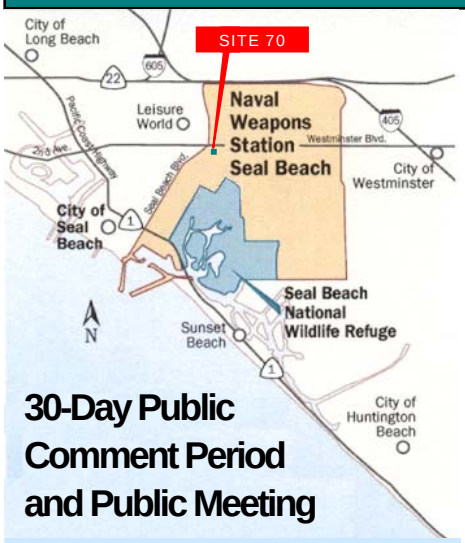
PROPOSED PLAN / DRAFT REMEDIAL ACTION PLAN

Installation Restoration Program – Site 70

NAVAL WEAPONS STATION SEAL BEACH

November 2005
DRAFT



30-Day Public Comment Period and Public Meeting

PUBLIC COMMENT PERIOD
month/day-month/day/year

We encourage you to comment on this Proposed Plan (PP) during the 30-day public comment period. You can submit written or oral comments at the public meeting or mail written comments (postmarked no later than month/day year) to: Ms. Pei-Fen Tamashiro (Code: N45WW), IR Program Manager, NAVWPNSTA Seal Beach, 800 Seal Beach Blvd.- Building 110, Seal Beach, CA 90740. Comments may also be sent to Ms. Tamashiro by fax [(562) 626-7131] or e-mail [pei-fen.tamashiro@navy.mil] no later than month/day/year. Public comments received during this period and at the public meeting will be considered in selecting the final remedy for Site 70.

PUBLIC MEETING
xx/xx/time

LOCATION
TBD before Final PP is issued (Navy prefers City Chamber or Station Building 110) 707 Electric Avenue, Seal Beach

Navy representatives will make a presentation on the Site 70 environmental investigations and the cleanup alternatives evaluated. You will have the opportunity to ask questions and formally comment on the preferred remedy and the other alternatives.

Navy Proposes Groundwater Cleanup Plan, Requests Public Comments

PROPOSED PLAN SUMMARY

Pages 1 through 4 of this Proposed Plan/Draft Remedial Action Plan (also referred to as the Proposed Plan [PP]) provide a short summary of the environmental investigation results and the Navy's cleanup recommendation for Site 70. If you would like to read more in-depth information that forms the basis of the cleanup recommendation, please see the Table of Contents below.

The Navy is requesting comments from the public on cleanup alternatives for the ***Installation Restoration (IR) Program**** at Site 70, the Research, Testing and Evaluation Area, located at the Naval Weapons Station (NAVWPNSTA) Seal Beach. This Proposed Plan / Draft Remedial Action Plan (also referred to as the PP) summarizes the Navy's preferred remedy and other cleanup alternatives that were considered and provides supporting information that forms the basis for this recommendation. The PP notifies the public of opportunities to review and comment on these alternatives (see left) and provides an overview of the environmental investigation results.

The Proposed Plan/Draft Remedial Action Plan also meets the ***remedial (cleanup) action*** plan requirements of the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), the lead oversight agency for the state. The California Health and Safety Code (Section 25356.1) presents the documentation requirements for draft and final remedial action plans. The regulatory guidance specifies a 30-day public review of the draft remedial action plan. The selection of the final remedy for Site 70 will be documented in the ***Record of Decision*** / Final Remedial Action Plan.

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*Words in ***bold italic*** type are defined in the glossary on page 11.

Proposed Plan Summary

The IR Program is a comprehensive environmental investigation and cleanup program that provides a structure to identify, investigate, and clean up chemical contamination that resulted from past practices aboard Department of Defense (DoD) installations. Figure 1 below shows the IR Program process for Site 70. Site 70 is a facility formerly used by NASA (the National Aeronautics and Space Administration) between 1962 and 1973 for design and manufacture of the second stage of the Saturn V launch vehicle for the Apollo Program (see Figure 2 on page 3).

Environmental Conditions at Site 70

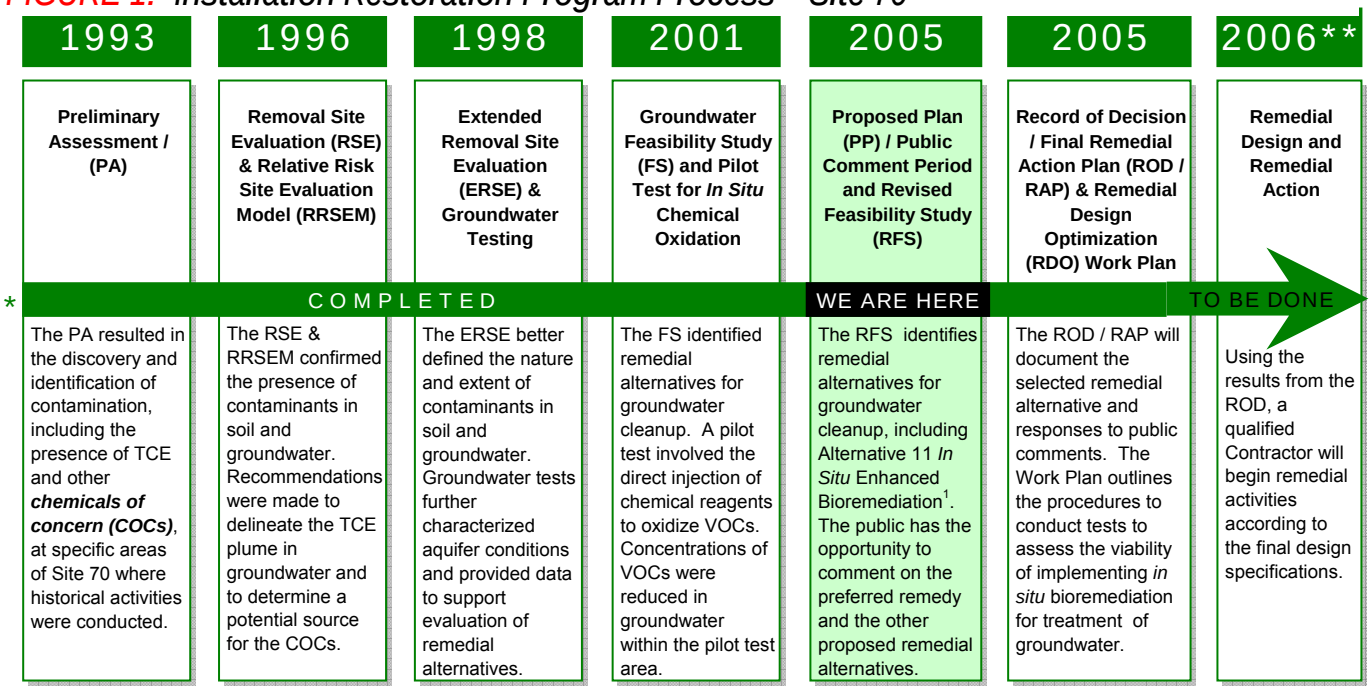
Industrial activities conducted at Site 70 by NASA to support the development of the Saturn V launch vehicle reportedly used chemicals including industrial solvents, primarily ***volatile organic compounds (VOCs)***, lubricating oils, and detergents in the manufacturing process. Some of these chemicals were released to the environment resulting in contamination to groundwater under Site 70. The primary VOC at Site 70 is trichloroethene (TCE). Other VOCs present are chloroform, dichloroethane (DCA), dichloroethene (DCE), tetrachloroethene (PCE), and vinyl chloride.

Extensive field investigations and laboratory analyses of ***soil*** and ***groundwater*** were conducted. An assessment of potential risks to human health and the environment was also performed. This risk screening assessment determined that potential risks from exposure to contaminants in soil and groundwater at Site 70 may exist.

The soil sampling results from additional investigations including the Remedial Investigation (RI) indicated that most of the original releases of VOCs have already moved into the groundwater or evaporated into the air. Based on the environmental studies and risk screening assessment, the Navy determined that no cleanup action is necessary for soil at Site 70.

Contaminated groundwater at Site 70 is present in two distinct phases which comprise the VOC ***plume***, including the source area within the shallow groundwater zone and the dissolved phase plume which extends from around the source area to the leading edge of the plume (see Figure 2 on page 3). Groundwater sampling results indicate that the source area is contaminated with TCE and other VOCs. The high concentrations of contaminants in the source area are indicative of what is known as ***Dense Non-Aqueous Phase Liquids***, otherwise known as DNAPL. The presence of DNAPL is critical in dealing with VOCs because the pure phase liquid continues to dissolve and produce a continuing source of VOCs into the dissolved phase plume. The dissolved phase plume area is the larger, remaining portion

FIGURE 1: Installation Restoration Program Process – Site 70



[1] "Technical Memorandum on Pilot Test for In Situ Enhanced Bioremediation at IR Site 40" prepared by Bechtel (2003).
* The arrow shows the status of Site 70.
** Assumes remedial action start-up would begin during last quarter of 2006.

Words in ***bold italic*** type are defined in the glossary on page 10.

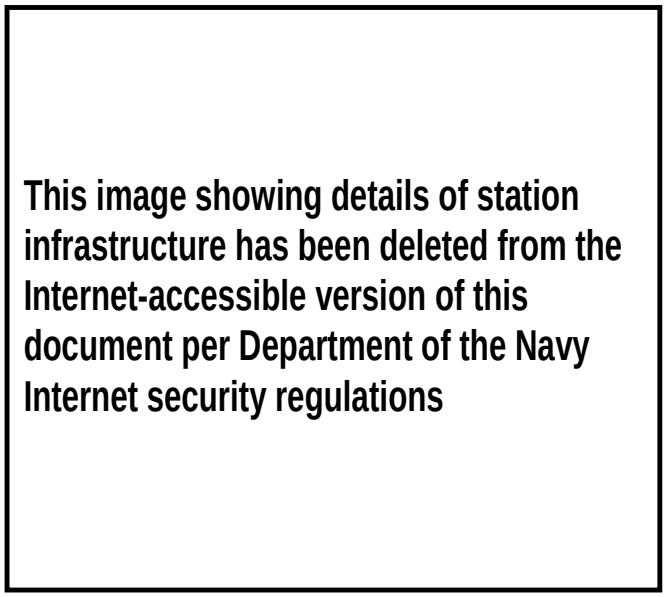


FIGURE 2: Site 70 Location

of the plume that contains TCE and VOCs that have dissolved in groundwater and are present at lower concentrations. The lateral extent of the plume is approximately 2,400 feet long by 2,000 feet wide and approximately 195 feet deep (refer to Figure 3 on this page). This data has been compiled into a database to provide three dimensional visualization of the groundwater contamination (see Figure 4 on page 4).

Concentrations of VOCs in groundwater exceed the state and federal primary ***maximum contaminant levels (MCLs)***. MCLs are enforceable standards that represent the maximum allowable levels of specific contaminants in water that is provided by a public water system and delivered to customers or users. MCLs are generally used to gauge whether cleanup actions are warranted. Table 1 on page 9 lists VOCs in groundwater at Site 70 and corresponding MCLs.

Cleanup of groundwater is recommended at Site 70 because TCE and other VOCs were reported in groundwater at concentrations that could result in adverse effects to human health if this water were extracted from the ground and used for domestic purposes such as drinking or bathing. The affected groundwater is not used for such purposes due to naturally occurring levels of salinity and hard mineral concentrations. However, cleanup is necessary to control migration and reduce concentrations of VOCs in groundwater to levels that are protective of human health and the environment and in compliance with applicable water quality standards. The Navy's cleanup recommendation for contaminated groundwater is based on the results of extensive field studies, groundwater monitoring, and the results of risk screening assessment.

Navy's Preferred Remedy for Groundwater Cleanup

Various remedial alternatives were developed and underwent detailed evaluation for cleaning up contaminated groundwater at Site 70. The Navy's preferred remedy is Alternative 11 – ***In Situ*** Treatment – Enhanced ***Bioremediation***.

- For the dissolved phase plume area, Alternative 11 would involve the creation of bioactive zones or ***biobarriers*** that transect the plume and treat VOCs as they migrate through. The biobarriers would be created by injecting an electron donor (emulsified vegetable oil or EVO) and halorespiring bacteria (***KB-1***™) into the subsurface to stimulate the bacteria to biodegrade VOCs into ethene, the non-toxic end-product of dechlorination. This process is referred to as ***bioaugmentation***.

- For the source area, Alternative 11 would consist of bioaugmentation, which is the injection of EVO and halorespiring bacteria (KB-1™) into the subsurface to dechlorinate VOCs to achieve enhanced dissolution and removal of DNAPL and accomplish remedial goals in a reasonable timeframe.

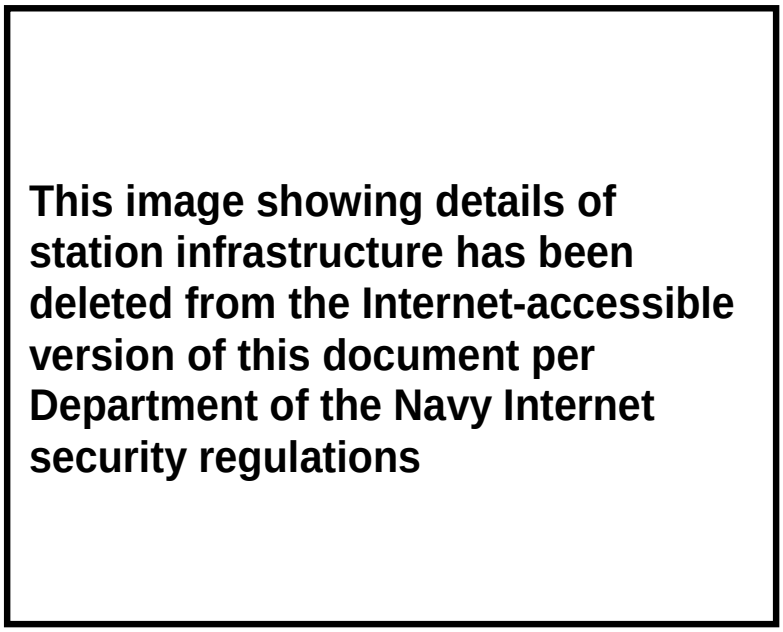


FIGURE 3: Dissolved TCE Plume

Words in ***bold italic*** type are defined in the glossary on page 10.

- Alternative 11 also includes an end-stage process, ***monitored natural attenuation (MNA)***, where natural biodegradation of VOCs continues to occur within the groundwater, and ***institutional controls***. Institutional controls are used to: prevent inadvertent exposure or use of VOC-contaminated groundwater until cleanup objectives are met; grant access for well installation and sampling; protect monitoring and injection wells; and manage EVO injection and groundwater monitoring activities to assure that hydraulic control of the plume is not compromised.

Navy Requests Public Input

The Navy invites the public to provide input on this Proposed Plan during the month/day/year public comment period. A final decision will be made after the public comment period has ended and all comments have been reviewed and considered. The selection of the final remedy for cleanup of Site 70 will be documented in a ROD / RAP and public comments will be addressed in the Responsiveness Summary portion of the ROD / RAP (see page 27, "Next Step for Site 70"). For locations where you can review the environmental investigation reports that provide the basis for selecting the remedy; see page 28.

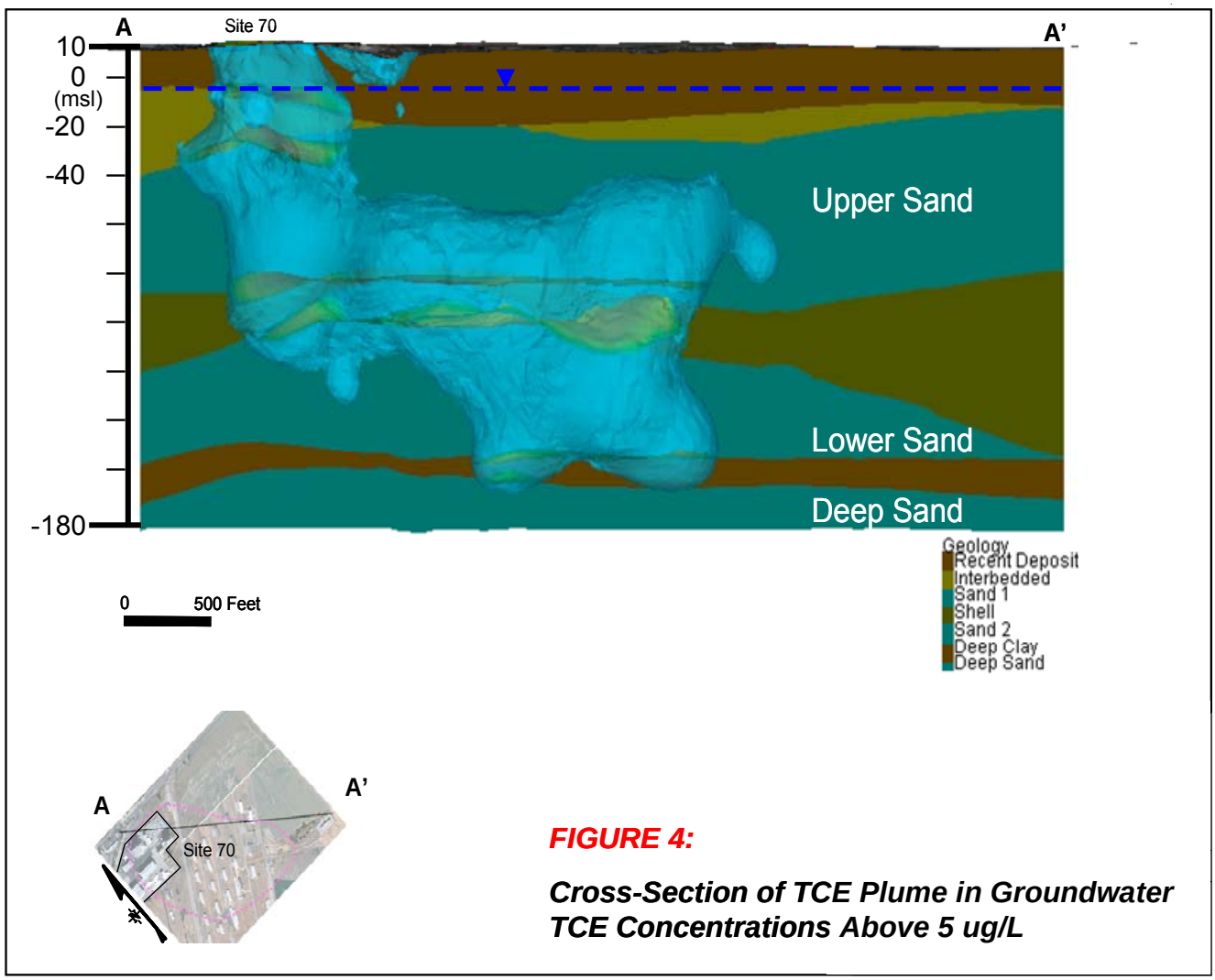


FIGURE 4:

Cross-Section of TCE Plume in Groundwater TCE Concentrations Above 5 ug/L

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Environmental Investigation Overview

NAVWPNSTA Seal Beach History

NAVWPNSTA Seal Beach (the Station) is located on the Pacific coast within the City of Seal Beach in Orange County, California. The Station comprises approximately 5,000 acres of land and a port area, with about 920 acres in the southwest portion of the Station designated as the Seal Beach National Wildlife Refuge (refer to the figure on Page 1). Cities surrounding the Station include Los Alamitos, Westminster, Huntington Beach, and Seal Beach.

The Station was originally commissioned in 1944, at the height of World War II, as a Naval Ammunition and Net Depot. The name has changed several times, but in 1998 the base was re-designated as Naval Weapons Station (NAVWPNSTA) Seal Beach. It is one of several weapons stations maintained by the Navy to provide fleet combatants with ready-for-use ***ordnance***. The Station includes a headquarters with central and administrative support detachments as well as storage, testing, and production facilities that support the Station's mission. The Station serves as a supply point for half of the Navy and Marine Corps forces operating in the Pacific region.

Installation Restoration (IR) Program

In the past, some hazardous waste disposal practices at Department of Defense (DoD) installations, although acceptable at the time, resulted in the release of pollutants into the environment. Since 1975, the DoD has been investigating and cleaning up these pollutants through the IR Programs of its individual services. The goal of the Navy's IR Program, started in 1983, is to protect human health and the environment through compliance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, also known as "Superfund").

NAVWPNSTA Seal Beach is actively working with state and local environmental regulatory agencies in a team effort to achieve and maintain a healthy environment for the Station and surrounding communities. IR Program cleanup partners consist of NAVWPNSTA Seal Beach, Cal/EPA's DTSC and Regional Water Quality Control Board (RWQCB), and the Orange County Department of Environmental Health Services (refer to Figure 5 below). The Navy is the lead federal agency for the IR Program. DTSC is the lead state agency, and RWQCB provides technical oversight of IR sites with water quality concerns or underground storage tanks.

Since 1985, 73 potential hazardous waste locations have been identified at NAVWPNSTA Seal Beach through the IR Program. Forty-six sites have were determined to contain no significant contamination and have been listed as No Further Response Action Planned (NFRAP), five operating and permitted facilities were removed from the Program, and two additional sites were transferred to other environmental programs specializing in underground storage tanks. Seven sites have had cleanup actions completed and are also now listed as NFRAP, and the remaining 13 sites are in various stages of active study or cleanup. In 1991, these sites were categorized into different ***operable units (OUs)*** to more effectively manage the IR Program. Operable units consist of one or more sites with similar characteristics. Site 70, the focus of this PP, comprises Operable Unit 8 and is a key component of the IR Program.

FIGURE 5: NAVWPNSTA Seal Beach Cleanup Team

*** See page 27 for more information on the role community members play on the NAVWPNSTA Seal Beach *Restoration Advisory Board*.**

Background – Site 70

Site 70, the Research, Testing and Evaluation Area, is the location of a facility built and operated by the National Aeronautic and Space Administration (NASA) between 1962 and 1973 for the design and manufacture of the second stage of the Saturn V launch vehicle for the Apollo Program. The facility consists of multi-story office and production buildings, aboveground storage tanks and associated aboveground and below ground piping systems, concrete-lined sumps, and underground storage tanks. When NASA used the facility, chemicals including industrial solvents, primarily TCE, dilute acids, detergents, petroleum and machine lubricating oils, and metal-containing fluids were reportedly used in the manufacturing process. Some of these chemicals were released to the environment, resulting in the contamination of groundwater under Site 70. From 1980 to 1985, the Department of Energy used portions of the facility to conduct pilot-

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scale testing of gas centrifuge equipment for a uranium enrichment process. These tests involved evaluation of equipment only and no radioactive materials were handled or processed at the facility. Currently the Navy uses this building for storage, communications research, and office space.

Environmental Studies Conducted

To efficiently and cost-effectively study hazardous waste sites at NAVWPNSTA Seal Beach, numerous sites are often investigated simultaneously. Site 70 was first identified in 1989 in a study that was performed to determine whether there had been, or were likely to be, releases of hazardous substances from locations where hazardous wastes or materials had been used, treated, stored, or disposed. Key studies and results are presented below.

- In 1993, a ***Preliminary Assessment (PA)*** of Site 70 was conducted and ten Areas of Concern (AOCs) were identified based on historical activities, use of chemicals at the site, and the likelihood of a potential threat to human health and the environment. Areas of Concern were designated for soil areas, piping systems, sumps, aboveground storage tanks, underground storage tanks, and areas inside the buildings. The major chemicals of concern identified were the industrial solvent TCE, phenolic compounds, trichlorotrif1uoroethane (Freon TF), hexavalent chromium, and heavy metals. The PA recommended further evaluation at Site 70 to assess the presence of these contaminants.

- In 1996, a ***Removal Site Evaluation (RSE)*** was conducted to address potential waste sources. During the RSE, an additional AOC was designated for soil, for a total of 11 AOCs. Of the 11 AOCs, 4 AOCs pertain to soil and the remaining 7 AOCs are associated with site structures (i.e., tanks, piping systems, other associated structures) at Site 70. The RSE report recommended that the tanks, piping systems, and associated structures be decommissioned. Subsequently, these 7 AOCs were removed from the IR Program, cleaned up, and decommissioned under the NAVWPNSTA Seal Beach Environmental Compliance Program.

  The RSE also recommended further evaluation of the presence of hexavalent chromium, vinyl chloride, and heavy metals for the four soil AOCs. Also, the RSE identified the presence of a TCE plume in groundwater and recommended the collection of additional data to determine the specific source area, to define the length, width, and depth of the plume, and to characterize the nature of chemicals present. The RSE also recommended that human health and ecological screening be conducted.

- In 1998, an ***Extended Removal Site Evaluation (ERSE)*** was conducted at Site 70 to supplement data from the previous investigations. The ERSE was a comprehensive investigation that served as the ***Remedial Investigation***, a key step in the IR Program process, for investigating hazardous waste sites. The ERSE included soil and groundwater sampling and provided information that enabled the Navy to better define the nature and extent of soil and groundwater contamination and assess potential threats to human health and the environment. During the ERSE, the Navy performed numerous tasks, including a geophysical survey, a soil gas survey, and soil and groundwater sampling. The information gathered during the ERSE was used to refine the Navy's understanding of the subsurface conditions and the migration of the TCE plume and chemicals in groundwater.

- Aquifer testing was performed at Site 70 in August-September 1998 to further characterize hydrogeologic properties of the shallow aquifer underlying the source area and develop a groundwater flow computer model. Between November 1998 and July 1999, a pilot test was conducted in the source area to assess the effectiveness of contaminant removal by continuous pumping. Data obtained from the aquifer and pilot tests was used in the development of remedial (cleanup) alternatives.

- Beginning in 2000, based on recommendations in the ERSE, groundwater sampling was performed to monitor the VOC plume at Site 70 and to further define the extent of metals (hexavalent chromium and mercury) in groundwater per the "Final Work Plan for Long-Term Groundwater Monitoring at Installation Restoration Sites 40 and 70, NAVWPNSTA Seal Beach" (BNI, 2000). Eleven new groundwater monitoring wells were installed and the closest of the Navy's former water supply wells (Navy Well No.2) was permanently sealed off. Samples were analyzed for VOCs and natural attenuation parameters to determine if natural conditions and processes occurring in the groundwater were capable of reducing concentrations of contaminants (Quarterly Groundwater Monitoring Report for 2000 (BNI, 2001) and Tech Memo #7 "Supplemental Shallow Groundwater Pilot Test Report" (BNI, 2000)).

- In 2001, a ***Feasibility Study (FS)*** was performed to identify remedial alternatives for groundwater cleanup. An *in situ* chemical oxidation pilot test was subsequently conducted to determine the feasibility of this technology to treat contaminated groundwater. Concentrations of VOCs were reduced within the pilot test area after direct injection of chemical reagents into groundwater.

Words in ***bold italic*** type are defined in the glossary on page 10.

Extent of Contamination / Investigation Conclusions

Soil Investigation Conclusions

Soil sampling conducted during the Extended Removal Site Evaluation (ERSE) focused on four Areas of Concern (AOCs) at Site 70. A total of 33 soil borings were drilled to a maximum depth of 12 feet below ground surface at AOC 2 (Former Stormwater Discharge Channel) and to depths of 10 feet at AOC 3 (Salt Marsh Discharge Point), AOC 4 (Perimeter Drainage Channel), and AOC 11 (Northwest Corner of Building 112). Soil samples were collected at various depths for laboratory analysis. These samples along with groundwater samples collected from seven monitoring wells, were analyzed for metals, VOCs, and semi-volatile organic compounds (SVOCs). The purpose of collecting soil samples, and in some cases soil gas samples, was to identify potential source areas for contamination that had migrated into the groundwater forming a plume of contaminants.

The ERSE concluded that the potential for movement of VOCs from soil to groundwater is currently negligible. Results of soil sampling indicated that most of the original releases of VOCs to soil have already leached to the groundwater or evaporated into the air. Leaching occurs when rainfall or water used for irrigation migrates through the soil and mixes with contaminants; this mixture then moves further downward into the subsurface. At most locations sampled, metals were identified in the soil at Site 70 at background (i.e., naturally occurring) levels for soils found throughout NAVWPNSTA Seal Beach. However, there were isolated locations at Site 70 where metals were reported above the naturally occurring levels. The results from these sampling efforts and the human health and ecological risk screening assessments ruled out soil at Site 70 as a health or environmental concern.

The human health risk screening assessment showed that the human health risk for cancer from contaminants in soil at the four AOCs is within the generally acceptable range, as defined in the National Oil and Hazardous Substances Contingency Plan (NCP), the federal regulation that provides guidelines on the determination of human health risks for hazardous wastes. Non-cancer risks, calculated as a hazard index, were slightly elevated; however, this is attributed to the naturally occurring metals in soil at Site 70. The ecological risk screening showed that there is no adverse impact to the ecology. Some areas of Site 70 are paved and thus, there is no pathway for contaminants in soil to reach plants and wildlife that may be present at Site 70. In areas where a pathway is present, the ecological risk was calculated and found to be comparable to the background (natural) risk at the Station. Therefore, no adverse impact to wildlife is predicted to occur. For more information on the human health and ecological risk screening assessments, refer to page 13.

Based on the study results, the Navy, with concurrence from the regulatory agencies, has concluded that no further action is needed for soil at Site 70.

Groundwater Investigation Conclusions

During the ERSE, groundwater samples were collected from 45 temporary well points and 16 monitoring wells. Sampling results showed that the groundwater plume primarily contains TCE and to a lesser extent other VOCs, including PCE, DCE, chloroform, vinyl chloride, and other compounds. TCE is present at a higher concentration than the other VOCs and defines the vertical and lateral extent of the groundwater plume. Based on data obtained from the ERSE and the monitoring program, the lateral extent of the plume is approximately 2,400 feet long by 2,000 feet wide and approximately 195 feet deep (refer to Figures 3 and 4 on pages 3 and 4, respectively).

The plume consists of two parts, a source area of highly contaminated groundwater and a much larger area of groundwater with lower concentrations of contaminants. The source area contains a dense mixture of TCE and other VOCs present in the groundwater. Because the contaminant levels are relatively high in the source area, the VOCs are suspected to exist in the form of what is technically referred to as a dense non-aqueous-phase liquid (DNAPL). The larger area comprises the main part of the plume that contains the dissolved-phase contamination, i.e. TCE and other VOCs that have dissolved in groundwater and are present at lower concentrations. Investigation results indicate that VOCs migrated from the soil in the source area to the groundwater and this functions as the source of contamination for the main part of the plume. Figure 4 on page 4 presents a cross-section representation of the TCE plume in groundwater.

Groundwater modeling shows that there is a negligible potential for the plume to migrate beyond the northwestern boundaries of NAVWPNSTA Seal Beach. Without further action, the potential for the TCE plume to eventually impact groundwater beyond its current extent to the southeast within the base boundaries is moderate to high. Figure 3 shows the current extent of the plume outside the original Site 70 boundary. The existing plume flow path indicates a continued southeastward migration toward the Seal Beach National Wildlife Refuge (See Figures 3 and 6 on pages 3 and 10, respectively), but due to the depth of the plume and

Words in ***bold italic*** type are defined in the glossary on page 10.

the tendency for the contaminants to move in a downward direction, it is not likely to reach this body of surface water.

Investigation results also show that natural attenuation in the form of biodegradation is occurring in the shallow groundwater and contributing to a reduction of TCE. Natural attenuation is expected to continue to reduce TCE concentrations and slow plume movement.

At this time, concentrations of several VOCs in groundwater exceed the state and federal primary ***maximum contaminant levels (MCLs)***, the maximum permissible level of a contaminant in water delivered to any user of a public water system (see Table 1 below). Maximum contaminant levels are generally used to gauge whether remedial (cleanup) action is warranted. These are enforceable standards even though groundwater in the impacted area does not serve as a source of water for domestic use. Furthermore, the human health risk screening assessment also shows that exposure to VOCs in groundwater from ingestion (drinking), direct skin contact (bathing or touching the water), or inhalation (steam from showering or washing dishes) could have an adverse impact on human health if groundwater from the plume were used for domestic purposes. Both cancer and non-cancer risks to human health exceed the NCP-defined generally acceptable range. No ecological risk screening was performed for groundwater because there is no pathway for plants and wildlife to come in contact with groundwater.

Based on the concentrations of VOCs in groundwater and the human health risk screening results, cleanup of the VOC plume is required. Cleanup will be performed to bring the concentrations of VOCs into compliance with water quality standards.

◆ ◆ ◆

In 2001, an extensive Feasibility Study (FS) was performed to develop and evaluate remedial alternatives to address the VOC plume at Site 70. The alternatives are comprised of combinations of cleanup technologies that address the source area within the plume and the larger dissolved phase portion of the plume. The alternatives are designed to reduce concentrations of VOCs in groundwater, prevent further migration of the plume, and prohibit use of contaminated groundwater.

As part of the FS, a pilot test was conducted in 2001 at Site 70 to help determine the technical and economic feasibility of *in situ* chemical oxidation. The pilot test involved the direct injection of chemical reagents (hydrogen peroxide and a catalyst solution) into the subsurface to a maximum depth of 35 feet below ground surface. The pilot test was limited to a small area measuring 25 feet by 40 feet and five groundwater monitoring wells were installed within and surrounding the pilot test area. Pre- and post-test soil and groundwater samples were collected and analytical results indicated VOC contaminant mass reduction. Overall, the pilot test validated assumptions made in the FS, which was that the in situ chemical oxidation (ISCO) remedial alternative could be a viable option for VOC cleanup. The original FS proposed a combination of ISCO and pump and treat to remediate the source and dissolved phase plume. Based on the analysis within the FS, the combination of ISCO and pump and treat would achieve cleanup within approximately 50 years. Pump

Table 1:
Standards and Cleanup Goals for VOCs in Groundwater at Site 70

Chemical VOC	Concentration (micrograms per liter)		
	GOAL U.S. EPA Maximum Contaminant Level (MCL)[a,b]	GOAL California Maximum Contaminant Level (MCL)[a,b]	ACTUAL Maximum Reported Concentration
Chloroform	100	100	460
1,1-dichloroethane (DCA)	7	5	159[c]
1,1-dichloroethene (DCE)[d]	7	6	299
Cis-1,2-dichloroethene (DCE)[d]	70	6	50,900[c]
Trans-1,2-dichloroethene (DCE)[d]	100	10	2,600[c]
Tetrachloroethene (PCE)	5	5	3,940[c]
Trichloroethene (TCE)	5	5	837,000
Vinyl Chloride	2	0.5	960

Notes:
a. Federal and state cleanup standards are established by the U.S. EPA Safe Drinking Water Act, in 40 Code of Federal Regulations, § 141; and Title 22 California Code of Regulations, § 64439, Requirements, and § 64444, Maximum Contaminant Levels, respectively.
b. All values reported in micrograms per liter.
c. Chemical not identified as a risk driver during the ERSE, but added as a Chemical of Concern (COC) because it was reported at Site 70 at concentrations above the MCL.
d. Variations of the compound dichloroethene (DCE).

Words in ***bold italic*** type are defined in the glossary on page 10.

and treat at this site would significantly impact the salt water intrusion limits. Figure 6 shows the earlier salt water intrusion limits and the current 50 mg/L chloride concentration that is indicative of salt water intrusion The plume is slowly migrating in a southeasterly direction toward Navy Well No. 3, approximately 4,000 feet from the plume's leading edge. Figure 6 below depicts salt water intrusion in the site vicinity. Salt water intrusion would be exacerbated by increased pumping. An increase in saltwater concentration within the pumping zone for the treatment system will significantly increase the cost to remediate the site and may trigger regulatory response from the RWQCB. Groundwater from Well No. 3 is not currently extracted or used as a water source for domestic purposes (i.e., drinking, cooking, bathing). Also, it is not expected to serve as a domestic water source in the future due to its naturally-occurring high salinity and hardness.

The Navy is re-evaluating all pump and treat approaches to groundwater remediation. Therefore, a Revised Feasibility Study (RFS) has recently been developed to include the remedial alternative, *in situ* enhanced bioremediation (Alternative 11). The cleanup objectives and remedial alternatives being evaluated and considered by the Navy for the remedial design phase are summarized beginning on page 16.

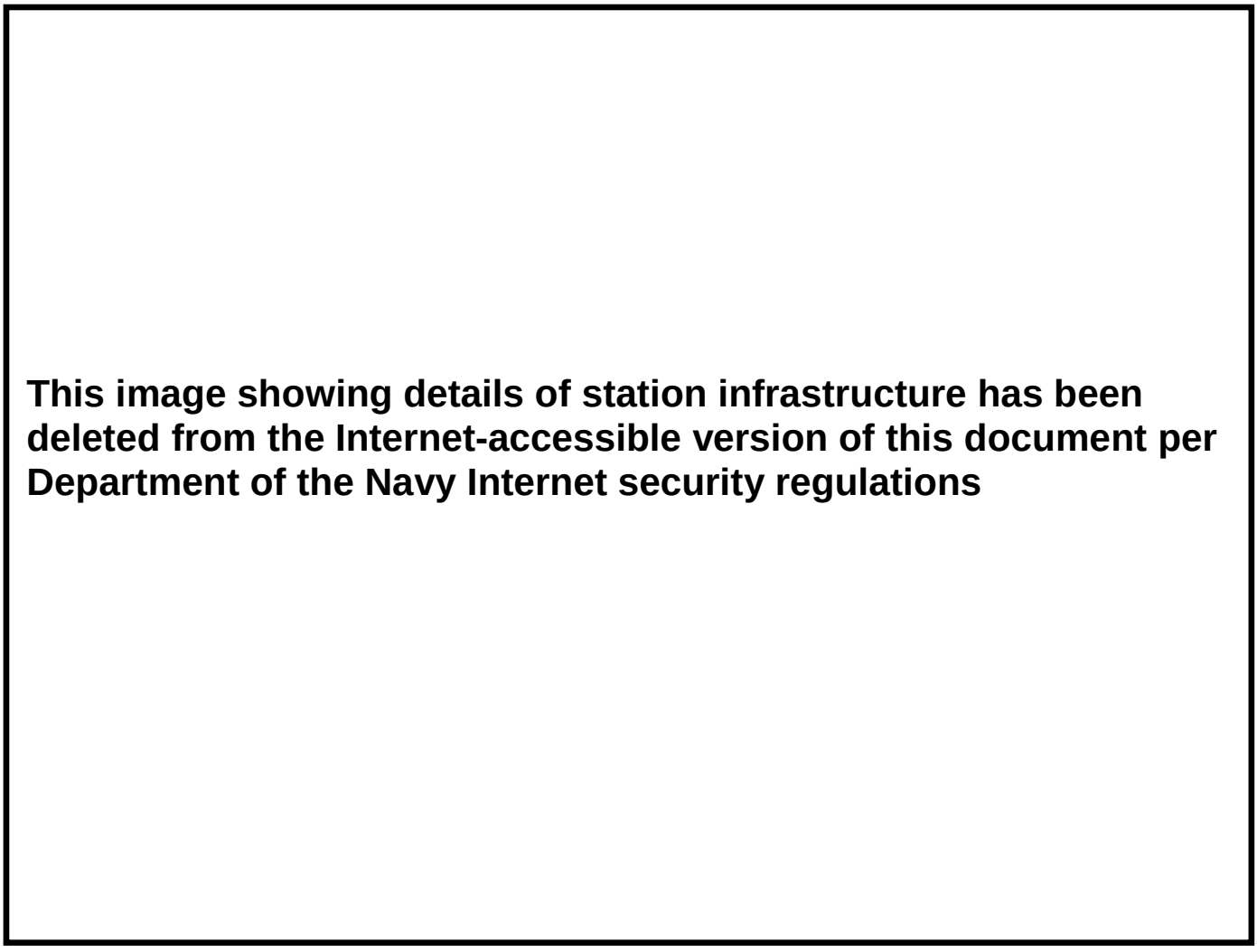

FIGURE 6: Salt Water Intrusion in the Site Vicinity

Words in ***bold italic*** type are defined in the glossary on page 10.

GLOSSARY OF TERMS

Anaerobic – Living or active in the absence of free oxygen.

Applicable, Relevant, and Appropriate Requirments (ARARs) – Federal or state environmental statutes, standards, requirements, criteria, or limitations determined to be legal and applicable or relevant and appropriate for addressing specific conditions to protect human health and the environment or use of cleanup technologies at a hazardous waste site.

Aquifer – An underground geological formation containing groundwater in sufficient amounts to serve as a source of water for supply or production wells.

Bioaugmentation – Stimulating microbial degradation through addition of microorganisms.

Biobarriers – In situ reactive zones created by injecting electron donor and halorespiring microbial culture to create a zone (vertical and horizontal) in which dechlorination occurs.

Bioremediation – Stimulating microbial degradation through the addition of donor/EVO. Bioremediation encompasses the use of bioaugmentation and is an engineered process.

California Environmental Quality Act (CEQA) – State law that requires state and local agencies to disclose the environmental implications of remedial action (cleanup) plans and the impacts of such decisions. These agencies are also required to avoid or reduce environmental impacts of cleanup decisions whenever feasible.

Chemical Oxidation – Treatment process that uses chemical reagents to chemically convert hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/ or inert.

Chemicals of Concern (COCs) – Potentially hazardous chemicals detected in soil and groundwater at Site 70.

Dense Non-Aqueous Phase Liquid (DNAPL) - A liquid or chemical that is denser than water and does not dissolve or mix easily in water (i.e., it is immiscible). In the presence of water it forms a separate phase from the water. Many chlorinated solvents, such as TCE, are DNAPLs.

Extended Removal Site Evaluation (ERSE) – A detailed environmental investigation that further evaluates site conditions, the presence and extent of contamination, as well as risks to human health and the environment. For Site 70, this is the equivalent of a remedial investigation.

Feasibility Study (FS) – A phase in the environmental investigation process that develops and evaluates the suitability of appropriate cleanup remedies or solutions.

Granulated Activated Carbon Adsorption (GAC) – A filtering system using charcoal to remove organic contaminants from water.

Groundwater – Water within the earth that moves through permeable rock, sand, or gravel.

Halorespiring Microbial Culture – A consortia of naturally occurring, pathogen-free microbes that, under proper anaerobic conditions, will convert chlorinated compounds to ethene, a non-toxic end-product, through biological processes.

In Situ – Refers to treatment systems that treat contaminants "in place." One example is the treatment of contaminated groundwater that is present in an aquifer beneath a hazardous waste site.

Installation Restoration (IR) Program – A comprehensive environmental program developed by the Department of Defense (DoD) to identify, investigate, and clean up hazardous waste sites at all DoD facilities (Navy, Army, Air Force, Marine Corps)

Institutional Controls – Guidelines developed to prevent exposure to and use of contaminated groundwater, protect wells and other equipment used to implement a cleanup remedy, and to assure access to the site to maintain the integrity of the remedy until site cleanup goals are achieved.

KB-1™– A microbial culture that contains halorespiring bacteria.

Maximum Contaminant Levels (MCLs) – The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

Monitored Natural Attenuation (MNA) – Refers to the routine sampling and testing of groundwater to assess the cleanup effectiveness of natural attenuation processes.

Words in ***bold italic*** type are defined in the glossary on page 10.

GLOSSARY OF TERMS

Natural Attenuation – The process by which a compound is reduced in concentration over time, through adsorption, biodegradation, dilution, and/ or transformation.

Operable Units (OUs) – A term for separate activities undertaken as part of the overall Installation Restoration Program cleanup of a military base. OUs generally consist of one site or more sites with similar characteristics.

Ordnance – Military supplies, including weapons and ammunition. Unexploded ordnance--remnants of intact ordnance from earlier activities-may present a safety hazard. No ordnance is present at Site 70.

Plume – A three-dimensional zone within the groundwater aquifer containing contaminants that generally move in the direction of, and with, groundwater flow.

Point of Departure – The threshold below which risk to human health is unconditionally acceptable, according to the NCP.

Preliminary Assessment (PA) – The process of collecting and reviewing available information about a known or suspected waste site or release.

Preliminary Remediation Goals (PRGs) – Concentrations of chemicals in soil and groundwater that represent an acceptable level of risk to human health and the environment. These are risk-based concentrations established by the U.S. EPA and Cal/EPA.

Record of Decision – A public document that explains what cleanup alternative will be used at a specific IR Program site. The ROD is based on information and technical analysis generated during the remedial investigation and feasibility study and consideration of public comments and community concerns.

Remedial (Cleanup) Action – The long-term cleanup action that is carried out to remove the risk to human health and the environment caused by contaminants at a site.

Remedial Investigation (RI) – One of the two major studies that must be completed before a decision can be made about how to clean up an Installation Restoration Program site. For Site 70, the Extended Removal Site Evaluation serves as the RI. (The Feasibility Study is the second major study.) The RI is designed to determine the nature and extent of contamination at the site.

Removal Site Evaluation (RSE) – An early phase in the environmental investigation process that evaluates the need to remove contaminants. It includes assessment of the presence and extent of contamination as well as risk to human health and the environment.

Restoration Advisory Board (RAB) – An advisory board composed of members of the community, regulatory agencies, and the Navy who meet to discuss, review, and provide input on environmental investigation and cleanup activities and decisions.

Revised Feasibility Study (RFS) – A description and evaluation of potential remedial alternatives to mitigate risks to human health from VOC contamination in groundwater beneath Site 70. An RFS is currently underway and future remedial actions will depend on the results of the public and agency review process.

Soil – Refers to areas at Site 70 that consist of dirt, sand, or gravel that are present on the surface of the ground or between ground surface and bedrock.

Volatile Organic Compounds (VOCs) – An organic (carbon containing) compound that evaporates readily at room temperature. VOCs, which includes chlorinated solvents, are commonly used in dry cleaning, metal plating, and machinery degreasing operations. At Site 70, VOCs of concern include: TCE (trichloroethene), DCE (dichloroethene), PCE (tetrachloroethene), DCA (dichloroethane), chloroform, and vinyl chloride.

Words in ***bold italic*** type are defined in the glossary on page 10.

Human-Health and Ecological Risk Screening Assessments

The Navy conducted human health and ecological screening risk assessments during the ERSE to assess potential impacts from contaminants at Site 70 on human health, plants, and wildlife. Screening risk assessments document the risks and hazards under current conditions at the site and provide information for determining if further actions are needed. The National Oil and Hazardous Substances Contingency Plan (NCP), the regulation established for assessing hazardous waste sites, provides guidelines to be used to assess the types of chemicals, degree of exposure to the chemicals, and potential toxic effects of the COCs.

Human Health Risk Screening Procedures

The human health screening risk assessment was performed for the chemicals identified at Site 70 using maximum chemical concentrations and risk-based concentrations that represent an acceptable level of risk, as determined by the regulatory agencies. These risk-based levels for chemicals in soil and groundwater are referred to as preliminary remediation goals (PRGs), and are established by the U.S. Environmental Protection Agency (U.S. EPA) and Cal/EPA.

When the regulatory agencies developed the PRGs, they considered various ways people could be exposed to the chemicals in soil and groundwater. Exposure routes incorporated into the PRGs include ingestion (incidental eating of soil or drinking the water), direct skin contact with soil (touching), and inhalation (from breathing in dust, soil particles, or vapors from exposure to soil or from breathing in vapors transferred from groundwater into air). Exposure conditions used by the agencies in the development of the PRGs are chosen to represent reasonable maximum exposures. When the PRGs are used in conjunction with the maximum concentration in a screening risk assessment, the result is an overestimate of actual risks. This effort to overestimate risk is deliberate because it provides a margin of safety for protecting public health and evaluating site conditions.

The PRGs for chemicals of concern are based on cancer-causing (carcinogenic) and non-cancer (non-carcinogenic) effects on human health. To assist with the characterization of risks, federally-established risk ranges have been developed to protect human health. If the cancer risk calculated falls into the range, then the conditions at the site are considered to be protective of public health. PRGs based on carcinogenic effects of chemicals correspond to a lifetime cancer risk of 1×10^{-6} (one additional cancer case in 1 million). In other words, for every million people that could be exposed over a 30-year period, one additional cancer case may occur as a result of exposure to site contaminants. One additional cancer case means that one more person could get cancer from chemicals present at a site than would normally be expected to get cancer from all other causes. The U.S. EPA considers risks from 10^{-6} to 10^{-4} to be generally acceptable.

For soil, the human health screening risk assessment was performed using the PRGs for both residential and industrial use, even though Site 70 is currently used for industrial purposes that support Station activities and continued industrial use is planned in the future. For groundwater, risk was assessed using tap water PRGs. Sites that do not pose an unacceptable risk under residential exposure conditions will not pose an unacceptable risk under industrial use scenarios.

For each of the four soil AOCs at Site 70, an incremental cancer risk was estimated. This is the risk attributed solely to site-specific chemicals associated with the industrial activities conducted at Site 70. The incremental cancer risk

Table 2:

Human Health Risk Assessment Results for Soil at Site 70

Area of Concern (AOC)	Cancer Risk Incremental Cancer Risk		Non-Cancer Risk Hazard Index	
	Residential Use Scenario	Industrial Use Scenario	Residential Use Scenario	Industrial Use Scenario
AOC 2 – Former Stormwater Discharge Area	4.9×10^{-5}	1.4×10^{-5}	4.0	0.41
AOC 3 – Salt Marsh Discharge Point	7.6×10^{-6}	1.2×10^{-6}	2.5	0.12
*AOC 4 – Perimeter Drainage Channel	1.9×10^{-5}	3.1×10^{-6}	1.72	0.08
AOC 11 – Northwest Corner of Bldg 112	4.1×10^{-5}	6.5×10^{-6}	3.1	0.15

* Based on the results of the initial human health risk screening assessment, the ERSE recommended that an additional risk evaluation be performed to more precisely estimate the risk. The results above are from the re-evaluation that involved performing a statistical analysis of soil sampling data. The Cal/EPA Department of Toxic Substances Control, the lead regulatory oversight agency, concurred with the evaluation procedures used by the Navy.

Words in ***bold italic*** type are defined in the glossary on page 10.

was used as the basis for rendering appropriate risk management decisions for soil at the AOCs. For groundwater, the total cancer risk, which is the risk attributed to site-specific chemicals associated with Site 70 and naturally occurring metals and compounds, was estimated and used as the basis for determining if cleanup of groundwater is required.

For non-cancer health effects, the PRG corresponds to a hazard index. A hazard index of 1.0 or greater indicates that a lifetime of exposure to the chemical(s) may have potential for causing adverse health effects (e.g., respiratory or kidney problems) and should be evaluated further. The hazard index also evaluates health risks associated with metals and inorganic compounds which are above background values. Background soil contaminants, which reflect the existing conditions at the site, are used for screening purposes. For inorganic compounds that exceed the background conditions, the hazard index for the total concentration will be evaluated.

For each COC in soil and groundwater, cancer and non-cancer risk is calculated using the ratio of the maximum reported chemical concentration and the cancer or non-cancer based PRG, respectively.

Soil-Screening Risk Assessment Results

The incremental cancer risk for soil exposure at Site 70 is shown on Table 2 (page 13). This risk was estimated to be within the NCP-defined generally acceptable range (10^{-6} to 10^{-4}) at all four AOCs. Estimates for non-cancer risk are also listed in Table 2. Non-cancer risk is based on the hazard index and requires further evaluation when the threshold of 1.0 is exceeded.

In addition, at AOC 11, an assessment of lead in soil was conducted to estimate lead concentrations in blood for various receptors, including a resident child and adult, and an industrial worker. This was only performed at AOC 11 because this was the only area where lead was reported in soil samples at a concentration that triggered this evaluation. At AOC 11, the estimated upper-bound concentrations of lead in the blood of these receptors fell below the benchmark of 10 mg/ dL (micrograms per deciliter) or 10 millionth of a gram per liter). Therefore, lead is not considered a health concern at any areas within Site 70.

Conclusion for Soil – No Action Required

Since the cancer risk is estimated for all four AOCs to be within the NCP-defined generally acceptable range, no further action is required for human health cancer risk. Where the hazard index exceeds 1.0, the majority of the risk is attributable to naturally occurring metals in soil at the four AOCs. Since COCs related to past site activities do not pose a significant risk for adverse health effects, soil at Site 70 does not require remediation.

Groundwater – Screening Risk Assessment Results

The total cancer risk associated with groundwater at Site 70 was estimated at 1.2×10^{-1} using U.S. EPA, tap water, and Cal/EPA-Modified PRGs. Approximately 85 percent of the total cancer risk is due to TCE and 6 percent is related to other VOCs. Since the cancer risk drivers are overwhelmingly chlorinated VOCs, no background or incremental risk estimates were made. The hazard index for groundwater was estimated at 4,600, indicating a potential for adverse health effects. Approximately 98 percent of the total hazard index is due to the presence of TCE.

Conclusion for Groundwater – Cleanup Action Required

Since the human health risk for groundwater exceeds the NCP-defined generally acceptable range (10^{-6} to 10^{-4}) and the hazard index is several orders of magnitude higher than the threshold of 1.0, human health risks trigger the need for cleanup of groundwater. Groundwater impacted by VOCs at Site 70 does not serve as a source of water for any of the beneficial uses designated in the RWQCB's Basin Plan and does not pose an immediate threat to human health or the environment. However, further evaluation to determine viable cleanup options is required to prevent possible exposure in the future and prevent migration of contamination to adjacent areas of the aquifer that are sources for beneficial uses.

Ecological Risk Screening

The ecological risk screening evaluated the potential effects on plants and animals from exposure to chemicals in soil at AOC 3 and AOC 4. These are the only two locations where there is a potential for contact with contamination. Therefore, no ecological risk screening assessment was conducted for soils at AOC 2 and AOC 11, or for groundwater. To perform the risk screening, estimated or measured concentrations or doses of chemicals in environmental samples were compared with criteria considered protective of ecological receptors to determine if there is a likelihood of adverse impacts. Ecological risks are expressed in terms of a hazard index. Hazard indexes greater than 1.0 indicate a potential for adverse effects on wildlife.

Words in ***bold italic*** type are defined in the glossary on page 10.

Risks in this range require further evaluation to determine if action is required.

Ecological Risk Screening – Results and Conclusions

The ecological risk screening for soil at AOC 3 and AOC 4 estimated the total hazard indexes for selected mammalian and avian receptors to be greater than 1.0. By comparison, hazard indices were also greater than 1.0 for selected receptors exposed to area background metal concentrations. Due to the limited toxicological data available, a very conservative approach was taken when estimating the risk. Because of this conservativeness and the similarities of risk at AOC 3 and AOC 4 to the background risk, adverse impacts to ecological receptors are unlikely at AOC 3 and AOC 4. Also, at AOC 4 (Perimeter Channel), it is highly unlikely that animals would burrow beneath the concrete channel to reach soils containing metals because the shallow groundwater over much of the area would preclude deep burrows (deeper than 6 feet). Also, the stormwater channel provides drainage through low areas that commonly are inundated during winter rains. As noted previously for AOC 2, AOC 11, and the groundwater, there is no complete pathway between contaminants and plants and animals. Based on this information, it was concluded that chemicals at Site 70 are not likely to have an adverse impact on ecological receptors and no further actions to protect the ecology are required.

Did You Know?

You can read more about the Navy's environmental program on the Internet!

The Naval Weapons Station Seal Beach IR Program Web Page address is:
http://www.sbeach.navy.mil/Programs/Environmental/IR/IR.htm

The Navy's Southwest Division Environmental Web Page address is:
http://www.sbeach.navy.mil/Programs/Environmental/Environmental.htm

Words in ***bold italic*** type are defined in the glossary on page 10.

Summary of Groundwater Cleanup Action Alternatives

Based on the investigation conclusions for Site 70, the Navy developed remedial (cleanup) action objectives that shaped the development of several remedial alternatives. The focus is on protecting public health and the environment and restoring beneficial uses of the shallow groundwater aquifer. Specific objectives are to:

- Reduce the concentrations of VOCs in groundwater to levels consistent with site cleanup goals (maximum contaminant levels);
- Prevent or limit VOC migration beyond the current depth and boundaries of the plume;
- Protect human health by preventing exposure (ingestion) of VOC-contaminated groundwater to potential receptors (such as future residential groundwater users); and
- Protect potential ecological receptors at the Seal Beach National Wildlife Refuge.

Cleanup goals for Site 70 are the more stringent of federal and state MCLs for groundwater. MCLs for VOCs at Site 70 are listed in Table 1 on page 9.

Feasibility Studies – Development of Alternatives

The Feasibility Study (FS) and Revised Feasibility Study (RFS) were performed to develop and evaluate remedial alternatives. A range of alternatives were developed to determine the most effective methods for meeting the remedial action objectives. The first step in the evaluation process was to identify and assess a broad range of technologies with potential for accomplishing cleanup objectives. Technology types examined included:

- Institutional controls to limit exposure to VOCs, such as monitoring to track groundwater conditions;
- Monitored natural attenuation (MNA), which relies on naturally-occurring processes to reduce the amount of VOCs present;
- Containment technologies to eliminate or reduce exposure routes or reduce movement of contaminants;
- *In situ* treatment which treats groundwater in-place;
- *Ex situ* treatment of groundwater once it has been extracted to the surface;
- *In situ* enhanced bioremediation, which involves creation of biobarriers and bioaugmentation to treat groundwater in-place.

Remedial technologies were then identified for screening and evaluation on the basis of effectiveness, implementability, and cost, consistent with U.S. EPA and NCP guidance.

Effectiveness was given the most weight, followed by implementability, then cost. The most effective technologies were developed into remedial alternatives and subjected to further evaluation. Table 3 on page 23 lists the criterion evaluated for the remedial alternatives.

Screening of Remedial Alternatives

Remedial alternatives developed in the FS were generally comprised of a combination of technologies to address contamination in the source area and the dissolved phase plume. Eleven alternatives were developed for Site 70 and were initially screened on the basis of effectiveness, implementability, and cost, in the same manner as the broad range of technologies that were previously screened. Alternatives that did not effectively contain and / or treat the dissolved phase plume area and the source area in groundwater were rejected. Six alternatives were retained for detailed analysis and are described as follows.

Six Remedial Alternatives Retained for Detailed Analysis

All remedial alternatives that were retained for detailed evaluation contain key components that address the source area in groundwater and the dissolved phase plume area.

For the dissolved phase plume area, hydraulic containment, pump and treat alternatives, and *in situ* enhanced bioremediation were evaluated. Both hydraulic containment and pump and treat alternatives require groundwater extraction. Hydraulic containment would contain the VOC mass and prevent it from migrating further, while pump and treat would remove groundwater containing the VOC mass from the more contaminated part of the dissolved phase plume for treatment. *In situ* enhanced bioremediation involves the creation of biobarriers in the subsurface to biodegrade VOCs as contaminated groundwater migrates through these bioactive zones. Through *in situ* enhanced bioremediation and bioaugmentation, microorganisms will dechlorinate or breakdown VOCs into ethene, the non-toxic end-product of reductive dechlorination.

Words in ***bold italic*** type are defined in the glossary on page 10.

Summary of Groundwater Cleanup Action Alternatives

For the source area, pump and treat, *in situ* chemical oxidation, and *in situ* enhanced bioremediation were evaluated. Pump and treat would contain DNAPL and slowly remove dissolved components while extracting large quantities of groundwater. *In situ* chemical oxidation treatment would involve the injection of chemical reagents into the groundwater to convert contaminants into compounds that are more stable, less mobile, and / or inert. *In situ* enhanced bioremediation would involve the injection of an electron donor and bioaugmentation to achieve complete dissolution and removal of DNAPL. Computer modeling indicates that TCE mass discharge from the source area will be effectively contained and treated using *in situ* enhanced bioremediation. The U.S. EPA has recognized that *in situ* enhanced bioremediation is a viable remediation technology for contaminant mass reduction in source areas such as Site 70.

In situ enhanced bioremediation is considered an innovative remediation technology. The use of such innovative technologies is encouraged by the U.S. EPA because they offer advantages in performance or cost over more conventional technologies. The Navy is continuing to assess results of further research and development efforts to advance the science and engineering of *in situ* enhanced bioremediation as a relevant approach to the cleanup of groundwater.

Common components of each alternative (except for the No Action alternative) are the use of monitored natural attenuation (MNA) and institutional controls.

- MNA relies on natural processes occurring in the subsurface, such as chemical reactions, biodegradation, dispersion, or dilution, to reduce the concentrations of COCs in the plume over time to reach the cleanup goals. Natural biodegradation processes involve microorganisms (bacteria naturally present in the groundwater) gradually breaking down VOC molecules and converting the compounds to harmless or non-hazardous byproducts. MNA serves as an end-stage technology to reduce contaminant levels in the plume in conjunction with, and following, the application of other technologies. Monitoring would track the VOC plume over time to verify that natural attenuation / biodegradation processes are occurring at a sufficient rate to achieve remedial action objectives within a reasonable timeframe.

- Institutional controls are used to: prevent inadvertent exposure or use of VOC-contaminated groundwater until cleanup objectives are met; grant access for installation and sampling of monitoring and injection wells; protect monitoring and injection wells; manage injection and groundwater monitoring activities to assure that hydraulic control of the plume is not compromised; and implement any additional remedial measures needed in the future. Institutional controls will be implemented over the footprint of the plume and an associated buffer zone that extends from the edge of the plume. The Navy would implement institutional controls through the NAVWPNSTA Seal Beach Base Master Plan. These controls would remain in effect until site cleanup goals are accomplished.

The U.S. EPA's evaluation criteria and published technical guidance were considered in the development of the alternatives. To compare the effectiveness of the alternatives, computer modeling was conducted to estimate the reduction of TCE within the groundwater at Site 70 and predict cleanup time frames. Alternatives 1, 6, 7, 9, 10, and 11 underwent detailed evaluation for Site 70 and are summarized below.

Alternative 1 – No Action

As required by the NCP, the No Action alternative is used as a baseline against which the other alternatives are evaluated. In Alternative 1, there are no actions taken to collect, contain, or treat VOC-contaminated groundwater. No institutional controls would be implemented to prevent exposure or use of VOC-contaminated groundwater, protect equipment, or control site access.

Alternative 6 – Hydraulic Containment (Dissolved Phase Plume Area) and *In Situ* Chemical Oxidation (ISCO) Treatment (Source Area in Groundwater) *(Additional components – MNA and Institutional Controls)*

For the dissolved phase plume area, hydraulic containment would involve extracting VOC-contaminated groundwater to contain the plume and prevent it from migrating further; treating extracted VOC-contaminated groundwater; and, for cost-estimating purposes, discharging treated water to a nearby storm channel. Other discharge options that also meet regulatory requirements may be developed during the remedial design.

The hydraulic containment portion of Alternative 6 would involve the extraction of VOC-contaminated groundwater from the dissolved phase plume area through wells installed to varying depths (less than 40 feet, 80 to 100 feet, and

Words in ***bold italic*** type are defined in the glossary on page 10.

greater than 120 feet) below the ground surface at the leading edge of the plume. The extraction of groundwater from the wells would create a hydraulic barrier that restricts further migration of VOCs within the shallow aquifer. Extracted groundwater would be pumped via buried pipelines to a treatment plant located at or near Site 70. VOC-contaminated groundwater would be pumped through a cartridge filtration system followed by two-stage ***granular activated carbon (GAC)*** adsorption treatment. The filters and GAC would trap VOCs and, when the filters and GAC are no longer effective, they would be transported off site and regenerated by a carbon supplier.

Treated groundwater would be conveyed via a pipeline to a nearby storm channel for discharge. Concentrations of contaminants would be monitored to make sure that they meet RWQCB requirements. Other treated groundwater discharge options may also be considered during remedial design.

Performance monitoring would be conducted to optimize the extraction system, verify containment of the plume, and to demonstrate the effectiveness of the treatment system. Samples from monitoring wells would be collected and tested. Treated water, at various points in the treatment process and prior to discharge, would also be tested to monitor the effectiveness of the treatment system.

For the source area in groundwater, the *in situ* treatment portion of Alternative 6 would utilize ISCO to destroy VOCs and reduce the mass of VOC contamination. Performance monitoring would also be conducted to verify the effectiveness of ISCO treatment. This involves groundwater sampling from specific wells and laboratory analysis to assess destruction / reduction of VOCs.

For both the dissolved phase plume and source areas, MNA would be used to reduce contaminant levels and complete the remediation over time. MNA would be implemented when the other treatment methods are no longer effective at further reducing contaminant concentrations in the groundwater and VOCs will not migrate at unacceptable levels. The VOC plume would be monitored over time to verify that natural attenuation (i.e., biodegradation) processes are occurring at a sufficient rate to achieve cleanup objectives in a reasonable time frame. Institutional controls, implemented at both the dissolved phase plume and source areas, would prevent inadvertent human exposure to VOCs until remediation goals are achieved and protect against any actions that could adversely affect performance of the alternative.

Computer modeling results indicate that Alternative 6 reduces TCE to the state and federal MCL of 5 micrograms per liter (mg/L) in groundwater at all depths after approximately 47 years. Furthermore, Alternative 6 would remove approximately 1,800 pounds of TCE with the extraction performed for hydraulic containment and destroy approximately 1,100 pounds of TCE by ISCO treatment. Approximately 400 pounds of TCE would undergo natural attenuation over 50 years. It is estimated that the hydraulic containment system would operate for 35 years, followed by MNA.

Alternative 7 – Hydraulic Containment (Dissolved Phase Plume Area) and Pump and Treat (Source Area in Groundwater) *(Additional components – MNA and Institutional Controls)*

For the dissolved phase plume area, hydraulic containment would involve extracting VOC-contaminated groundwater at the leading edge of the plume to contain the plume and preventing VOCs from migrating further; treating extracted VOC-contaminated groundwater; and discharging treated water to a nearby storm channel or via another suitable discharge option that would also meet all regulatory requirements. For the hydraulic containment portion of Alternative 7, the same systems and specifications used in Alternative 6 would be used. Hydraulic containment would continue until VOCs no longer migrate at unacceptable levels. It is estimated the hydraulic containment system would operate for 35 years, followed by MNA.

For the source area in groundwater, the pump and treat portion of Alternative 7 would involve aggressive pumping to remove DNAPL. The pump and treat system would operate for approximately 50 years. The extracted groundwater would be conveyed to the same treatment facility that would treat contaminated groundwater from the dissolved phase plume area. Groundwater from the source area would be added to extracted groundwater from dissolved phase plume area prior to treatment. Extracted water would be treated and discharged in the same manner as described under hydraulic containment for Alternative 6. Performance monitoring would be performed similar to Alternative 6.

For both the dissolved phase plume and source areas, MNA and institutional controls would be implemented in the same manner as Alternative 6.

Words in ***bold italic*** type are defined in the glossary on page 10.

Summary of Groundwater Cleanup Action Alternatives

Computer modeling results indicate that Alternative 7 would remove approximately 2,300 pounds of TCE after 30 years. Approximately 1,000 pounds of TCE are estimated to undergo natural attenuation processes over 50 years. However, Alternative 7 will not reduce TCE concentrations in groundwater at all depths to 5 mg/L within 50 years.

Alternative 9 – Pump and Treat (Dissolved Phase Plume Area) and ISCO Treatment (Source Area in Groundwater)

(Additional components – MNA and Institutional Controls)

For the dissolved phase plume area, the pump and treat portion of Alternative 9 would involve the installation of extraction wells in areas where TCE concentrations are greater than 1 part per million (ppm) or 1,000 micrograms per liter (µg/L). Pumping and treating the more contaminated areas within the plume would accelerate cleanup of Site 70. Extraction wells would also be installed at the leading edge of the plume to provide hydraulic containment in a similar manner as hydraulic containment for Alternative 6. Extracted water would be treated and discharged in the same manner as described under hydraulic containment for Alternative 6. Pumping and treating is expected to continue for approximately 15 years, followed by MNA.

For the source area in groundwater, the *in situ* treatment portion of Alternative 9 would be performed in the same manner as Alternative 6. It is assumed that one treatment would effectively lower the contaminant concentrations in most locations within the source area in groundwater to remediation goals. Pilot scale testing was conducted in 2001 and results indicated that *in situ* chemical oxidation could be a viable option for VOC cleanup. Variations of the *in situ* chemical oxidation process would be considered prior to any full-scale implementation. Performance monitoring would be performed similar to Alternative 6.

For both the dissolved phase plume and source areas, MNA and institutional controls would be implemented in the same manner as Alternative 6.

Computer modeling results indicate Alternative 9 reduces TCE to 5 mg/L in groundwater at all depths after 46 years. Alternative 9 removes approximately 1,100 pounds of TCE by *in situ* treatment and approximately 1,900 pounds by pumping after 10 years. Approximately 300 pounds of TCE are estimated to undergo natural attenuation over 50 years.

Alternative 10 – Alternative to-Pump and Treat (Dissolved Phase Plume Area) and Pump and Treat (Source Area in Groundwater)

(Additional components – MNA and Institutional Controls)

For the dissolved phase plume area, the pump and treat portion of Alternative 10 would be implemented in the same manner as Alternative 9, except the well scheme will have two fewer wells. Pumping and treating VOC-contaminated groundwater would accelerate cleanup and could be performed in conjunction with hydraulic containment. Extraction wells would be placed at the leading edge of the plume to extract groundwater, thereby creating a hydraulic barrier to restrict further migration of VOCs within the shallow aquifer. Extracted water would be treated and discharged in the same fashion as described under the hydraulic containment portion for Alternative 6. Pumping and treating is expected to continue for approximately 15 years, followed by MNA.

For the source area in groundwater, the pump and treat portion of Alternative 10 would use the same pumping scheme as Alternative 7. It would involve aggressive pumping to remove DNAPL using a system of nine closely-spaced wells. The pump and treat system would operate for approximately 50 years. The extracted groundwater would be conveyed to the same treatment facility that would treat contaminated groundwater from the dissolved phase plume area. Groundwater from the source area would be added to extracted groundwater from dissolved phase plume area prior to treatment. Extracted water would be treated and discharged in the same manner as described under hydraulic containment for Alternative 6. Performance monitoring would be conducted in the same manner as Alternative 6.

For both the dissolved phase plume and source areas, MNA and institutional controls would be implemented in the same manner as Alternative 6.

Computer modeling results indicate that Alternative 10 will not reduce TCE concentrations in all subsurface groundwater areas to 5 mg/L within 50 years. Modeling results indicate that alternative 10 would remove approximately 2,400 pounds of TCE by pumping after 10 years. Approximately 900 pounds of TCE are estimated to undergo natural attenuation over 50 years.

Words in ***bold italic*** type are defined in the glossary on page 10.

Alternative 11 – (Preferred Remedy) ***In Situ*** **Treatment – Enhanced Bioremediation** *(Additional components – MNA and Institutional Controls)*

For the dissolved phase plume area, Alternative 11 would involve the creation of bioactive zones or biobarriers that would segment the plume area into treatment zones. At each selected biobarrier location, multiple injection wells would be installed perpendicular to groundwater flow direction. VOCs would be treated as they migrate through these biobarriers that transect the plume (refer to Figure 7 on this page and Figure 8 on page 22). The biobarriers would be created by first injecting an electron donor (i.e., emulsified vegetable oil or EVO), which will be immobile relative to groundwater flow, into the subsurface to create a reduced environment. Halorespiring microorganisms (KB-1™) will then be injected to dechlorinate the site COCs into ethene, a non-toxic end-product of reductive dechlorination (refer to Figure 9 on page 22). This process is referred to as bioaugmentation. Bioaugmentation can significantly shorten the time to achieve complete dechlorination of VOCs to ethene.

The EVO is commercially available and would be blended with existing site groundwater as it is injected into the aquifer for the creation of biobarriers. The creation of biobarriers at the site is a passive remediation approach, requiring injection of the EVO at low concentrations on an as-needed basis. A one time inoculation of KB-1 will be required.

For the source area in groundwater, Alternative 11 would most likely involve the injection of an electron donor (EVO) and bioaugmented microorganisms (KB-1) into a grid of wells installed in the source area to achieve enhanced dissolution and removal of DNAPL. Based on laboratory and field tests documented by the U. S. EPA, high concentrations of chlorinated VOCs associated with source areas have been found to be ideal niches for halorespiring microorganisms, because the high concentrations suppress the growth of other microorganisms that may compete for the added electron donor. Therefore, electron donors are more efficiently used and directed towards reductive dechlorination in source areas.

This image showing details of station infrastructure has been deleted from the Internet-accessible version of this document per Department of the Navy Internet security regulations

FIGURE 7: Plan View of Treatment System for Alternative 11

Words in ***bold italic*** type are defined in the glossary on page 10.

Summary of Groundwater Cleanup Action Alternatives

For both the dissolved phase plume and source areas, periodic groundwater monitoring would be conducted to determine the need for additional electron donor injections, growth and dispersion of halorespiring microorganisms, and the effectiveness of each step of the in situ enhanced bioremediation. MNA and institutional controls would be implemented in the same manner as Alternative 6. Bench- and pilot-scale testing of the biobarrier and DNAPL in situ enhanced bioremediation will be conducted prior to full-scale implementation of this remedy.

Computer modeling results indicate Alternative 11 reduces TCE to 5 mg/L in groundwater at all depths after 15 years. Alternative 11 achieves approximately 98% destruction of DNAPL within the first year of treatment and destroys approximately 99% of the dissolved phase TCE mass within the first six years of treatment. The remaining mass of VOCs would be removed by natural attenuation in the dissolved phase plume over the following nine years. The effectiveness of MNA would be enhanced due to the halorespiring microbial culture.

Words in ***bold italic*** type are defined in the glossary on page 10.

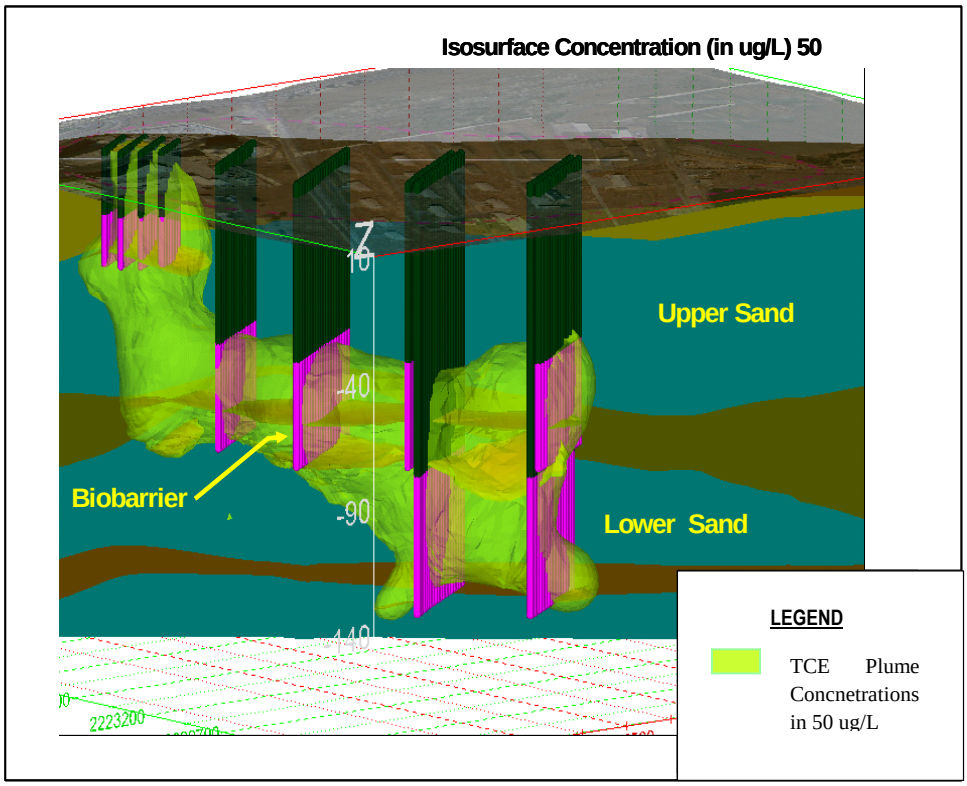

FIGURE 8: Cross-Section of Biobarriers in the Dissolved Phase Plume Area and Biostimulation / Bioaugmentation in the Source Area

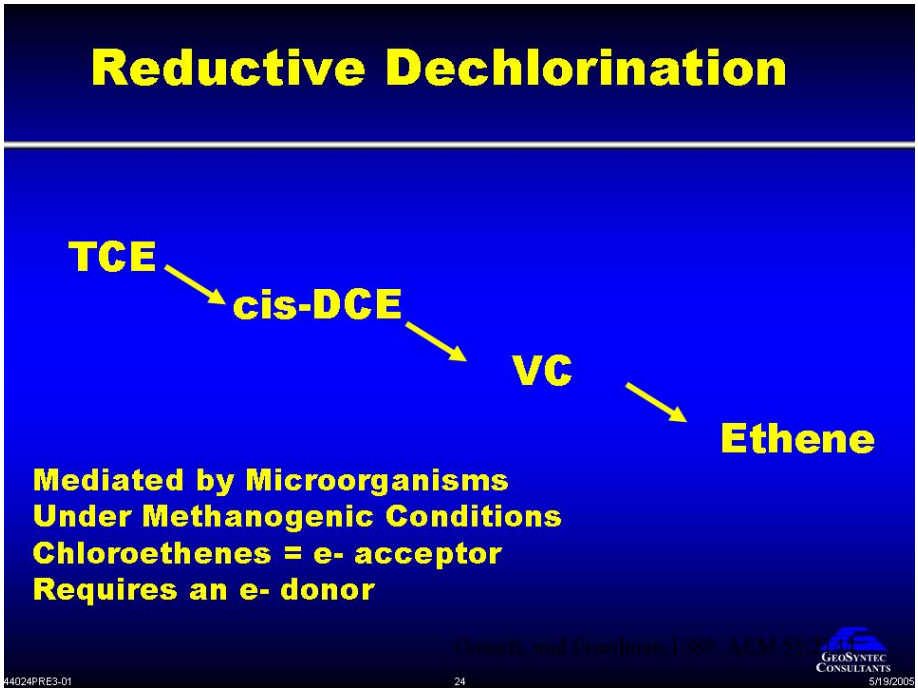

FIGURE 9: Breakdown Process of TCE into Ethene in the Presence of Halorespiring Bacteria

Words in ***bold italic*** type are defined in the glossary on page 10.

Evaluation of the Site 70 Groundwater Cleanup Alternatives

Each Site 70 alternative has undergone detailed evaluation and analysis, following the nine criteria developed by the U.S. EPA. These criteria are categorized into three general groups: threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria must be satisfied in order for an alternative to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs among alternatives. Generally, modifying criteria are taken into account after public comment is received on the Proposed Plan and reviewed with the various State regulatory agencies to determine if the preferred alternative remains the most appropriate remedial action. Table 3 below summarizes the comparative analysis of all the Site 70 remedial alternatives.

A. THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment – Assesses whether an alternative provides for adequate protection of public health and the environment by eliminating, reducing or controlling risks through treatment, engineered response actions or controls, or Institutional and regulatory controls.

Alternative 1, No Action, does not protect human health and the environment because no institutional controls would exist to prohibit extraction of contaminated groundwater. Alternatives 6, 7, 9, 10, and 11 meet the threshold criteria for overall protection of human health and the environment.

Compliance with *Applicable or Relevant and Appropriate Requirements (ARARs)* – Evaluates whether an alternative complies with all federal, state and local environmental statutes, regulations, and other requirements, or whether a waiver is justified.

Potential ARARs do not apply to Alternative 1 because no action is being taken. Alternatives 6, 7, 9, 10, and 11 comply with all ARARs.

B. PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence – Considers the ability of an alternative to maintain protection of human health and the environment over time after remediation is complete.

Alternative 1 rates low in long-term effectiveness and permanence because there would be no remedial activities, no verification of natural attenuation processes, and no monitoring of plume migration patterns to demonstrate protectiveness. Alternatives 6, 9, and 11 rate high in this criteria, because *in situ* chemical oxidation and *in situ* enhanced bioremediation of the source area in groundwater is expected to permanently destroy a significant mass of contamination and implementation of these technologies in the dissolved phase plume area would prevent further migration. Alternative 10 rates medium in this criteria because, although contaminant mass removal would be

Preferred Remedy ★

Table 3: Summary of Comparative Analysis of Site 70 Remedial Alternatives

Criterion	Alternative 1 No Action	Alternative 6 Hydraulic Containment & *In Situ* Treatment	Alternative 7 Hydraulic Containment & Pump and Treat	Alternative 9 Pump and Treat & *In Situ* Treatment	Alternative 10 Pump and Treat & Pump and Treat	Alternative 11 *In Situ* Treatment – Enhanced Bioremediation
1. Overall Protection of Human Health and the Environment	Not Protective	Protective	Protective	Protective	Protective	Protective
2. Compliance with ARARs	Not Applicable	Complies	Complies	Complies	Complies	Complies
3. Long-Term Effectiveness and Permanence	○	●	○	●	◒	●
4. Reduction of Toxicity, Mobility, or Volume through Treatment	○	◒	○	●	◒	●
5. Short-Term Effectiveness	○	◒	○	◒	○	●
6. Implementability	●	○	◒	○	◒	◒
7. Cost-Effectiveness	◒	○	◒	●	○	●
8. State Acceptance – State concurs with the preferred remedy, performance criteria to be determined for all other alternatives.						
9. Community Acceptance – This criteria will be addressed in the Record of Decision / Remedial Action Plan (ROD / RAP).						

○ Low ◒ Medium ● High

Note: The first portion of Alternatives 6, 7, 9, and 10 addresses the Dissolved Phase Plume Area, while the second portion addresses the Source Area in Groundwater. For the Primary Balancing Criteria 3 through 7 above, please see the text on pages 23 through 25 for a further explanation of the ratings.

Words in ***bold italic*** type are defined in the glossary on page 10.

Table 4: Cost Estimate of Site 70 Remedial Alternatives

Alternative	Total Direct Capital Cost	Total Direct O & M Cost[a]	Total Cost[c]	Net Present Value	Years to Complete Cleanup[d]
Alternative 1, No Action	$0	$0	$0	$0	Not Applicable
Alternative 6, Hydraulic Containment (Dissolved Phase Plume Area) & *In Situ* Treatment (Source Area in Groundwater)	$3.5 million[a]	$5.2 million[a]	$24.2 million[a]	$11.0 million[a]	Approximately 25 to 47 years
Alternative 7, Hydraulic Containment (Dissolved Phase Plume Area) & Pump and Treat (Source Area in Groundwater)	$831,200[a]	$6.3 million[a]	$23.9 million[a]	$6.7 million[a]	Greater than 50 years
Alternative 9, Pump and Treat (Dissolved Phase Plume Area) & *In Situ* Treatment (Source Area in Groundwater)	$7.9 million[b]	$10.1 million[b]	$21.6 million[b]	$12.1 million[b]	Approximately 46 years
Alternative 10, Pump and Treat (Dissolved Phase Plume Area) & Pump and Treat (Source Area in Groundwater)	$1.3 million[a]	$6.6 million[a]	$26.8 million[a]	$8.5 million[a]	Greater than 50 years
Alternative 11, *In Situ* Treatment – Enhanced Bioremediation, Including Biostimulation and Bioaugmentation	$4.3 million	$11.4 million	$18.8 million	$14.7 million	Approximately 15 years

In accordance with U.S. EPA guidance for developing and documenting cost estimates, the estimates presented are contingent upon a -30 to +50 percent accuracy. Cost estimates prepared for the FS and RFS Reports can increase during the design and / or implementation phases as a result of unforeseen conditions or items or additional pilot tests that are not reflected in the conceptual plans used as a basis for comparison.

ACRONYMS / ABBREVIATIONS / DEFINITIONS:

O&M = Operation and maintenance
Capital Cost = Costs required for construction (design, build, install) of a remedial action (e.g., groundwater treatment system and related site work).
O&M Cost = Post construction costs necessary to ensure and verify the continued effectiveness of a remedial action, mostly on an annual basis, plus periodic costs occurring once every few years (e.g., monitoring, 5-year reviews, and associated professional / technical services).
Total Cost = Sum of capital and O&M costs, total cost of remedy.
Net Present Value = Amount of money that, if invested in the initial year of the remedial action and disbursed as needed, would be sufficient to cover all costs associated with the alternative (based on 2005 dollars).

NOTES:

a = Indicates price with a 3% per year cost increase to reflect 2004 pricing
b = Indicates BNI revised estimates from the "White Paper – Alternative Technology Evaluation IR Site 70, NAVWPNSTA Seal Beach" June 2004.
c = Includes 20% contingency costs
d = Years to complete cleanup based on computer modeling results for reducing TCE concentrations to 5 mg/L in all subsurface groundwater areas impacted by Site 70.

achieved in the dissolved phase plume area, continued containment of the source area in groundwater would be necessary over the long term. Alternative 7 rates low because pump and treat has not been shown to be a viable alternative for removal of DNAPL. Additionally, the hydraulic containment portion of Alternative 7 will require an extensive timeframe.

Reduction of Toxicity, Mobility, or Volume through Treatment – Refers to the degree to which an alternative uses treatment technologies to reduce: 1) Harmful effects to human health and the environment (toxicity), 2) Contaminant's ability to move (mobility) in the environment, and 3) The amount of contamination (mass and volume).

Alternative 1 rates lowest in reduction of toxicity, mobility, or volume through treatment because there is no active treatment associated with this alternative. Alternative 6 rates medium in this criteria because *in situ* chemical oxidation of the source area in groundwater would permanently destroy a significant mass of contamination and contamination in the dissolved phase plume area would migrate toward the containment system, where it would be removed and permanently destroyed. Alternative 7 rates low in this criteria, because, although some contaminants in the dissolved phase plume would be removed as contamination migrates toward the containment system, pump and treat would not be effective at removing DNAPL and there would be significant impacts to the aquifer from pumping. Alternative 9 rates moderately high in this criteria because the use of *in situ* chemical oxidation in the source area and pump and treat in the dissolved phase plume would remove significant contaminant mass. However, pump and treat would result in significant impacts to the aquifer. Alternative 10 rates medium in this criteria because of the less aggressive pump and treat scheme used in the source area. Alternative 11 rates high because testing performed by

Words in ***bold italic*** type are defined in the glossary on page 10.

U. S. EPA has demonstrated that 98% of DNAPL mass could be destroyed within the first year of bioaugmentation.

Short-Term Effectiveness – Considers the impact of an alternative relative to human health and the environment during the construction and implementation phase and until remedial action objectives are achieved. Also considers time to achieve cleanup goals.

Alternative 11 is rated highest for short-term effectiveness because this alternative is expected to remove VOC mass the most effectively and achieve cleanup goals in the shortest period of time. Computer modeling showed Alternative 11 could remove 98% of DNAPL mass during the first year by bioaugmentation and 99% of the dissolved phase TCE mass within the first 6 years of in situ enhanced bioremediation. Alternatives 6 and 9 are rated medium and Alternatives 7 and 10 are rated low. Alternative 6, like Alternative 9, is expected to remove 1,100 pounds of TCE during the first year by chemical oxidation. Cleanup goals may be achieved within 50 years for Alternatives 6 and 9. However, Alternative 6 would require a longer time frame than Alternative 9 because the hydraulic containment wells are located at the leading edge of the dissolved phase plume instead of within the areas where TCE concentrations are highest. High risks to site workers and facilities are associated with the *in situ* chemical oxidation portion of Alternatives 6 and 9. Alternatives 7 and 10 remove mass more slowly and are expected to require more than 50 years to achieve cleanup. Alternative 1 is rated lowest because it is expected to take the longest to achieve cleanup, does not include monitoring to verify when cleanup is complete, does not contain the plume, and does not prevent use of contaminated groundwater while cleanup is occurring.

Implementability – Considers the technical feasibility (how difficult the alternative is to construct and operate) and administrative feasibility (coordination with other agencies) of Implementing an alternative.

Alternative 1 rates highest in implementability because there would be no field construction or other remedial activities. Alternatives 6 and 9 rate low in implementability because the *in situ* chemical oxidation technology is considered innovative and results of the 2001 pilot test indicate the potential for violent reactions and eruptions during implementation. Alternative 7 rates medium in this criteria because the hydraulic containment system would employ reliable, widely available technologies. Alternative 10 rates medium in this criteria because the pump and treat system would employ reliable, widely available technologies. Alternative 11 rates medium because *in situ* enhanced bioremediation requires some treatability studies and a large number of injection well points. Possible biofouling and groundwater flow issues may impact the implementation and operation of *in situ* enhanced bioremediation.

The institutional controls and water-use restrictions that are part of Alternatives 6, 7, 9, 10, and 11 are considered administratively feasible and are not expected to prevent future operations at NAVWPNSTA Seal Beach.

Cost-Effectiveness – The effectiveness of the alternative to achieve remediation goals versus costs, including estimated capital and annual operations and maintenance (O&M) costs, and total costs in present net value. Present net value is the cost of the alternative over time and all estimates are expressed in terms of year 2005 dollars.

The estimated costs for the six remedial alternatives are summarized on Table 4 on page 24. Alternative 11 is rated highest because *in situ* enhanced bioremediation has lower total costs. There are high capital costs associated with implementation of the technology but it achieves the cleanup in the shortest time period. Alternative 1 is rated medium because even though there are no costs associated with this alternative, the alternative will not be effective at achieving cleanup goals. Alternative 7 is also rated medium because the cost in proportion to effectiveness is questionable. Alternatives 6 and 10 with total costs of $24.2 million and $26.8 million, respectively, are rated low in terms of cost. Alternative 9 is rated moderately high because the permanent destruction of VOCs would provide low costs in proportion to effectiveness.

C. MODIFYING CRITERIA

State Acceptance – Considers whether the State of California's environmental agencies agree with the analysis presented In the FS and RFS reports and the Navy's preferred remedy.

State of California representatives from DTSC and the RWQCB concur with the selection of Alternative 11, the Navy's preferred alternative.

Community Acceptance – Evaluates whether the local community agrees with the Navy's analysis and if the community has a preference for an alternative.

This Proposed Plan is the Navy's request to the community to comment on the FS and RFS reports, remedial alternatives developed, and the Navy's preferred alternative. Responses to comments received from the public will be addressed in the Record of Decision/Final Remedial Action Plan (ROD/RAP), see "Next Step for Site 70" on page 27.

Words in ***bold italic*** type are defined in the glossary on page 10.

Site 70 Preferred Remedy – Alternative 11

IN SITU TREAMENT – ENHANCED BIOREMEDIATION

The Navy's preferred remedy for cleanup of Site 70 – Alternative 11 – consists of *in situ* enhanced bioremediation, which would involve biostimulation and bioaugmentation to breakdown (i.e., biodegrade) VOCs into ethene, the non-toxic end-product of reductive dechlorination.

For the dissolved phase plume area, Alternative 11 would involve the creation of biobarriers that would transect the plume area and would treat or biodegrade VOCs as they migrate through (refer to Figures 7 and 8 on pages 20 and 22, respectively). The biobarriers would be created by injecting an electron donor into the subsurface to stimulate indigenous halorespiring microorganisms to completely breakdown VOCs into ethene. This process is referred to as biostimulation. Additionally, halorespiring microorganisms may also be injected into the subsurface to enhance destruction of chlorinated VOCs. This process is referred to as bioaugmentation.

For the source area in groundwater, Alternative 11 would most likely involve the injection of an electron donor and bioaugmented microorganisms into the source area to achieve enhanced dissolution and removal of DNAPL.

For both the dissolved phase plume and source areas, MNA would be used to further reduce contaminant levels and complete the remediation over time. Additionally, institutional controls would be implemented at both the dissolved phase plume and source areas to prevent inadvertent human exposure to VOCs until remediation goals are achieved.

Bench- and/or pilot-scale testing of the biobarrier and DNAPL bioremediation will be conducted prior to full-scale implementation of this remedy. Computer modeling results indicate Alternative 11 reduces TCE to the state and federal MCL of 5 micrograms per liter (mg/L) in groundwater at all depths after 15 years.

RATIONALE FOR THE NAVY'S PREFERRED REMEDY

Key points that support the Navy's preference for Alternative 11 are listed below.

- Protective of human health and the environment. *In situ* enhanced bioremediation minimizes any short or long term risks to aquifers, workers, overlying structures, and the overall environment.
- Provides for long-term effectiveness and permanence – *in situ* enhanced bioremediation completely destroys both sorbed and unsorbed components of the VOC plume.
- Computer modeling results indicate approximately 98% of DNAPL could be destroyed in the first year of treatment, thereby shortening the time to reduce VOC concentrations to meet cleanup goals and provided effective containment and treatment of VOCs in the source area.
- Provides for significant reduction of toxicity, mobility, and volume of contamination in groundwater. Computer modeling results indicate approximately 99% of TCE in the dissolved phase plume would be destroyed within the first six years.
- Is not only compatible with, but also enhances long-term MNA through the distribution of microbial culture and nutrients.
- Will not result in significant impacts to the site and assures that hydraulic control of the plume is not compromised.
- In comparison to the other remedial alternatives, *in situ* enhanced bioremediation does not require the pumping and removal of contaminated groundwater, which can result in salt water intrusion and cause serious negative impacts to the aquifer. As a result, large aboveground treatment systems (piping, containment, etc.) will not be required.
- Although *in situ* enhanced bioremediation results in higher up front costs, Alternative 11 is the least expensive of the remedial alternatives evaluated and in comparison to the other alternatives, cleanup goals could be achieved in the shortest timeframe. Thus, Alternative 11 is considered cost-effective because the costs are proportional to its effectiveness.
- Incorporates an innovative cleanup technology, as encouraged by the U. S. EPA and the Interstate Technology Regulatory Council.
- Alternative 11 is capable of meeting potential federal or state (if more stringent) environmental standards, requirements, criteria, or limitations that are determined to be legal and applicable or relevant and appropriate requirements (ARARs) for cleanup of VOC-contaminated groundwater at Site 70. Potential ARARs are presented in the FS and RFS, which are available at the information repositories listed on page 28. Final ARARs will be documented in the Record of Decision / Remedial Action Plan (ROD / RAP) after the final remedy for Site 70 is selected.

Words in ***bold italic*** type are defined in the glossary on page 10.

Multi-Agency Environmental Team Concurs with the Navy's Preferred Remedy for Site 70

The NAVWPNSTA Seal Beach Installation Restoration Program cleanup team partnership, composed of the Navy, Cal/EPA's Department of Toxic Substances Control (DTSC) and Regional Water Quality Control Board (RWQCB), and the Orange County Department of Environmental Services, was established in 1991. At that time, these agencies agreed to work together to meet the environmental obligations of the Navy and the other agencies. The formal agreement between the agencies is known as the Federal Facility Site Remediation Agreement. The primary goals stated in the agreement are to protect human health and the environment, expedite environmental cleanup, and coordinate environmental investigations and cleanup at the Station.

These agencies have reviewed all major documents and activities associated with Site 70. Particular emphasis was placed on the ERSE report and risk screening documentation, groundwater monitoring program reports, the FS report, and RFS report. Based on reviews of these reports, the cleanup team partners concur with the Navy's recommendation of Alternative 11, *In Situ* Treatment – Enhanced Bioremediation, as the preferred remedy for addressing the VOC plume of contaminated groundwater at Site 70. In addition, the agencies concur with the Navy that no further action is needed for soil at Site 70.

NEXT STEP FOR SITE 70: PUBLIC COMMENTS

Comments on this Proposed Plan received during the 30-day public comment period (**month/day-month/day/year**) and at the **month/day/year** public meeting will be considered in the final environmental determination for Site 70. At the public meeting (see page 1 for location), community members may submit oral or written comments. Public comments will be accepted on all of the alternatives for Site 70 outlined in this Proposed Plan and on information presented in the ERSE, FS, and RFS reports. During the public comment period, community members may submit comments by mail, fax, or e-mail (**postmarked or sent no later than month/day/year**) to:

Ms. Pei-Fen Tamashiro (Code: N45WW)
IR Program Manager
NAVWPNSTA Seal Beach
800 Seal Beach Blvd., Building 110
Seal Beach, CA 90740
Fax: (562) 626-7131
E-mail: pei-fen.tamashiro@navy.mil

Community members may also attend the **month/day/year** public meeting held during the public comment period. Navy representatives will make a presentation on the Site 70 environmental investigations and the cleanup alternatives evaluated.

You will have the opportunity to ask questions and formally comment orally or in writing on the preferred remedy and the other alternatives. Following the public comment period, the next step in the IR Program process is the Record of Decision/Final Remedial Action Plan (ROD/RAP) that formally documents the selected remedy for Site 70. A Responsiveness Summary, containing responses to comments provided at the public meeting and during the public comment period, will accompany the ROD/RAP. The ROD/RAP will also meet Cal/EPA DTSC's requirements for final remedial action plans as detailed in the California Environmental Quality Act.

After the ROD/RAP is signed by the Navy and the regulatory agencies, the remedial design and remedial action phases begin. Remedial design involves developing detailed designs for the selected remedy. Design documents undergo Navy and regulatory agency review. Remedial action refers to the construction, testing, and operation of the selected remedy. Regulatory agencies also provide oversight during this phase. After the remedial design is completed, it will be described in a fact sheet produced for the general public.

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Restoration Advisory Board

COMMUNITY PARTICIPATES IN NAVY'S ENVIRONMENTAL PROGRAM

The NAVWPNSTA Seal Beach Restoration Advisory Board (RAB) was established in January 1995 to increase public participation in the environmental restoration program at the Station. The RAB is made up of community members and representatives of various organizations that volunteer their time to support the IR Program. The RAB provides a forum for community members, the Navy, and regulatory agencies to discuss cleanup issues and approaches. RAB members review and comment on environmental documents, attend monthly meetings, and act as a liaison between the Station's environmental program and the community.

The RAB currently meets in the evening on the second Wednesday of every other month. The meetings are open to the public and are announced through mailers sent to all names on the Station's community mailing list. The RAB and the Navy encourage members of the public to attend the meetings. For more information about the next NAVWPNSTA Seal Beach RAB meeting and how to become a RAB member, contact Ms. Pei-Fen Tamashiro, Navy Co-Chair, at (562) 626-7897 or Ms. Lindi Willhite, Community Co-Chair, at (714) 839-5663. To add your name to the community mailing list, fill out and send in the mailing list request form (see page 29).

INFORMATION REPOSITORIES

Site 70 Environmental Investigation and Feasibility Study Reports Available for Review and Comment

Two information repositories have been established to provide public access to technical reports and other IR Program information. The collection of reports used by the Navy and the regulatory agencies to form the basis of the recommendations for Site 70 are available for public review. The key Site 70 documents consist of: Final Extended Removal Site Evaluation Report, Sites 40 and 70 (October 1999), the Final Groundwater Feasibility Study Report, Sites 40 and 70 (June 2002), the Final Pilot Test Report for *In Situ* Oxidation at Site 70 (August 2002), and the Final Revised Feasibility Study Report, Site 70 (Pending, 2005). These documents, along with other IR Program reports, RAB meeting minutes, newsletters, and environmental documentation, are available for review at the following locations:

Seal Beach Public Library
Mary Wilson Branch
707 Electric Avenue
Seal Beach, CA 90740
(562) 431-3584
(call for library operating hours)

NAVWPNSTA Seal Beach
Environmental Office, Building 110
Naval Weapons Station
Seal Beach, CA 90740-5000
(562) 626-7897 (call for an appointment to obtain entrance to the Station)

FOR MORE INFORMATION

The Navy encourages community involvement in the IR Program at NAVWPNSTA Seal Beach. For more information, or if you have any questions or concerns about environmental activities, please contact:

Ms. Pei-Fen Tamashiro (Code: N45WW)
IR Program Manager
NAVWPNSTA Seal Beach
800 Seal Beach Boulevard, Building 110
Seal Beach, California 90740
(562) 626-7897
e-mail: pei-fen.tamashiro@navy.mil

Ms. Katherine Leibel
Remedial Project Manager
Cal/EPA, Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, California 90630
(714) 484-5446
e-mail: kleibel@dtsc.ca.gov

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What's Inside?

Proposed Plan / Draft Remedial Action Plan
Installation Restoration Program – Site 70

Navy Proposes Groundwater Cleanup Plan, Requests Public Comments

Address Correction Requested

If you wish to be added to the mailing list, or no longer wish to receive mailings, please contact Ms. Pei-Fen Tamashiro at (562) 626-7897, or return the mailing list request below.

NAVWPNSTA Seal Beach Community
MAILING LIST REQUEST

☐ Add me to the NAVWPNSTA Seal Beach Community mailing list
☐ Remove me from the mailing list
☐ Send me Restoration Advisory Board Information
☐ Change of Address
☐ Mr. ☐ Mrs. ☐ Ms.

Name: _____

Affiliation: _____

Address: _____

_____

City: _____

Zip: _____ Telephone: _____

Fax: _____

I would like my name entered as:

☐ a resident ☐ representing an organization
☐ a business ☐ an elected city, county, or state official

Note: Please clip and mail this coupon to:
Naval Weapons Station Seal Beach
Ms. Pei-Fen Tamashiro (Code: N45WW)
800 Seal Beach Boulevard
Seal Beach, CA 90740

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