTAL	R	R	18.7	20.3	R	43.7	46.5	R	R

PPB - Parts Per Billion R - Rejected Blank Spaces - Not Detected DUP - Duplicate Sample

TABLE 4-4 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM INTERMEDIATE MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 2

		Monitor Well Locations and Concentrations (PPB)								
Metal		EPA-2	EPA-6	EPA-8	EPA-10	102-M	103-M	104-M	105-M	105-M DUP
Arsenic	DISSOLVED									
	TOTAL		1.6							
Beryllium	DISSOLVED									
	TOTAL						1.1			
Cadmium	DISSOLVED		4.7			9.1		8.8		
	TOTAL		9.1		4.8	12.2	8.3	13.1		
Chromium	DISSOLVED	7.5				9.7			8.5	
	TOTAL	25.8	50.7	250.0	27.8	78.0	464.0	86.3	126.0	85.0
Copper	DISSOLVED	R	R	R	R	R	R	R	R	R
	TOTAL	84.7		11.3	8.5	31.7	181.0	17.9	18.7	13.8
Lead	DISSOLVED				R				5.0	
	TOTAL	4.4	3.4	1.5		6.6	15.2		6.0	3.0
Mercury	DISSOLVED									
	TOTAL						0.3			
Nickel	DISSOLVED			21.5		22.2	25.5			
	TOTAL	17.2	41.9	32.4		64.8	318.0	60.4	70.8	48.3
Selenium	DISSOLVED		3.0				1.7			
	TOTAL		1.8				3.6		1.8	
Silver	DISSOLVED									
	TOTAL			6.8	4.3					8.1
Zinc	DISSOLVED	R	R	R	R	R	R	R	R	R
	TOTAL	77.0	R	R	R	R	68.4	R	R	R

PPB - Parts Per Billion R - Rejected Blank Spaces - Not Detected DUP - Duplicate Sample

TABLE 4-4 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM INTERMEDIATE MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Compound	EPA-2	EPA-6	EPA-8	EPA-10	102-M	103-M	104-M	105-M
Insecticides								
Round 1								
				Monitor Well Locations and Concentrations (PPB)				
Endosulfan II							0.03	
Endosulfan Sulfate		0.04						
Round 2								
None								

PPB - Parts Per Billion Blank Spaces - Not Detected

TABLE 4-5

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM SHALLOW MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Volatile Organic Compounds

Round 1

Compound	Monitor Well Locations and Concentrations (PPB)					
	EPA-1	EPA-5	EPA-5 DUP	102-S	104-S	105-S
Trans 1,2-dichloroethylene						1.0
Chloroform				1.4	1.0	
Trichloroethylene				2.6		6.0
Tetrachloroethylene		53.0		140.0	140.0	16.0
Toluene						
TOTAL	ND	53.0	ND	144.0	141.0	23.0

Round 2

Trans 1,2-dichloroethylene						1.0
2-Butanone						7.0
Trichloroethylene					0.9	6.0
Tetrachloroethylene		19.0	14.0	470.0	250.0	29.0
Toluene				4.0	2.0	0.5
TOTAL	ND	19.0	14.0	474.0	252.9	43.5

Base Neutral and Acid Extractable Compounds

Round 1

None	ND	ND	ND	ND	ND	ND

Round 2

Bis (2-ethylhexyl) phthalate	ND	ND	ND	9.0	ND	3.0

ND/Blank Spaces - Not Detected PPB - Parts Per Billion DUP - Duplicate Sample

TABLE 4-5 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM SHALLOW MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 1

Monitor Well Locations and Concentrations (PPB)

Metal		EPA-1	EPA-5	102-S	104-S	105-S
Arsenic	DISSOLVED					
	TOTAL			1.3	1.4	1.7
Beryllium	DISSOLVED					
	TOTAL			2.0	1.2	1.0
Cadmium	DISSOLVED		13.8	77.8	81.2	
	TOTAL		15.9	79.9	85.7	
Chromium	DISSOLVED			25.5	9.2	
	TOTAL	8.6	8.4	220.0	181.0	249.0
Copper	DISSOLVED	R	R	R	38.2	R
	TOTAL	14.6	21.1	R	76.6	R
Lead	DISSOLVED		R	19.3	2.4	R
	TOTAL	2.3	3.3	14.0	14.7	R
Nickel	DISSOLVED				14.1	
	TOTAL			45.8	103.0	133.0
Zinc	DISSOLVED	35.1	R	R	41.4	R
	TOTAL	40.0	R	R	55.8	R

PPB = Parts Per Billion R - Rejected Blank Spaces - Not Detected

TABLE 4.5 (Continued)

ANALYTICAL RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM SHALLOW MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Round 2

Monitor Well Locations and Concentrations (PPB)

Metal		EPA-1	EPA-5	EPA-5 DUP	102-S	104-S	105-S
Arsenic	DISSOLVED						
	TOTAL		1.0	1.6			2.7
Beryllium	DISSOLVED						
	TOTAL				5.2		
Cadmium	DISSOLVED		10.6	12.9	43.2	83.3	
	TOTAL	4.1	13.4	13.1	144.0	89.2	4.9
Chromium	DISSOLVED				18.7	19.7	
	TOTAL	35.7	13.1	10.0	466.0	64.0	115.0
Copper	DISSOLVED	R	R	R	R	R	R
	TOTAL	18.7	R	R	148.0	28.3	16.6
Lead	DISSOLVED	R		R-			
	TOTAL	2.4	3.8	3.8	79.9	8.9	7.2
Mercury	DISSOLVED						
	TOTAL				0.3		
Nickel	DISSOLVED						
	TOTAL				201.0	33.3	58.5
Selenium	DISSOLVED		1.4				3.3
	TOTAL						

PPB = Parts Per Billion Blank Spaces - Not Detected R - Rejected DUP - Duplicate Sample

Table 3 (continued)

TABLE 4-5 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN GROUNDWATER COLLECTED FROM SHALLOW MONITOR WELLS

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Compound		EPA-1	EPA-5	EPA-5 DUP	102-S	104-S	105-S
Priority Pollutant Metals							
Round 2 (Continued)							
		Monitor Well Locations and Concentrations (PPB)					
Silver	DISSOLVED						
	TOTAL				7.3		
Zinc	DISSOLVED	R	R	R	R	R	R
	TOTAL	R	R	R	154.0	R	R
Cyanide and Insecticides							
Round 1							
Cyanide					9.5		
Lindane					0.01	0.06	
Endosulfan Sulfate						0.19	
Round 2							
None							

PPB = Parts Per Billion Blank Spaces - Not Detected R - Rejected DUP - Duplicate Sample

Table 4

TABLE 4-6

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN SURFACE WATER COLLECTED FROM HANNABRAND BROOK (REM III)

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Compound	HB-01A	HB-01	HB-01 COL	HB-02	HB-03	HB-04	HB-05	HB-06	HB-06 DUP
Volatile Organic Compounds									
			Sample Locations and Concentrations (PPB)						
Carbon disulfide								1.0	
Tetrachloroethylene							1.0	2.0	2.0
Acetone								37.0*	
TOTAL	ND	ND	ND	ND	ND	ND	1.0	40.0	2.0
Base Neutral and Acid Extractable Compounds									
Di-N-butyl-phthalate	2.0			3.0	2.0				
Bis(2-ethylhexyl) phthalate	6.0	11.0					79.0		
TOTAL	8.0	11.0	ND	3.0	2.0	ND	79.0	ND	ND

*Possible/Probable Lab/Field Contamination

ND/Blank Spaces - Not Detected

PPB - Parts Per Billion

COL - Collocate Sample

DUP - Duplicate Sample

Table 4 (continued)

TABLE 4-6 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN SURFACE WATER COLLECTED FROM HANNABRAND BROOK (REM III)

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Sample Locations and Concentrations (PPB)

Compound		HB-01A	HB-01	HB-01 COL	HB-02	HB-03	HB-04	HB-05	HB-06	HB-06 DUP
Arsenic	DISSOLVED									
	TOTAL						2.4			
Beryllium	DISSOLVED							1.8		
	TOTAL									
Chromium	DISSOLVED									
	TOTAL			8.8		10.0			10.0	
Copper	DISSOLVED		73.8	20.8	221.0	89.2	73.0		10.8	
	TOTAL					7.3				
Lead	DISSOLVED		11.2		24.2	10.8	8.2		R	
	TOTAL			2.1	6.9	8.6	18.5		R	
Selenium	DISSOLVED									
	TOTAL								3.5	
Zinc	DISSOLVED	33.2	191.0	66.4	384.0	R	147.0	30.0	R	
	TOTAL	25.6	36.9	28.7	R	R	56.1	17.4	R	17.4

R - Rejected Blank Spaces - Not Detected PPB - Parts Per Billion COL - Collocate Sample

DUP - Duplicate Sample

Table 5

TABLE 4-7

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN SEDIMENT COLLECTED FROM HANNABRAND BROOK (REM III)

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Compound	HB-01A	HB-01	HB-01 COL	HB-02	HB-03	HB-04	HB-05	HB-06	HB-06 DUP
Volatile Organic Compounds									
Sample Locations and Concentrations (PPB)									
Toluene	19.0		8.0						
Base Neutral and Acid Extractable Compounds									
Phenol	11000.0								
2-Chlorophenol	10000.0								
1,4-Dichlorobenzene	4600.0								
N-nitrosodi-n-propylamine	4800.0								
1,2,4-Trichlorobenzene	5300.0								
Napthalene	1700.0								
4-Chloro-3-methylphenol	6300.0								
2-Methylnapthalene	940.0								
Acenaphthene	7600.0								
4-Nitrophenol	11000.0								
Dibenzofuran	1900.0								
Fluorene	3000.0								
Pentachlorophenol	9800.0								
Phenanthrene	12000.0				450.0	230.0	910.0	120.0	1400.0
Anthracene	4700.0						130.0		130.0
Di-n-butylphthalate	76.0			85.0					130.0
Fluoranthene	9200.0			370.0	640.0	370.0	1600.0	310.0	2500.0
Pyrene	12000.0			300.0	530.0	300.0	1200.0	2400.0	1800.0
Benzo (a) anthracene	4100.0			160.0	230.0	130.0	530.0	120.0	750.0
Chrysene	3900.0			190.0	330.0	180.0	680.0	150.0	930.0
Benzo (b) fluoranthene	2800.0			260.0		270.0	980.0	250.0	1700.0
Benzo (k) fluoranthene	2100.0				450.0				160.0
Benzo (a) pyrene	3000.0			150.0		130.0	480.0	130.0	790.0

PPB - Parts Per Billion COL - Collocate Sample DUP - Duplicate Sample ND/Blank Spaces - Not Detected

TIC - Tentatively Identified Compound

Table 5 (continued)

TABLE 4-7 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN SEDIMENT COLLECTED FROM HANNABRAND BROOK (REM III)

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Base Neutral and Acid Extractable Compounds (Continued)

Sample Locations and Concentrations (PPB)

Compound	HB-01A	HB-01	HB-01 COL	HB-02	HB-03	HB-04	HB-05	HB-06	HB-06 DUP
Indeno (1,2,3-cd) pyrene	1000.0						320.0	86.0	480.0
Dibenzo (a,h) anthracene	360.0								130.0
Benzo (g,h,i) perylene	1000.0						360.0		580.0
Bis (2-chloroisopropyl) ether	5300.0								
Methylphenol	1700.0								
TOTAL	141,176.0	ND	ND	1,515.0	2,630.0	1,610.0	7,190.0	3,566.0	11,480.0
TIC (Count) Concentration	(7) 14,960.0		(10) 6,080.0	(3) 2,490.0	(8) 13,180.0	(5) 2,750.0	(16) 22,790.0	(3) 1,150.0	(15) 31,910.0

PPB - Parts Per Billion COL - Collocate Sample DUP - Duplicate Sample ND/Blank Spaces - Not Detected

TIC - Tentatively Identified Compound

Table 5 (continued)

TABLE 4-7 (Continued)

ANALYTICAL-RESULTS SUMMARY OF CONTAMINANTS IDENTIFIED IN SEDIMENT COLLECTED FROM HANNABRAND BROOK (REM III)

WALDICK AEROSPACE DEVICES, WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

Priority Pollutant Metals

Sample Locations and Concentrations (PPB)

Metal	HB-01A	HB-01	HB-01 COL	HB-02	HB-03	HB-04	HB-05	HB-06	HB-06 DUP
Arsenic	1.0	0.6	0.5	0.7	0.5	0.4	1.1	0.8	0.7
Chromium	12.0			2.3	2.6	2.2	8.9	3.5	2.4
Copper				3.8	4.9	2.0	10.0	R	R
Lead	6.4	3.7	23.3	8.7	12.7	9.6	29.1	R	R
Selenium	0.9	R	1.1	R	0.6	1.0	1.1	0.5	
Zinc	7.1			R	R	5.2	18.1	7.2	5.4

PPB - Parts Per Billion COL - Collocate Sample DUP - Duplicate Sample R - Rejected

Blank Spaces - Not Detected

Table 6

TABLE 1-8
CHEMICALS OF POTENTIAL CONCERN BY MEDIUM
WALDICK AEROSPACE DEVICES SITE

CHEMICAL	Subsurface Soil	Surface Water	Sediment	Groundwater		
				Shallow	Intermediate	Deep
Organics						
Acetone		X				
2-Butanone				X		
Bis(2-ethylhexyl)phthalate	X	X		X	X	X
Carbon disulfide		X				X
Chloroform				X	X	
Tetrachloroethylene	X	X		X	X	
Trichloroethylene				X	X	
Trans-1,2-Dichloroethylene				X		
Toluene				X	X	X
Carcinogenic PAHs			X			
Pentachlorophenol			X			
Inorganics						
Aluminum	X	X	X	X	X	X
Barium				X	X	X
Cadmium				X	X	
Chromium				X	X	X
Copper		X		X		X
Iron	X	X		X		X
Lead		X		X		X
Manganese				X	X	X
Nickel				X	X	
Vanadium			X	X		X
Zinc		X	X	X	X	X

Table 7

TABLE 6-13
SUMMARY OF HEALTH EFFECTS CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN
WALDICK AEROSPACE DEVICES SITE

CHEMICAL	ORAL CRITERIA					INHALATION CRITERIA				
	Noncarcinogenic Effects			Carcinogenic Effects		Noncarcinogenic Effects			Carcinogenic Effects	
	Reference Dose (RfD) (mg/kg/d)	Safety Factor (a)	Source (b)	EPA/CAG Cancer Potency Factor (mg/kg/d)-1	Weight of Evidence (c)	Reference Dose (RfD) (mg/kg/d)	Safety Factor (a)	Source (b)	EPA/CAG Cancer Potency Factor (mg/kg/d)-1	Weight of Evidence (c)
2-BUTANONE	5.00E-02	1.00E+03	IRIS	--	--	9.00E-02	1.00E+03	IRIS	--	--
CARBON DISULFIDE	1.00E-01	1.00E+02	IRIS	--	--	--	--	--	--	--
CHLOROFORM	1.00E-02	1.00E+03	IRIS	6.10E-03	B2	--	--	--	8.10E-02	B2
TRANS-1,2-DICHLOROETHYLENE	2.00E-02	1.00E+03	IRIS	-- (d)	--	--	--	--	--	--
TETRACHLOROETHYLENE	1.00E-02	1.00E+03	IRIS	5.10E-02	B2	--	--	--	3.30E-03	B2
TRICHLOROETHYLENE	7.40E-03 *	1.00E+03	HA	1.10E-02	B2	--	--	--	4.60E-03	B2
TOLUENE	3.00E-01	1.00E+02	IRIS	--	--	5.70E-01	1.00E+02	HEA	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	2.00E-02	1.00E+03	IRIS	1.40E-02	B2	--	--	--	--	--
ACETONE	1.00E-01	1.00E+03	IRIS	--	--	3.00E+00	--	EPA 1986a	--	--
ALUMINUM	--	--	--	--	--	--	--	--	--	--
BARIUM	5.00E-02	1.00E+02	IRIS	--	--	1.00E-04	1.00E+03	HEA	--	
CADMIUM	5.00E-04 (e) 1.00E-03 (e)	1.00E+01	IRIS IRIS	--	--	--	--	--	6.10E+00	B1
CHROMIUM (f)	5.00E-03	5.00E+01	IRIS	--	--	--	--	--	4.10E+01	A
COPPER (g)	3.70E-02	--	HEA	--	--	--	--	--	--	--
IRON	--	--	--	--	--	--	--	--	--	--
LEAD (h)					B2					
MANGANESE	2.00E-01	1.00E+02	HEA	--	--	3.00E-04	1.00E+02	HEA	--	--
NICKEL	2.00E-02	3.00E+02	IRIS	--	--	--	--	--	--	--
VANADIUM	7.00E-03	1.00E+02	HEA	--	--	--	--	--	--	--
ZINC	2.00E-01	1.00E+01	HEA	--	--	--	--	--	--	--

(a) Safety factors used to develop reference doses consist of multiples of 10; each factor representing a specific area of uncertainty inherent in the data available. The standard uncertainty factors include:
- o A ten-fold factor to account for the variation in sensitivity among the members of the human population;
- o A ten-fold factor to account for the uncetainty in extrapolating animal data to the case of humans;
- o A ten-fold factor to account for the uncertainty in extrapolating from less than chronic No Observed Adverse Effects Levels (NOAELs) to chronic NOAELs; and
- o A ten-fold factor to account for the uncertainty in extrapolating from Lowest Observed Adverse Effect Levels (LOAELs) to NOAELs.

(b) Sources of Reference Doses: IRIS = chemical files of the Integrated Risk Information System; HEA = Health Effects Assessments; HA = Health Advisory.

(c) Weight of evidence classification scheme for carcinogens:
- A -- Human Carcinogen, sufficient evidence from human epidemiological studies;
- B1 -- Probable Human Carcinogen, limited evidence from epidemiological studies and adequate evidence from animal studies;
- B2 -- Probable Human Carcinogen, inadequate evidence from epidemiological studies and adequate evidence from animal studies;
- C -- Possible Human Carcinogen, limited evidence in animals in the absence of human studies;
- D -- Not Classified as to human carcinogenicity; and
- E -- Evidence of Noncarcinogenicity.

(d) -- Indicates that no criteria have been established in IRIS, HEA, or HA for this chemical via this route of exposure.

(e) 5E-04 mg/kg/d for drinking water exposure. 1E-03 mg/kg/d for nonaqueous oral exposure.

(f) Criteria are for CrVI.

(g) This dose is equivalent to the reported drinking water standard of 1.3 mg/liter, assuming a 70 kg person ingests 2 liters of water per day. The Drinking Water Criteria Document concluded that toxicity data were inadequate for calculation of an RfD for copper.

(h) EPA (1989) has indicated a preference for estimating blood lead levels rather than using a mg/kg/d approach.

* Review pending.

Table 7

TABLE 6-13
SUMMARY OF HEALTH EFFECTS CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN
WALDICK AEROSPACE DEVICES SITE

CHEMICAL	ORAL CRITERIA					INHALATION CRITERIA				
	Noncarcinogenic Effects			Carcinogenic Effects		Noncarcinogenic Effects			Carcinogenic Effects	
	Reference Dose (RfD) (mg/kg/d)	Safety Factor (a)	Source (b)	EPA/CAG Cancer Potency Factor (mg/kg/d)-1	Weight of Evidence (c)	Reference Dose (RfD) (mg/kg/d)	Safety Factor (a)	Source (b)	EPA/CAG Cancer Potency Factor (mg/kg/d)-1	Weight of Evidence (c)
2-BUTANONE	5.00E-02	1.00E+03	IRIS	--	--	9.00E-02	1.00E+03	IRIS	--	--
CARBON DISULFIDE	1.00E-01	1.00E+02	IRIS	--	--	--	--	--	--	--
CHLOROFORM	1.00E-02	1.00E+03	IRIS	6.10E-03	B2	--	--	--	8.10E-02	B2
TRANS-1,2-DICHLOROETHYLENE	2.00E-02	1.00E+03	IRIS	-- (d)	--	--	--	--	--	--
TETRACHLOROETHYLENE	1.00E-02	1.00E+03	IRIS	5.10E-02	B2	--	--	--	3.30E-03	B2
TRICHLOROETHYLENE	7.40E-03 *	1.00E+03	HA	1.10E-02	B2	--	--	--	4.60E-03	B2
TOLUENE	3.00E-01	1.00E+02	IRIS	--	--	5.70E-01	1.00E+02	HEA	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	2.00E-02	1.00E+03	IRIS	1.40E-02	B2	--	--	--	--	--
ACETONE	1.00E-01	1.00E+03	IRIS	--	--	3.00E+00	--	EPA 1986a	--	--
ALUMINUM	--	--	--	--	--	--	--	--	--	--
BARIUM	5.00E-02	1.00E+02	IRIS	--	--	1.00E-04	1.00E+03	HEA	--	
CADMIUM	5.00E-04 (e) 1.00E-03 (e)	1.00E+01	IRIS IRIS	--	--	--	--	--	6.10E+00	B1
CHROMIUM (f)	5.00E-03	5.00E+01	IRIS	--	--	--	--	--	4.10E+01	A
COPPER (g)	3.70E-02	--	HEA	--	--	--	--	--	--	--
IRON	--	--	--	--	--	--	--	--	--	--
LEAD (h)					B2					
MANGANESE	2.00E-01	1.00E+02	HEA	--	--	3.00E-04	1.00E+02	HEA	--	--
NICKEL	2.00E-02	3.00E+02	IRIS	--	--	--	--	--	--	--
VANADIUM	7.00E-03	1.00E+02	HEA	--	--	--	--	--	--	--
ZINC	2.00E-01	1.00E+01	HEA	--	--	--	--	--	--	--

(a) Safety factors used to develop reference doses consist of multiples of 10; each factor representing a specific area of uncertainty inherent
ncertainty fact
r the variatio

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Table 9

TABLE 6-17
POTENTIAL EXPOSURES AND RISKS FROM DERMAL CONTACT WHILE WADING
FUTURE-USE SCENARIO
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL CARCINOGENIC EFFECTS	SURFACE WATER CONCENTRATION		CHRONIC DAILY INTAKE		CANCER POTENCY FACTOR	UPPER BOUND EXCESS LIFETIME CANCER RISK	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)-1	Average Case	Plausible Maximum Case
Chloroform	9.09E-07	2.29E-06	7.77E-14	1.53E-12	6.10E-03	4.74E-16	9.33E-15
Tetrachloroethylene	1.08E-04	4.03E-04	1.38E-11	2.69E-10	1.40E-02	1.93E-13	3.77E-12
Trichloroethylene	1.07E-06	4.00E-06	1.37E-13	2.67E-12	5.10E-02	6.96E-15	1.36E-13
					TOTAL:	2E-13	4E-12

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS	SURFACE WATER CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RFD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)	Average Case	Plausible Maximum Case
2-Butanone	9.14E-07	3.43E-06	9.72E-13	1.15E-11	5.00E-02	1.94E-11	2.29E-10
Chloroform	6.09E-07	2.29E-06	6.48E-13	7.65E-12	1.00E-02	6.48E-11	7.65E-10
Tetrachloroethylene	1.08E-04	4.03E-04	1.15E-10	1.35E-09	2.00E-02	5.74E-09	6.73E-08
Trichloroethylene	1.07E-06	4.00E-06	1.14E-12	1.34E-11	1.00E-02	1.14E-10	1.34E-09
trans-1,2-Dichloroethylene	6.09E-07	2.29E-06	6.48E-13	7.65E-12	1.00E-01	6.48E-12	7.65E-11
Toluene	7.62E-07	2.86E-06	8.10E-13	9.55E-12	3.00E-01	2.70E-12	3.18E-11
					HAZARD INDEX:	5.95E-09	6.97E-08

Table 9

TABLE 6-17
POTENTIAL EXPOSURES AND RISKS FROM DERMAL CONTACT WHILE WADING
FUTURE-USE SCENARIO
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL CARCINOGENIC EFFECTS	SURFACE WATER CONCENTRATION		CHRONIC DAILY INTAKE		CANCER POTENCY FACTOR	UPPER BOUND EXCESS LIFETIME CANCER RISK	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)-1	Average Case	Plausible Maximum Case
Chloroform	9.09E-07	2.29E-06	7.77E-14	1.53E-12	6.10E-03	4.74E-16	9.33E-15
Tetrachloroethylene	1.08E-04	4.03E-04	1.38E-11	2.69E-10	1.40E-02	1.93E-13	3.77E-12
Trichloroethylene	1.07E-06	4.00E-06	1.37E-13	2.67E-12	5.10E-02	6.96E-15	1.36E-13
					TOTAL:	2E-13	9E-12

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS	SURFACE WATER CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RFD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)	Average Case	Plausible Maximum Case
2-Butanone	9.14E-07	3.43E-06	9.72E-13	1.15E-11	5.00E-02	1.94E-11	2.29E-10
Chloroform	6.09E-07	2.29E-06	6.48E-13	7.65E-12	1.00E-02	6.48E-11	7.65E-10
Tetrachloroethylene	1.08E-04	4.03E-04	1.15E-10	1.35E-09	2.00E-02	5.74E-09	6.73E-08
Trichloroethylene	1.07E-06	4.00E-06	1.14E-12	1.34E-11	1.00E-02	1.14E-10	1.34E-09
trans-1,2-Dichloroethylene	6.09E-07	2.29E-06	6.48E-13	7.65E-12	1.00E-01	6.48E-12	7.65E-11
Toluene	7.62E-07	2.86E-06	8.10E-13	9.55E-12	3.00E-01	2.70E-12	3.18E-11
					HAZARD INDEX:	5.95E-09	6.97E-08

Table 10 (continued)

TABLE 6-19 (Continued)
POTENTIAL EXPOSURES AND RISKS FROM INGESTION OF GROUNDWATER AND INHALATION OF VOLATILES WHILE SHOWERING
BASED ON CONTAMINANTS IN THE SHALLOW AND INTERMEDIATE MONITORING WELLS
WALDICK AEROSPACES DEVICES SITE

CHEMICALS EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS (b)	GROUNDWATER CONCENTRATION (DISSOLVED)		CHRONIC DAILY INTAKE FROM INGESTION		ORAL REFERENCE DOSE (mg/kg/d)-1	CHRONIC DAILY INTAKE FROM SHOWERING		INHALATION REFERENCE DOSE (mg/kg/d)-1	COMBINED CDI:RfD RATIO	
	Geometric Mean (mg/l)	Maximum (mg/l)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)		Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)		Average Case	Plausible Maximum Case
2-Butanone	NR	NR						9.00E-02	--	--
Chloroform	NR	NR						**	--	--
trans-1,2-Dichloroethylene	NR	NR	--	--	2.00E-02	--	--	**	--	--
Tetrachloroethylene	NR	NR	--	--	1.00E-02	--	--	**	--	--
Trichloroethylene	NR	NR	--	--	7.35E-03	--	--	**	--	--
Toluene	NR	NR						5.70E-01	--	--
Bis(2-ethylhexyl)phthalate	NR	NR						**	--	--
Barium	3.51E-02	6.63E-02	1.46E-03	5.16E-03	5.00E-02	NA	NA	NA	2.92E-02	1.03E-01
Cadmium	6.70E-03	8.22E-02	2.79E-04	6.39E-03	5.00E-04	NA	NA	NA	5.58E-01	1.28E+01
Chromium	8.10E-03	2.93E-02	3.37E-04	2.28E-03	5.00E-03	NA	NA	NA	6.75E-02	4.56E-01
Copper	3.86E-02	7.51E-02	1.61E-03	5.84E-03	3.70E-02	NA	NA	NA	4.35E-02	1.58E-01
Lead	3.00E-03	6.90E-03	1.25E-04 (c)	5.37E-04 (c)		NA	NA	NA		
Manganese	6.09E-02	4.73E-01	2.54E-03	3.68E-02	2.00E-01	NA	NA	NA	1.27E-02	1.84E-01
Nickel	2.26E-02	6.10E-02	--	--	2.00E-02	NA	NA	NA	--	--
Vanadium	ND	ND	--	--	7.00E-03	NA	NA	NA	--	--
Zinc	4.14E-02	4.70E-02	1.72E-03	3.66E-03	2.00E-01	NA	NA	NA	8.62E-03	1.83E-02
								HAZARD INDEX:	7.20E-01	1.37E+01

(a) Based on total (unfiltered) samples for inorganics.
(b) Based on dissolved (filtered) samples for inorganics.
(c) Reference dose not available for lead. See text for lead exposure.
NR = Not reported. Organic concentrations determined for total samples only.
NA = Not applicable. Showering exposure not applicable for inorganics.
** = No inhalation reference dose or potency factor available for this chemical.
-- = Not calculated.

TABLE 6-19 (Continued)
POTENTIAL EXPOSURES AND RISKS FROM INGESTION OF GROUNDWATER AND INHALATION OF VOLATILES WHILE SHOWERING
BASED ON CONTAMINANTS IN THE SHALLOW AND INTERMEDIATE MONITORING WELLS
WALDICK AEROSPACES DEVICES SITE

CHEMICALS EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS (b)	GROUNDWATER CONCENTRATION (DISSOLVED)		CHRONIC DAILY INTAKE FROM INGESTION		ORAL REFERENCE DOSE (mg/kg/d)-1	CHRONIC DAILY INTAKE FROM SHOWERING		INHALATION REFERENCE DOSE (mg/kg/d)-1	COMBINED CDI:RfD RATIO	
	Geometric Mean (mg/l)	Maximum (mg/l)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)		Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)		Average Case	Plausible Maximum Case
2-Butanone	NR	NR						9.00E-02	--	--
Chloroform	NR	NR						**	--	--
trans-1,2-Dichloroethylene	NR	NR	--	--	2.00E-02	--	--	**	--	--
Tetrachloroethylene	NR	NR	--	--	1.00E-02	--	--	**	--	--
Trichloroethylene	NR	NR	--	--	7.35E-03	--	--	**	--	--
Toluene	NR	NR						5.70E-01	--	--
Bis(2-ethylhexyl)phthalate	NR	NR						**	--	--
Barium	3.51E-02	6.63E-02	1.46E-03	5.16E-03	5.00E-02	NA	NA	NA	2.92E-02	1.03E-01
Cadmium	6.70E-03	8.22E-02	2.79E-04	6.39E-03	5.00E-04	NA	NA	NA	5.58E-01	1.28E+01
Chromium	8.10E-03	2.93E-02	3.37E-04	2.28E-03	5.00E-03	NA	NA	NA	6.75E-02	4.56E-01
Copper	3.86E-02	7.51E-02	1.61E-03	5.84E-03	3.70E-02	NA	NA	NA	4.35E-02	1.58E-01
Lead	3.00E-03	6.90E-03	1.25E-04 (c)	5.37E-04 (c)		NA	NA	NA		
Manganese	6.09E-02	4.73E-01	2.54E-03	3.68E-02	2.00E-01	NA	NA	NA	1.27E-02	1.84E-01
Nickel	2.26E-02	6.10E-02	--	--	2.00E-02	NA	NA	NA	--	--
Vanadium	ND	ND	--	--	7.00E-03	NA	NA	NA	--	--
Zinc	4.14E-02	4.70E-02	1.72E-03	3.66E-03	2.00E-01	NA	NA	NA	8.62E-03	1.83E-02
								HAZARD INDEX:	7.20E-01	1.37E+01

(a) Based on total (unfiltered) samples for inorganics.
(b) Based on dissolved (filtered) samples for inorganics.
(c) Reference dose not available for lead. See text for lead exposure.
NR = Not reported. Organic concentrations determined for total samples only.
NA = Not applicable. Showering exposure not applicable for inorganics.
** = No inhalation reference dose or potency factor available for this chemical.
-- = Not calculated.

** = No inhalation reference dose available for this chemical.
-- = Not calculated.

Table 12

TABLE 6-21
POTENTIAL EXPOSURES AND RISKS FROM INHALATION OF VOLATILES RELEASED WHILE LAWN WATERING
FUTURE-USE SCENARIO - BASED ON CONTAMINANTS IN THE SHALLOW AND INTERMEDIATE WELLS
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL CARCINOGENIC EFFECTS	AIR CONCENTRATION		CHRONIC DAILY INTAKE		CANCER POTENCY FACTOR	UPPER BOUND EXCESS LIFETIME CANCER RISK	
	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	(mg/kg/d)-1	Average Case	Plausible Maximum Case
Chloroform	4.83E-06	1.25E-05	1.91E-10	6.58E-09	8.10E-02	1.54E-11	5.33E-10
Tetrachloroethylene	2.11E-04	3.65E-03	8.32E-09	1.92E-06	3.30E-03	2.75E-11	6.34E-09
Trichloroethylene	9.72E-06	1.34E-04	3.83E-10	7.05E-08	4.60E-03	1.76E-12	3.24E-10
Bis(2-ethylhexyl)phthalate	1.39E-07	2.96E-07	5.48E-12	1.56E-10	--	--	--
					TOTAL:	4E-11	7E-09

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS	AIR CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RFD RATIO	
	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	(mg/kg/d)	Average Case	Plausible Maximum Case
2-Butanone	1.42E-06	2.91E-05	4.67E-10	3.83E-08	9.00E-02	5.19E-09	4.25E-07
Chloroform	4.83E-06	1.25E-05	1.59E-09	1.64E-08	--	--	--
Tetrachloroethylene	2.11E-04	3.65E-03	6.94E-08	4.80E-06	--	--	--
Trichloroethylene	9.72E-06	1.34E-04	3.20E-09	1.76E-07	--	--	--
trans-1,2-Dichloroethylene	6.40E-06	8.65E-05	2.10E-09	1.14E-07	--	--	--
Toluene	7.60E-06	1.77E-05	2.50E-09	2.33E-08	5.70E-01	4.38E-09	4.08E-08
Bis(2-ethylhexyl)phthalate	1.39E-07	1.96E-07	4.57E-11	2.58E-10	--	--	--
					HAZARD INDEX:	9.57E-09	4.66E-07

-- = Risk not calculated. No Reference dose or potency factor available for the inhalation route.

Table 13

TABLE 6-22
POTENTIAL EXPOSURES AND RISKS FROM INHALATION OF VOLATILES RELEASED WHILE LAWN WATERING
FUTURE-USE SCENARIO - BASED ON CONTAMINANTS IN THE DEEP WELLS
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS	AIR CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RfD RATIO	
	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	Average Case (mg/m3)	Plausible Maximum Case (mg/m3)	(mg/kg/d)	Average Case	Plausible Maximum Case
Carbon disulfide	9.29E-07	1.86E-06	3.05E-10	2.45E-09	--	--	--
Toluene	7.22E-06	1.99E-05	2.37E-09	2.62E-08	5.70E-01	4.16E-09	4.59E-08
					HAZARD INDEX:	4.16E-09	4.59E-08

-- = Risk not calculated. No reference dose available for the inhalation route.

Table 14

TABLE 6-24
POTENTIAL EXPOSURES AND RISKS FROM DERMAL CONTACT WHILE SWIMMING
FUTURE-USE SCENARIO - BASED ON CONTAMINANTS IN THE SHALLOW AND INTERMEDIATE WELLS
WILDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL CARCINOGENIC EFFECTS	GROUNDWATER CONCENTRATION		CHRONIC DAILY INTAKE		CANCER POTENCY FACTOR	UPPER BOUND EXCESS LIFETIME CANCER RISK	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)-1	Average Case	Plausible Maximum Case
Chloroform	3.10E-04	8.00E-04	2.58E-09	3.57E-08	6.10E-03	1.57E-11	2.18E-10
Tetrachloroethylene	1.49E-02	2.57E-01	1.24E-07	1.15E-05	5.10E-02	6.31E-09	5.86E-07
Trichloroethylene	6.30E-04	8.70E-03	5.23E-09	3.89E-07	1.10E-02	5.76E-11	4.28E-09
Bis(2-ethylhexyl)phthalate	6.50E-03	1.38E-02	5.40E-08	6.17E-07	1.40E-02	7.56E-10	8.63E-09
					TOTAL:	7E-09	6E-07

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS	GROUNDWATER CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RfD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)	Average Case	Plausible Maximum Case
2-Butanone	3.40E-04	7.00E-03	2.35E-08	7.82E-07	5.00E-02	4.71E-07	1.56E-05
Chloroform	3.10E-04	8.00E-04	2.15E-08	8.94E-08	1.00E-02	2.15E-06	8.94E-06
Tetrachloroethylene	1.49E-02	2.57E-01	1.03E-06	2.87E-05	1.00E-02	1.03E-04	2.87E-03
Trichloroethylene	6.30E-04	8.70E-03	4.36E-08	9.72E-07	7.40E-03	5.89E-06	1.31E-04
trans-1,2-Dichloroethylene	3.70E-04	5.00E-03	2.56E-08	5.58E-07	2.00E-02	1.28E-06	2.79E-05
Toluene	4.30E-04	1.00E-03	2.98E-08	1.12E-07	3.00E-01	9.92E-08	3.72E-07
Bis(2-ethylhexyl)phthalate	6.50E-03	1.38E-02	4.50E-07	1.54E-06	2.00E-02	2.25E-05	7.71E-05
					HAZARD INDEX:	1.36E-04	3.13E-03

Table 15

TABLE 6-25
POTENTIAL EXPOSURES AND RISKS FROM DERMAL CONTACT WHILE SWIMMING
FUTURE-USE SCENARIO - BASED ON CONTAMINANTS IN THE DEEP WELLS
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS (a)	GROUNDWATER CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RfD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)	Average Case	Plausible Maximum Case
Carbon disulfide	3.00E-04	6.00E-04	2.08E-08	6.70E-08	1.00E-01	2.08E-07	6.70E-07
Toluene	4.00E-04	1.10E-03	2.77E-08	1.23E-07	3.00E-01	9.23E-08	4.10E-07
					HAZARD INDEX:	3.00E-07	1.08E-06

(a) No chemicals of potential concern in the deep wells exhibit carcinogenic effects.

Table 16

TABLE 6-27
POTENTIAL EXPOSURES AND RISKS FROM INGESTION OF GARDEN VEGETABLES
TRANSLOCATING CONTAMINANTS FROM GROUNDWATER USED FOR GARDEN WATERING
FUTURE-USE SCENARIO - BASED ON CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS (a)	GROUNDWATER CONCENTRATION		CHRONIC DAILY INTAKE		REFFRENCE DOSE	CDI:RfD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	(mg/kg/d)	Average Case	Plausible Maximum Case
TOTAL CONCENTRATIONS							
Barium	5.61E-02	1.35E-01	4.99E-06	3.21E-05	5.00E-02	9.98E-05	6.42E-04
Cadmium	8.20E-03	1.07E-01	6.73E-07	2.46E-05	1.00E-03	6.73E-04	2.46E-02
Chromium	1.27E-01	7.86E-01	3.55E-06	5.66E-05	5.00E-03	7.10E-04	1.13E-02
Copper	2.90E-02	1.24E-01	2.68E-05	3.11E-04	3.70E-02	7.24E-04	8.40E-03
Lead	6.00E-03	3.34E-02	6.50E-06 (b)	8.74E-05 (b)			
Nickel	4.80E-02	5.10E-01	1.78E-05	5.00E-04	2.00E-02	8.92E-04	2.50E-02
Manganese	1.75E-01	8.41E-01	5.63E-05	7.41E-04	2.00E-01	2.82E-04	3.71E-03
Vanadium	3.74E-02	8.38E-02	1.22E-05	7.47E-05	7.00E-03	1.74E-03	1.07E-02
Zinc	1.96E-02	1.54E-01	5.72E-05	1.21E-03	2.00E-01	2.86E-04	6.04E-03
					HAZARD INDEX:	5.41E-03	9.04E-02
DISSOLVED CONCENTRATIONS							
Barium	3.51E-02	6.63E-03	3.12E-06	1.58E-06	5.00E-02	6.25E-05	3.16E-05
Cadmium	6.70E-03	8.22E-02	5.50E-07	1.88E-05	1.00E-03	5.50E-04	1.88E-02
Chromium	8.10E-03	2.93E-02	2.27E-07	2.11E-06	5.00E-03	4.53E-05	4.22E-04
Copper	3.86E-02	7.51E-02	3.56E-05	1.89E-04	3.70E-02	9.63E-04	5.09E-03
Lead	3.90E-03	6.90E-03	3.25E-06 (b)	1.81E-05 (b)	--		
Nickel	2.20E-02	6.10E-02	2.40E-06	5.99E-05	2.00E-02	4.20E-04	2.99E-03
Manganese	6.09E-02	4.73E-01	1.96E-05	4.17E-04	2.00E-01	9.80E-05	2.08E-03
Vanadium	ND	ND	--	--	7.00E-03	--	--
Zinc	4.41E-02	4.70E-02	1.29E-04	2.68E-04	2.00E-01	6.44E-04	1.84E-03
					HAZARD INDEX:	2.78E-03	3.13E-02

(a) None of the inorganic chemicals of potential concern exhibit carcinogenic effects via the ingestion route.
(b) Reference dose not available for lead. See text for discussion of lead exposure.
ND = Chemical not detected.
-- = Not calculated. Chemical not detected.

Table 17

TABLE 6-28
POTENTIAL EXPOSURES AND RISKS FROM INGESTION OF GARDEN VEGETABLES
TRANSLOCATING CONTAMINANTS FROM GROUNDWATER USED FOR GARDEN WATERING
FUTURE-USE SCENARIO - BASED ON CONCENTRATIONS IN DEEP GROUNDWATER
WALDICK AEROSPACE DEVICES SITE

CHEMICAL EXHIBITING POTENTIAL NONCARCINOGENIC EFFECTS (a)	GROUNDWATER CONCENTRATION		CHRONIC DAILY INTAKE		REFERENCE DOSE	CDI:RfD RATIO	
	Average Case (mg/liter)	Plausible Maximum Case (mg/liter)	Average Case (mg/kg/d)	Plausible Maximum Case (mg/kg/d)	(mg/kg/d)	Average Case	Plausible Maximum Case
TOTAL CONCENTRATIONS							
Barium	1.23E-01	2.68E-01	1.09E-05	6.37E-05	5.00E-02	2.19E-04	1.27E-03
Chromium	8.41E-02	4.03E-01	2.35E-06	2.90E-05	5.00E-03	4.70E-04	5.80E-03
Copper	2.57E-02	7.21E-02	2.37E-05	1.81E-04	3.70E-02	6.41E-04	4.89E-03
Lead	1.08E-02	6.35E-02	1.17E-05 (b)	1.66E-04 (b)			
Manganese	9.11E-02	2.88E-01	2.93E-05	2.54E-04	2.00E-01	1.47E-04	1.27E-03
Vanadium	2.13E-02	4.89E-02	6.95E-06	4.36E-05	7.00E-03	9.93E-04	6.23E-03
Zinc	1.52E-01	3.15E-01	4.44E-04	2.47E-03	2.00E-01	2.22E-03	1.23E-02
					HAZARD INDEX:	4.69E-03	3.18E-02
DISSOLVED CONCENTRATIONS							
Barium	7.33E-02	1.76E-01	6.52E-06	4.19E-05	5.00E-02	1.30E-04	8.39E-04
Chromium	ND	ND	--	--	5.00E-03	--	--
Copper	1.18E-02	3.12E-02	1.09E-05	7.82E-05	3.70E-02	2.95E-04	2.11E-03
Lead	ND	ND	--	--			
Manganese	3.92E-02	4.92E-02	1.26E-05	4.34E-05	2.00E-01	6.31E-05	2.17E-04
Vanadium	ND	ND	--	--	7.00E-03	--	--
Zinc	1.48E-01	2.25E-01	4.31E-04	1.76E-03	2.00E-01	2.15E-03	8.82E-03
					HAZARD INDEX:	2.64E-03	1.20E-02

(a) None of the inorganic chemicals of potential concern exhibit carcinogenic effects via the ingestion route.
(b) Reference dose not available for lead. See text for discussion of lead exposure.
ND = Chemical not detected.
-- = Not calculated. Chemical not detected.