



Proposed Plan

Site 3 – Chlorinated Solvent Groundwater Plume Naval Weapons Industrial Reserve Plant (NWIRP) Bedford, Massachusetts

The Proposed Cleanup

After careful study of Site 3, the Chlorinated Solvent Groundwater Plume, at the former NWIRP in Bedford, Massachusetts, the Navy has identified its preferred cleanup approach. The Navy hereby proposes the following cleanup actions for public comment:

- In-place **enhanced bioremediation** to treat the source area
- Continued **groundwater pump-and-treat** to control the migration of contaminants and to protect the off-site aquifer
- **Monitored natural attenuation** of the remaining plume area until cleanup goals are achieved
- **Land use controls**
- **Five-year reviews** of the remedy to ensure continued protection of human health and the environment.

Introduction

This document provides information on the Navy's preferred cleanup plan for Site 3, the Chlorinated Solvent Groundwater Plume, at the Naval Weapons Industrial Reserve Plant located in Bedford, Massachusetts (NWIRP Bedford). This plan has been prepared to inform the community of the Navy's reasons for the proposed cleanup approach, and to encourage community input on the proposed plan and overall environmental cleanup process for Site 3.

Federal and state environmental laws govern cleanup activities at federal facilities. A federal law called the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), better known as "Superfund", provides procedures for investigating and cleaning up environmental problems. Under this law, the Navy is pursuing cleanup of designated sites at NWIRP Bedford to restore the environmental condition of the property. The Navy works closely with the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) to achieve this objective. The Navy is the lead agency for all investigation and cleanup programs ongoing at NWIRP Bedford. EPA oversees the Navy's Site 3 cleanup and must concur with the final cleanup plan.

Let us know what you think!

Mark Your Calendar!

PUBLIC COMMENT PERIOD
July 15, 2010 to August 13, 2010



The Navy will accept comments on the Site 3 Proposed Plan during this period. Send written comments, postmarked no later than August 13, 2010, to:

NAVFAC MID-ATLANTIC
Attn: Public Affairs Officer, Code 09PA
9742 Maryland Ave.
Norfolk, VA 23511-3095
Fax: (757) 341-1481
thomas.kreidel@navy.mil

PUBLIC MEETING AND PUBLIC HEARING
July 21, 2010, 6:00 PM to 7:30 PM
Bedford Town Hall, 10 Mudge Way
Selectmen's Hearing Room

The Navy will hold a public meeting at 6:00 PM to provide information about this Proposed Plan. Following a presentation describing the planned site cleanup, the Navy will host an informal question-and-answer session. The Navy will then hold a formal Public Hearing at 7:00 PM until all comments on the Proposed Plan are heard. It is at this Hearing that an official transcript of comments will be entered into the record.

For more information, visit the local Information Repository listed at the back of this Proposed Plan.

As the lead agency, the Navy has prepared this Proposed Plan for Site 3 in accordance with CERCLA Section 117(a) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan. This plan and its associated public involvement opportunities fulfill the Navy's public participation responsibilities under these laws. This proposed plan was developed with support from the EPA and the MassDEP.

The purpose of this Proposed Plan is to:

- Provide background information on Site 3, including a description of the site, a summary of past investigations, and conclusions from the baseline human health and ecological risk assessments.
- Identify the Navy's preferred cleanup plan for Site 3, and explain the reasons for this preference.
- Describe the other cleanup options which were considered.
- Encourage public review and comment on this Proposed Plan.
- Provide information on how the public can be involved in the cleanup selection process for Site 3.

Once the public has had the opportunity to review this Proposed Plan, the Navy, EPA, and MassDEP will carefully consider all comments received and, based on the comments, could modify the cleanup plan or even select a different plan from the one currently proposed. Ultimately, the selected remedy will be documented in a Record of Decision for the Site. The Navy will respond to all comments received during the comment period and public hearing in a document called the Responsiveness Summary. The Responsiveness Summary will be issued with the Record of Decision.

This Proposed Plan presents the highlights of key information from previous investigations at Site 3, many of which have been presented to the public at Restoration Advisory Board meetings. More detailed information about Site 3 can be found in the Remedial Investigation, Feasibility Study, Interim Remedial Action monitoring reports, the related regulatory agency correspondence, and other documents available for review at the public Information Repository listed at the end of this Proposed Plan. The Navy encourages the public to review these documents to gain a better understanding of environmental activities completed at Site 3 which support this Proposed Plan.

Scope and Role of the Response Action for Site 3

Site 3, which is also called the "Chlorinated Solvent Groundwater Plume", is one of four sites at NWIRP Bedford requiring investigation under CERCLA. Each of these sites progresses through the cleanup

process independently. For Sites 1 and 2, Proposed Plans and Records of Decision were approved in 2000, indicating that no further actions were required at those sites. A Proposed Plan and Record of Decision for Site 4 were approved in 2009 for source area excavation and monitored natural attenuation of groundwater contamination.

The Proposed Plan for Site 3 is not expected to hinder the strategy or progress of cleanup for other sites at NWIRP Bedford. Although the extent of groundwater contamination from Site 3 overlaps (is co-mingled with) the smaller Site 4 groundwater plume, the contaminants at both sites are "volatile organic compounds" and similar cleanup options are proposed for groundwater at both sites in that area (natural attenuation).

Site Background

Where is Site 3?

NWIRP Bedford is shown in Figure 1. Site 3 is defined by the area where chlorinated solvents from the northern part of the facility have impacted groundwater (Figure 2). The Site 3 source area is located by the loading docks on the north side of the Components Laboratory building. The source area is the location where solvents originally were released to the environment and which currently has the highest contaminant levels. Contaminants from this area have spread outward as a plume in groundwater primarily extending westward toward the Facility Storage Building and then off of Hartwells Hill into a low-lying, wooded area and wetlands associated with Elm Brook.

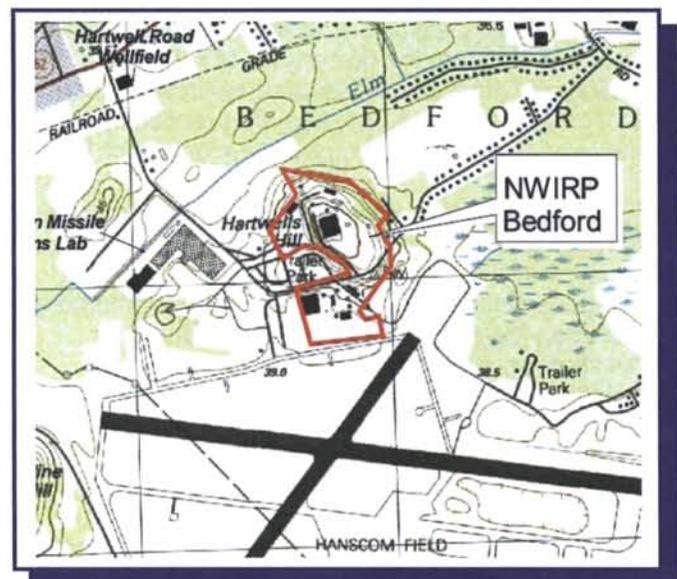


Figure 1 – NWIRP Bedford Location Map

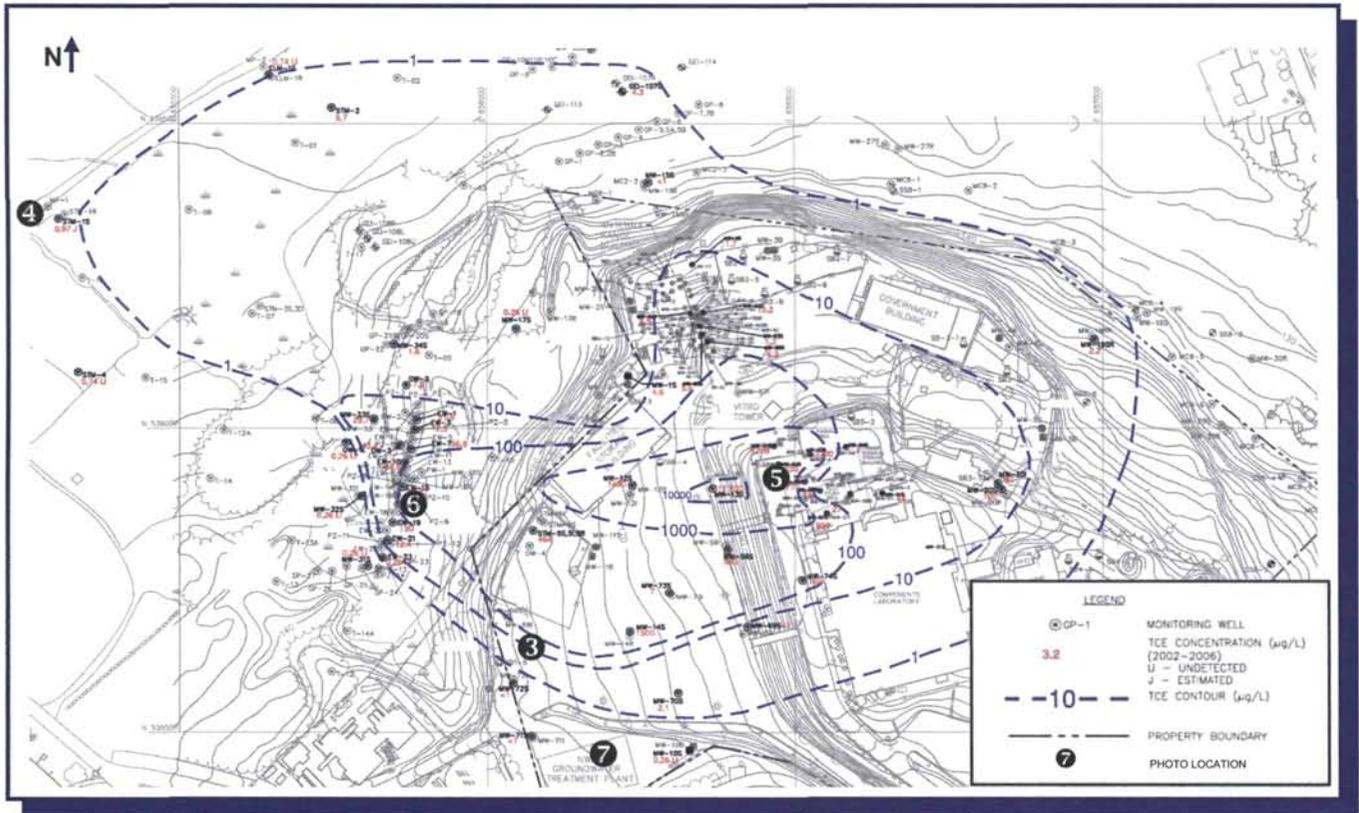


Figure 2 – General Extent of the Site 3 Plume in Shallow Groundwater Showing Trichloroethene (TCE) Concentration Contours in Parts-Per-Billion

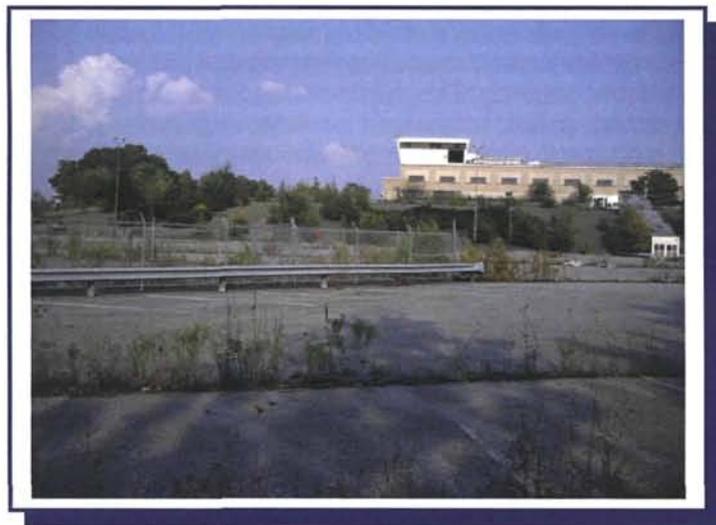


Figure 3 – Site 3, West of the Components Laboratory Building



Figure 4 – Elm Brook and Wetlands

What caused the contamination at Site 3?

NWIRP Bedford was a Navy research and development facility operated from the mid-1950s until 2000 by the Raytheon Manufacturing Company. Solvents such as trichloroethene (TCE) are commonly used in industrial operations. Accidental spills or releases of some solvents likely occurred at the Components Laboratory as well as the Facility Storage Building. In 1976, there was a documented release from a ruptured 55-gallon drum containing a solvent at the Components Laboratory shipping and receiving area. The spill entered a storm drain, where it discharged to the ground on the northwest portion of Hartwells Hill. Although there have been no other documented spills of a solvent, it is believed that there may have been other similar releases during the facility's history.

Site Characteristics

What does Site 3 look like?

NWIRP Bedford has been vacant since 2000 except for the Navy's groundwater treatment plant for Site 3. The facility is surrounded by a chain link fence and many of the buildings have been boarded up for security. Figure 3 presents a photograph of the area west of the Components Laboratory, along the main contaminant plume flow direction. Figure 4 shows Elm Brook, where the outermost edge of the plume has been detected.

What contaminants are at Site 3?

The Navy's investigations (see History of Site Investigations text box) have shown that the specific chemicals of concern in Site 3 groundwater include TCE, perchloroethene (PCE); cis-1,2-dichloroethene (DCE); 1,1-DCE; 1,2-dichloroethane (DCA), and vinyl chloride. Each of these chemicals are "chlorinated volatile organic compounds". The primary contaminant at Site 3 is TCE.

Where are the Site 3 contaminants located?

The source area is located by the loading dock area on the north side of the Components Laboratory. The highest contaminant concentrations in soil and groundwater within the source area are generally found 30 to 50 feet below the ground surface. Substantially lower concentrations are found in shallow groundwater (approximately 20 to 30 feet below ground surface) and in bedrock groundwater (depth varies, but can be approximately 100 feet below ground surface on Hartwells Hill). As groundwater flows through the source area, some of the contaminants are carried away and spread out into a groundwater plume. Contaminant concentrations decrease with distance from the source area until they are no longer detectable.

Since the source area is situated atop Hartwells Hill, some of the plume has expanded radially (in all directions) from that area, although the primary flow is westward to an off-property wooded/wetland area and then northwest toward Elm Brook. In the wooded/wetland area, the plume is in shallower groundwater than in the source area. At Elm Brook, the plume is either present at trace levels or is not detectable.

Will the Site 3 plume expand?

Past investigations have shown that expansion of the plume is unlikely. The Navy's ongoing monitoring (sampling) program indicates that contaminant concentrations have been either stable or diminishing over time. Further, the Navy has been operating a groundwater pump-and-treat system in the vicinity of the western property line to prevent migration of the plume.

History of Site Investigations

1983/1984 – Benzene and three chlorinated solvents (TCE, PCE, and 1,2-DCE) were detected in three water supply wells operated by the Town of Bedford at the Hartwell Road Wellfield, located northwest of NWIRP Bedford (Figure 1). The Navy undertook several investigations to evaluate whether this contamination originated from NWIRP Bedford.

1986 – Installation Restoration Program begins
The Navy's first step for evaluating sites at NWIRP Bedford under this cleanup program was to complete an Initial Assessment Study. This study recommended that a groundwater and surface water monitoring program be conducted to evaluate the potential for contaminants from NWIRP Bedford to leave the site.

1990 – First phase of Remedial Investigation completed
The Navy performed the first phase of a detailed study, called a Remedial Investigation Phase I, as well as a supplemental investigation, to evaluate where contaminants are located at NWIRP Bedford.

1993 – Second phase of Remedial Investigation begins and a Short Term Measure is designed and implemented
The Navy began the Remedial Investigation Phase II and additional supplemental investigations to further evaluate the nature and extent of contaminants at NWIRP Bedford. The Phase II work included an extensive sampling program for site characterization as well as conducting human health and ecological risk assessments. The Navy started work on a Short Term Measure, now called the Interim Remedial Action, to prevent contaminated groundwater from leaving the site (see Text Box on page 5, "Interim Remedial Action for Groundwater at Site 3").

(continued on page 6)

Interim Remedial Action (IRA) for Groundwater at Site 3

Based on initial field studies which indicated that groundwater contamination was migrating from Hartwells Hill to Elm Brook, the Navy took action to control the plume of chlorinated solvents. This action was originally called the "Short Term Measure", and was later renamed the "Immediate Response Action" (IRA), based on terminology derived from state environmental regulations (Massachusetts General Law Chapter 21E and the Massachusetts Contingency Plan). The plume is now being addressed by the Navy as Site 3 under the federal CERCLA law. The IRA acronym was retained but now stands for Interim Remedial Action to be consistent with CERCLA.

Several cleanup options were evaluated, but ultimately a groundwater pump-and-treat system was selected to prevent the migration of the contaminant plume to the off-property wetlands and to Elm Brook. The construction of the system was completed in 1996, and the system began operating in 1997.

A row of 23 groundwater pumping wells (Figure 6) were installed at the base of Hartwells Hill near the western property fenceline (west of the Facility Storage Building) (Figure 2). The plume depth is shallower here and the soil types are more conducive to the pumping of groundwater, as compared to the tighter soils on Hartwells Hill. The extraction wells are connected to a nearby pump house which then sends the water to a treatment building located on the Navy property (Figure 7).

The treatment plant is capable of handling up to 30 gallons per minute and is currently being operated at approximately 11 gallons per minute.



Figure 6 – Row of 23 Extraction Wells

Contaminants in the water are removed using a specialized carbon filtration system ("granular activated carbon"). The water is pumped through the carbon vessels where the contaminants stick to the carbon granules. Over time, the surface of the carbon granules fill up and the carbon vessels are periodically replenished with fresh carbon. The spent carbon is shipped off-site for treatment or disposal.

The clean water exiting the filter is discharged to the ground surface where it then infiltrates back into the ground and the subsurface aquifer. The Navy collects samples of the water entering and leaving the treatment plant to monitor system performance and to ensure compliance with federal and state regulations.

Since system start-up in 1997, the Navy has also been conducting a semi-annual (twice yearly) sampling program for the groundwater plume. Data trends show that contaminant concentrations in groundwater beyond the row of extraction wells have been decreasing. Contaminant concentrations in groundwater in other areas of the plume also have been decreasing or have remained stable. Thus, the system has been effective at controlling the migration of chlorinated solvents from Site 3. This system will continue to be used until the source area cleanup has sufficiently reduced the plume extending toward the off-property area.



Figure 7 – Treatment Plant Operations

History of Site Investigations (continued from page 4)

1994 – NWIRP Bedford placed on National Priorities List
The EPA placed NWIRP Bedford on the National Priorities List. This list identifies sites selected by EPA for priority environmental investigation and cleanup.

1997 to present – Interim Remedial Action
Since start-up of the groundwater treatment plant in 1997, the Navy has been conducting a program of groundwater sampling to monitor plume concentrations over time.

2003 – Thermal Treatment Pilot Study
The Navy installed and operated an in-situ (in-place) thermal treatment system in a portion of the Site 3 source area in order to evaluate the feasibility of using this technology for reducing contaminant concentrations throughout the source area. The test appears to have been successful for removing some contamination within the test area but identified the technical challenges for a full-scale operation.

2007 – Hydrogeological Modeling
The computational model used during the Remedial Investigation to support risk assessments and predict the contaminant plume migration over time was updated to include an evaluation of various cleanup options.

2010 – Source area delineation
In order to provide a clearer picture of the Site 3 source area contamination and help select the preferred cleanup option, additional soil and groundwater samples were collected to delineate the horizontal and vertical extent of the source area. During this and previous investigations, no separate-phase product was found (i.e., no pools or globules of undissolved chlorinated solvents are present as a "dense, non-aqueous phase liquid" or "DNAPL").



Figure 5 – Source Area Soil Sampling

2010 – Feasibility Study finalized
The Feasibility Study developed and evaluated various cleanup options for Site 3, based on the results of the Remedial Investigation and supplemental investigations, the thermal treatment pilot study, and the updated groundwater model. The preferred alternative presented in this Proposed Plan follows from the results of the Feasibility Study.

Summary of Site Risks

As part of the Remedial Investigation, the Navy completed risk assessments to evaluate current and potential future effects of site contaminants on human health and the environment.

HUMAN HEALTH RISKS

The Human Health Risk Assessment estimated the "baseline risk," which is the likelihood of health problems occurring if no cleanup actions were taken at the site. To estimate the baseline risk for human health, a four-step process was used:

Step 1 - Identify Chemicals of Potential Concern. Chemicals of Potential Concern were defined as chemicals detected at Site 3 at concentrations that exceeded federal and state risk-screening levels. Chemicals with concentrations above these benchmarks were further evaluated in Step 2.

Step 2 - Conduct an Exposure Assessment. The ways that humans could come into contact with the Chemicals of Potential Concern were evaluated. Both current and reasonably foreseeable future exposure scenarios were considered. NWIRP workers, trespassers, and on- and off-site resident scenarios were evaluated. For Site 3, potential exposures to Chemicals of Potential Concern include:

- Workers or trespassers could come into contact with site soil through direct contact, ingesting, or inhaling soil particulates (dust).
- Workers, trespassers, or residents could come into contact with vapors from the contaminants in groundwater.
- Residents could come into contact with groundwater through direct contact, ingesting, or inhaling vapors.
- Trespassers could come into contact with Elm Brook (surface water and sediments) through direct contact or ingesting.

Step 3 - Complete a Toxicity Assessment. Possible harmful effects associated with potential exposure to the Chemicals of Potential Concern were evaluated. Generally, these Chemicals of Potential Concern were separated into two groups: carcinogens (chemicals that may cause cancer) and non-carcinogens (chemicals that may cause adverse health effects other than cancer).

Step 4 - Characterize the Risk. Here, the results of Steps 2 and 3 were combined to estimate overall risks from exposure to Site 3 Chemicals of Potential Concern. The terms used to define the estimated risk are explained in the text box, *What's the Risk to Me?*

Step 4 - Characterize the Risk (continued). The results of the Site 3 Human Health Risk Assessment were as follow:

- There were no unacceptable risks associated with exposure to soil, surface water, or sediment.
- The estimated total carcinogenic risk for a hypothetical on-site resident exposed to groundwater at Site 3 was 2.8×10^{-2} , which exceeds EPA's acceptable risk range. The main contaminants contributing to this estimated risk were TCE, 1,1-DCE, 1,2-DCA, PCE, and vinyl chloride.
- The non-cancer hazard index estimate for a hypothetical on-site resident exposed to Site 3 groundwater was 100, which exceeds EPA's acceptable level of 1. The main contaminants contributing to this estimated risk were TCE, PCE, cis-1,2-DCE, and 1,1-DCE.

In summary, the human health risk assessment identified unacceptable risks associated with a scenario where groundwater from Site 3 was used as a drinking water source.

What's the Risk to Me?

In evaluating risks to humans, risk estimates for carcinogens (chemicals that may cause cancer) and non-carcinogens (chemicals that may cause adverse effects other than cancer) are expressed differently.

For carcinogens, risk estimates are expressed in terms of probability. For example, exposure to a particular carcinogenic chemical may present a 1 in 10,000 chance of causing cancer over an estimated lifetime of 70 years. This can also be expressed as 1×10^{-4} . The EPA acceptable risk range for carcinogens is 1×10^{-6} (1 in 1,000,000) to 1×10^{-4} (1 in 10,000). In general, calculated risks higher than this range would require consideration of clean-up alternatives.

For non-carcinogens, exposures are first estimated and then compared to a reference dose (RfD). The RfD is developed by EPA scientists to estimate the amount of a chemical a person (including the most sensitive person) could be exposed to over a lifetime without developing adverse health effects. The exposure dose is divided by the RfD to calculate the measure known as a hazard index (a ratio). A hazard index greater than 1 suggests that adverse effects may be possible.

ECOLOGICAL RISKS

To conduct the Ecological Risk Assessment, the following three-step process was used:

Step 1 - Problem Formulation. The primary objective of the Ecological Risk Assessment was to evaluate whether or not ecological receptors (animals and plants) are potentially at risk when exposed to contaminants at Site 3. The ecological risk assessment for NWIRP Bedford was completed to make sure that ecological receptors were able to exist and grow in ways similar to the surrounding area.

The ecological receptors evaluated for the Ecological Risk Assessment included:

- Terrestrial vertebrates (small mammals and birds) coming into contact with soil and aquatic media (wetland sediment, surface water, runoff/seepage, and groundwater discharge),
- Terrestrial plants directly contacting surface soil and aquatic media, and
- Aquatic life in contact with aquatic media.

Similar to the Human Health Risk Assessment, Chemicals of Potential Concern were identified by comparing Site 3 chemical concentrations to risk-based screening levels. These Chemicals of Potential Concern were evaluated further in Step 2.

How is Ecological Risk Expressed?

The risk to ecological receptors is expressed as a Hazard Quotient. A receptor's exposure estimate (e.g., amount of chemical in media or ingested in food) is compared to benchmarks for the chemicals that are designed to be protective. When the Hazard Quotient is below 1, toxicological effects are unlikely to occur and no significant risk is present. When the Hazard Quotient is above 1, there is a potential for significant risk to be present.

Step 2 - Risk Analysis. The potential exposures to the Chemicals of Potential Concern and the resulting possible harmful effects were evaluated. Exposure was determined by estimating or measuring the amount of a chemical in soil, surface water, sediment, plant or animal tissue, and evaluating exposure to these chemical concentrations by ecological receptors.

Step 3 - Risk Characterization. The results from Step 2 were evaluated for the likelihood of harmful effects to ecological receptors at Site 3. The Ecological Risk Assessment concluded that risks to ecological receptors at Site 3 are minimal.

Remedial Action Objectives

Remedial action objectives are the specific goals to be achieved by the cleanup plan. The goals are designed to be protective of human health and the environment and to comply with pertinent federal and state regulations. The following three objectives were identified for Site 3:

1. **Mitigate the identified unacceptable risks to human health** associated with the use of Site 3 groundwater as a drinking water supply by reducing the concentrations of 1,1-DCE, 1,2-DCA, cis-1,2-DCE, PCE, TCE, and vinyl chloride in groundwater to remediation goals.
2. **Prevent the use of on-site groundwater** for human consumption until groundwater remediation goals have been achieved on-site.
3. **Prevent the migration** of 1,1-DCE, 1,2-DCA, cis-1,2-DCE, PCE, TCE and vinyl chloride in groundwater at concentrations greater than the remediation goals.

What are the Site 3 Cleanup Goals?

The Town of Bedford has designated groundwater in this area as a potential drinking water source. Accordingly, the cleanup goals for the Site 3 contaminants are the federal and state drinking water standards:

1,1-DCE	7 parts per billion (ppb)
1,2-DCA	5 ppb
cis-1,2-DCE	70 ppb
PCE	5 ppb
TCE	5 ppb
Vinyl Chloride	2 ppb

Summary of Cleanup Alternatives

Remedial alternatives (cleanup options) were developed and evaluated in the Site 3 Feasibility Study. The alternatives were developed to meet the Remedial Action Objectives listed above. The cleanup options are briefly described below. The evaluation results are summarized in Table 1 (page 12). Full details are available for review in the Feasibility Study, which is available at the public Information Repository. The following five cleanup options were evaluated for the Site 3 source area:

Alternative 1 – No Further Action

Under CERCLA, a "no action" alternative must be evaluated in order to serve as a baseline for comparison with the other alternatives. Under this option, the site would be left as it is today and no

further cleanup or monitoring would be performed. Only administrative reviews of the site status would be conducted every 5 years, in accordance with CERCLA.

Alternative 2 – Excavation

This alternative would include the removal of approximately 12,410 cubic yards of soil with the highest contamination in the source area. Contaminated groundwater would remain; however, removal of the most contaminated soil would help to remove the overall mass of chemicals in the source area which is contributing to the plume in groundwater. Due to the depth of the excavation (approximately 50 feet deep), the use of retaining walls and extensive dewatering would be necessary (the groundwater table is only 20 feet below the ground surface). Water derived from the excavation activities would be treated using the existing groundwater treatment plant at NWIRP Bedford or disposed off-site. The excavated soil would be disposed at a licensed, off-site facility and the area would be backfilled with clean fill obtained from an off-site source. This source area cleanup would be completed in approximately 3 years.

Alternative 3 – In-Place Thermal Treatment

This alternative would expand upon the pilot study conducted in 2003 (see text box, *History of Site Investigations*). Thermal treatment is a process by which the subsurface is greatly heated (e.g., by installing a series of large electrodes). Once the ground reaches the design temperature, the chlorinated solvents present in the ground would be converted to the vapor phase and then captured using a series of wells, called "soil vapor extraction" wells. The extracted air would be treated (such as carbon filtration) to remove the contaminant vapors before the air is released to the atmosphere. This source area cleanup would be completed in approximately 3 years.

Alternative 4 – In-Place Enhanced Bioremediation

This alternative involves the injection of nutrients into the source area to stimulate the activity and growth of naturally-occurring microbes that can break down (metabolize) the site contaminants. The injection of an organic nutrient (microbial food source) will promote the anaerobic (low oxygen) conditions needed for microbes to degrade the contaminants in soil and groundwater. This will result in the degradation or transformation of the contaminants into less toxic or non-toxic forms. The nutrients will be injected through a series of wells. Additional injection wells will be installed beyond of the source area in the paved parking area lot near the Facility Storage Building in order to provide a second line of treatment. Plume conditions will be monitored over time and additional nutrients will be added as needed to complete the process. Other subsurface conditions such as pH and moisture may also be

adjusted to enhance the process, if necessary. This source area cleanup would be completed in approximately 10 years.

Alternative 5 – Groundwater Extraction

This alternative would include the installation of pumping wells in the source area to extract groundwater and prevent the source area from further contributing to a groundwater plume. Due to tight soils, groundwater flows slowly in the source area. Therefore, pumping wells would likely be used as a containment measure (dewatering the source area) rather than a means to remove the contaminant mass. As a result, this extraction system may need to be run indefinitely. The extracted water would be treated on-site using the existing treatment plant at NWIRP Bedford. The treated water would be discharged back to the ground. The treatment plant's carbon filter would be changed-out periodically with fresh carbon. The spent carbon would be shipped off-site for disposal or treatment at an approved facility.

COMMON ELEMENTS

Each of the cleanup options, except for the No Further Action alternative, also include the following elements as part of the overall site remedy:

- **Downgradient Pump-and-Treat** – The groundwater plume will continue to be controlled by the existing Interim Remedial Action (IRA) system. Groundwater extraction in this area will continue to prevent the migration of contaminants to the off-property, wooded/wetland area. If deemed necessary, system optimizations over time may include the installation of additional extraction wells to ensure the plume is being adequately captured. The IRA system will continue to be operated until no longer needed to achieve cleanup goals in the off-property area (e.g., depending on the success of the source area treatment and attenuation processes to reduce the plume before it reaches the off-property area).
- **Monitored Natural Attenuation** – The Navy will implement a long-term groundwater monitoring program to verify that natural attenuation processes are effectively reducing contaminant concentrations in the remaining areas of the plume. This will include areas where contaminant concentrations are lower such as the bedrock zone and the off-property wetland area. Monitored natural attenuation is not a "no action" option, but is instead a careful examination of the site geochemistry and plume conditions, with a focus on the natural microbial degradation of contaminants. Monitoring of the overall plume and the treatment system operations will also be performed. For each of the alternatives, cleanup of the off-property

plume area is expected to be completed in approximately 7 years. Cleanup of the on-property plume may take decades due to the nature of the contamination and the site geology.

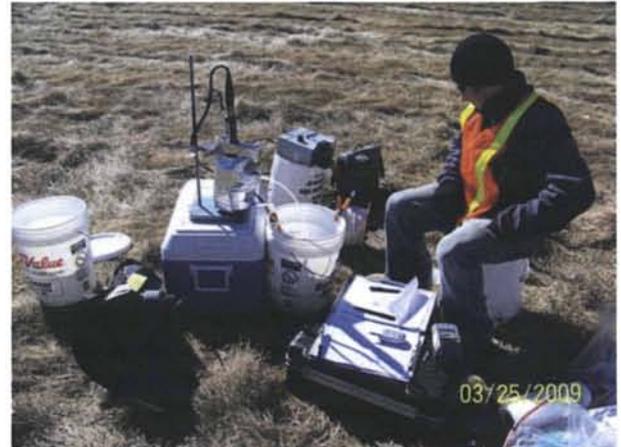


Figure 8 – Groundwater Monitoring

- **Land Use Controls** – The Navy will implement land use controls to restrict certain uses of groundwater and the Navy property, pending full site cleanup. The Navy will work with Town officials to apply the local drinking water well ordinance to prevent groundwater use in the affected private properties until cleanup goals are achieved.
- **Review** – A detailed review of site conditions would occur every 5 years until cleanup goals are met.

Evaluation of Alternatives

EPA has established nine criteria for use in comparing the advantages/disadvantages of each cleanup alternative. These criteria fall into three groups: (1) "threshold criteria" that any selected alternative must meet; (2) "primary balancing criteria" that are used to differentiate between alternatives; and (3) "modifying criteria" that may be used to modify the recommended remedy. In the Feasibility Study, each alternative identified above was individually analyzed with respect to the criteria. Next, the alternatives are compared against each other with respect to each criterion. Table 1 (page 12) provides a summary of these comparisons.

Preferred Alternative

In summary, the Navy is proposing Alternative 4, which is an overall site remedy that includes enhanced bioremediation for the source area, continued groundwater pump-and-treat at the facility boundary, monitored natural attenuation of the residual plume, land use controls, and 5-year

reviews. This combination is recommended because it offers the best balance among the nine evaluation criteria.

The available groundwater monitoring data indicate that natural biodegradation processes are already working to break down compounds such as TCE, which is the primary contaminant at Site 3. However, the unaided process is slow and appears to be stalling part way through the multi-step degradation process. This biodegradation process would be benefited by the addition of nutrients and adjusting water quality parameters such that microbial activity is increased and the destruction of contaminants can be accelerated.

Enhanced bioremediation can be a cost-effective means for achieving cleanup goals without the need for energy-intensive equipment (such as thermal treatment) or off-site disposal of large volumes of material (such as excavation). The overall cleanup timeframes are similar between the different options, but can be achieved at a lower cost under Alternative 4. Alternative 4 also satisfies the preference for treatment of contamination and is considered a "greener" choice overall because contaminants would be destroyed in-place using microbial activity with little new construction required. Alternative 3 would have a far greater energy (electricity) demand which would, in effect, produce more air emissions. Similarly, Alternative 2 would also have a greater energy demand (construction vehicle fuel) than Alternative 4 and would also consume more environmental resources such as landfill space. Alternative 2 would be effective for achieving cleanup goals in the source area in a similar time frame to Alternative 3, but would present greater physical and chemical risks to remediation workers and the community due to the excavation and ex-situ handling and transportation of source area soil.

The source area remedy will be complicated by the depth of contamination and the nature of the site soils. However, throughout the implementation process, the Navy will look for ways to optimize and accelerate the site cleanup. Cleanup strategies will be adapted in response to trends in the monitoring data. The treatment systems can be modified (e.g., extra nutrient injections, new nutrient mixes), expanded (e.g., additional injection/extraction points), or combined with supplemental treatment technologies.

Continued operation of the pump-and-treat system downgradient of the source area will allow for ongoing plume control and restoration of the off-property wetland area. The monitored natural attenuation program will verify that the residual concentrations in groundwater are being reduced to acceptable levels over time. Estimated cleanup timeframes under the

preferred alternative are 10 years for the source area and 7 years for the off-property plume. Under any of the options, several decades will be required for cleanup of the on-property plume; however, the plume will be under control and land use controls to prevent the use of site groundwater, and 5-year reviews by the Navy, EPA, and MassDEP, will be conducted to ensure that the site poses no risks to human health or the environment during the time until site cleanup is complete.

The evaluation of cleanup options (Table 1, page 12) shows that most alternatives for the plume area are comparable with regard to most criteria. Further details on the comparison of alternatives are provided in the Feasibility Study, which is available for public review at the local Information Repository listed at the end of this Proposed Plan.

Overall, the Navy expects the Preferred Alternative to (1) be protective of human health and the environment; (2) comply with all pertinent federal and state regulations; (3) be cost-effective; (4) use technologies that are permanent; and (5) provide treatment.

Next Steps

Community consideration of this Proposed Plan is the next step in the cleanup process for Site 3. The public is encouraged to review this plan and submit comments to the Navy. The Navy will accept written comments on the Proposed Plan during the public comment period, from July 15, 2010 to August 13, 2010. The Navy will accept oral comments during a Public Hearing that follows a Public Information Session to be held on July 21, 2010 at the Bedford Town Hall (Selectmen's Meeting Room). You do not have to be a technical expert to take part in the process. The Navy would like to know your thoughts before making a final decision on whether or not to implement the proposed remedy for Site 3.

Once the community has commented on this Proposed Plan, the Navy, EPA, and MassDEP will consider all comments received. It is possible that this Proposed Plan could change based on comments received from the community. The Navy will provide written responses to all comments received on the Proposed Plan. The responses to public comments will be provided in a document called a Responsiveness Summary, which will be submitted with the Record of Decision prepared for the Site.

The Record of Decision (cleanup plan) will contain the rationale for the Navy's and EPA's decision for the Site. The Navy and EPA anticipate that all comments will be reviewed and the Record of Decision will be signed by September 2010. The Record of Decision will then be made available to the public at the local Information Repository. The Navy

will announce the availability of the Record of Decision through local newspapers and to the NWIRP Bedford Restoration Advisory Board.

Commitment to the Communities

The Navy is committed to keeping the communities informed on the environmental cleanup program at NWIRP Bedford. The Restoration Advisory Board, composed of the community and government agency representatives, meets periodically to discuss the environmental cleanup program at NWIRP Bedford. At these meetings, community Restoration Advisory Board members can provide input and offer suggestions on program activities. Upcoming Restoration Advisory Board meetings are publicized in the local news media and are open to the public. If you would like further information about the Restoration Advisory Board or the environmental restoration program at NWIRP Bedford, please contact the Navy Public Affairs Office at the address provided on Page 1 of this Proposed Plan. If you would like further information about the specific investigations conducted at NWIRP Bedford, please contact the Navy project manager at the phone number listed at the end of this Proposed Plan.

For More Information

This Proposed Plan summarizes information that can be found in greater detail in the Feasibility Study and its addendums. These and other site documents are on file at the Bedford Public Library reference desk. The public is invited to review these documents and comment on this Proposed Plan during the public comment period. A copy of the Record of Decision which selects the final remedy and includes the Responsiveness Summary will be made available in the Bedford Public Library.

Important Dates

30-Day Public Comment Period
July 15, 2010 to August 13, 2010

Public Meeting
July 21, 2010 (6:00 p.m. to 7:00 p.m.)

Public Hearing
July 21, 2010 (7:00 p.m. to 7:30 p.m.)

Your Comments Are Important!

Public comments are used to improve the decision-making process. The Navy will hold a 30-day comment period for receiving written comments as well as hold a Public Hearing for receiving oral comments. All comments, whether oral or written, received during the public comment period and Public Hearing will become part of the official public record. The Navy will respond to all these comments in writing. See Page 1 regarding how to submit a comment to the Navy.

All public comments and the Navy's responses will be issued in a document called a Responsiveness Summary that will accompany the Record of Decision (cleanup plan) for Site 3. Copies of the Responsiveness Summary will be mailed or emailed to everyone who gave comment(s). The Navy will consider all comments in making the final decision for the Site. The Navy will announce the final decision through the local newspapers.

The public is encouraged to participate during this period as your thoughts and opinions will help in making the final decision. You do not have to be a technical expert to take part in the process.

**TABLE 1
COMPARISON OF CLEANUP ALTERNATIVES**

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
ALTERNATIVE DESCRIPTION/COMPONENTS					
Source Area	No Further Action	Excavation	In-Place Thermal Treatment	In-Place Enhanced Bioremediation	Pump-and-Treat
Groundwater Plume	No Further Action	P&T MNA	P&T MNA	P&T MNA	P&T MNA
ESTIMATED TIMEFRAMES FOR CLEANUP (YEARS) (individually, not additive) (see footnote "a")					
Source Area Action	NA	3	3	10	80+
On-Property Plume	150+	80+	80+	80+	80+
Off-Property Plume	150+	7	7	7	7
CRITERIA ANALYSIS:					
Threshold Criteria					
Protects Human Health and the Environment – <i>Will it protect people and animal life? Is it permanent?</i>	⊖	●	●	●	○
Compliance with ARARs – <i>Does this alternative meet federal and state environmental laws, regulations, and requirements?</i>	⊖	●	●	●	○
Primary Balancing Criteria					
Provides Long-Term Effectiveness and Permanence – <i>Do risks remain onsite? If so, are the controls adequate and reliable?</i>	⊖	●	●	●	○
Reduces Mobility, Toxicity, and Volume Through Treatment – <i>Does the alternative reduce the harmful effects of the contaminants, their ability to spread, and the amount of contaminated material present?</i>	⊖	○	●	●	○
Provides Short-Term Protection – <i>How soon will risks be reduced? Are there short-term hazards to workers, residents, or the environment that could occur during cleanup?</i>	⊖	○	●	●	○
Implementability – <i>Is the alternative technically feasible? Are necessary goods and services (treatment equipment, space, etc.) available?</i>	●	○	○	○	●
Cost – <i>Based on a total 30-year present worth.</i>	●	⊖	⊖	○	○
Costs (see footnotes b,c, and d) Capital Costs (initial costs) O&M Costs (total long-term, 30-year) Total Present Worth Cost (total cost in today's dollars)	Nominal	\$4,972,000 \$7,212,000 \$12,184,000	\$4,918,000 \$7,212,000 \$12,130,000	\$1,584,000 \$7,212,000 \$8,796,000	\$469,000 \$7,726,000 \$8,195,000
Modifying Criteria					
State Agency Acceptance – <i>Do state environmental agencies agree with Navy's recommended alternative?</i>	To be determined following the public comment period.				
Community Acceptance – <i>What objections, modifications, or suggestions do the public offer during the public comment period?</i>	To be determined following the public comment period.				
Notes:					
a) Estimated timeframes are based on the results of the 2007 groundwater model.					
b) Costs shown do not include the capital and O&M costs already incurred as part of the Interim Remedial Action.					
c) For purposes of cost estimation, all O&M costs represent 30-year timeframes only. Actual total costs may be higher.					
d) The No Action alternative costs include decommissioning the groundwater pump and treat system and conducting 5-year reviews.					
P&T: Pump-and-Treat MNA: Monitored Natural Attenuation ARARs: Applicable or relevant and appropriate requirements O&M: Operation and Maintenance			● Good ○ Average ⊖ Poor		

GLOSSARY OF TERMS

Administrative Record: The collection of documents supporting the decision for the proposed cleanup alternative. A copy of the Administrative Record is available for public review at the local information repository (Bedford town library).

Applicable Relevant and Appropriate Requirements (ARARs): Federal environmental and state environmental and facility siting statutes and regulations that must be complied with for each alternative. The ARARs vary depending on the alternative being proposed.

Chemicals of Concern: Chemicals identified in risk assessments as the primary drivers of unacceptable risks.

Chemicals of Potential Concern: Chemicals which are found at concentrations above federal and state risk-screening levels and, therefore, are included in further risk assessments.

Chlorinated Solvent: An organic compound that is frequently used for degreasing or dry cleaning. Examples of chlorinated solvents include trichloroethene (TCE) and perchloroethene (PCE).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA). These laws created a system and funding mechanism for investigating and cleaning up abandoned and/or uncontrolled hazardous waste sites. The Navy's cleanup of sites regulated by CERCLA/SARA is funded by the Department of Defense under the Defense Environmental Restoration Fund.

Extraction Well: A well that is used to remove liquid or vapor from beneath the ground surface.

Feasibility Study: A description and engineering study of the potential cleanup alternatives for a site.

Groundwater: Groundwater is the water found beneath the earth's surface that fills pores and cracks between such materials as sand, soil, gravel, or rock.

Information Repository: A public file containing site information, documents of onsite activities, and general information about a site.

Injection Wells: Wells that are used for adding liquid, solid, and/or gaseous substances into the ground for purposes of site cleanup.

Installation Restoration Program: A Navy program created to identify, investigate, evaluate, and if necessary, clean up sites to protect human health and the environment.

Land Use Control: A legal or administrative restriction that prevents access or certain uses of land.

Monitoring Wells: A monitoring well is drilled at a specific location on or off a waste site. Groundwater can be sampled at selected depths and studied to determine the direction of groundwater flow and the types and quantities of chemicals present in groundwater.

Proposed Plan: A CERCLA document that summarizes the preferred cleanup remedy for a site and provides the public with information on how they can participate in the remedy selection process.

Record of Decision: A CERCLA legal, technical, and public document that explains the rationale and final cleanup decision for a site. It contains a summary of the public's involvement in the cleanup decision.

Remedial Action Objectives: Goals that are set to protect human health and the environment, and provide the basis to select cleanup methods.

Remedial Investigation: A step in the CERCLA process that is completed to gather sufficient information to support selection of a cleanup approach to a site. The Remedial Investigation involves site characterization or the collection of data and information necessary to characterize the nature and extent of contamination at a site. The Remedial Investigation also determines whether or not the contamination presents a significant risk to human health or the environment.

Responsiveness Summary: A document containing the responses to the public comments on the Proposed Plan. This summary is issued as part of the Record of Decision.

Restoration Advisory Board: A forum for the exchange of information and partnership among citizens, community representatives, the Navy, and regulatory agencies for the environmental cleanup programs at NWIRP Bedford.

Volatile Organic Compound: An organic chemical that easily forms vapors under normal temperatures and pressures.

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55 Jonspin Road
Wilmington, MA 01887

For More Information...

Contacts

If you have general questions about the restoration program at NWIRP Bedford, please contact:

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Michael.J.Moran@state.ma.us



Information Repository

Documents relating to environmental cleanup activities for the NWIRP Bedford property are available for public review at the following information repository:

Bedford Free Public Library
7 Mudge Way
Bedford, MA 01730
781-275-9440
Monday-Thursday: 9:00 – 9:00
Friday: 9:00 – 6:00
Saturday: 9:00 – 5:00
Sunday (Sep – May): 12:00 - 5:00
(closed on Sundays from Memorial Day through Labor Day)