CHAPTER 3

Making SMART Cleanup Happen

The Chief of Naval Operations and the Commandant of the Marine Corps depend on a host of internal and external organizations to accomplish their Environmental Restoration goals. Naval Facilities Engineering Command (NAVFAC) and the eight Engineering Field Divisions and Activities (EFD/As) manage implementation of the program in specific geographic regions of the United States. Remedial Project Managers (RPMs) supervise the cleanup at each installation. For technical help, RPMS turn to the Remedial Technical Managers (RTMs), who provide guidance for use of specific cleanup techniques based on their in-depth knowledge. State and federal regulatory agencies interact with the above groups on a regular basis, which streamlines the cleanup process and ensures consistency.

DON's investment in new technology, training, research, documentation and innovative contracting methods has paid off. Many restoration projects are being accomplished faster, more effectively, and at lower cost to the taxpayer as a result. The following pages show recent examples of these efforts.

To our Remedial Project Managers (RPMs), the Department of the Navy says "Thank you!" for handling the tough decisions that make cleanup happen every day!

SMART Training

DON personnel, regulators, and the public can benefit from effective environmental training in numerous ways—gaining a better understanding of the cleanup process, learning about the latest technology and methodology, and sharing lessons learned with other professionals. The Civil Engineer Corps Officer Training School (CECOS) and the Remedial Innovative Technology Seminars (RITS) offer state-of the-art training in restoration-related topics.

CECOS

The Civil Engineer Corps Officers School (CECOS) is a Navy schoolhouse, offering training courses on diverse topics for military and civilian personnel. The Environmental Training Division within CECOS provides environmental personnel with tools and techniques to make intelligent decisions and develop strategies to clean up sites in a cost-effective manner while protecting human health and the environment.

CECOS facility in Port Hueneme, CA

CECOS is working with the Army, Air Force, and Marine Corps to consolidate existing environmental courses with similar content. This initiative avoids duplication of effort for the military and saves money for the taxpayer.

Course Offering and Seminar Highlights

Ecological Risk Assessment

Now offered as a tri-service class, this course provides attendees with current information on Ecological Risk Assessment (ERA) and its use in the IR program. Instruction includes the clarification of each ERA component, decision-making strategies for site specific ERAs, and a description of technical oversight that should be included in the ERA. Procedures for performing ERA tasks, estimating risk, and meeting regulatory requirements are also addressed.

Health and Environmental Risk Communication Workshop

In this three-day course, attendees learn basic knowledge and tools to effectively communicate risk and risk management issues to diverse stakeholders. This includes developing a proactive program to establish and maintain a sound relationship with stakeholders through dialogue, fostering mutual trust and credibility. The class is offered in coordination with the Army and Air Force, and is open to all DoD environmental personnel.

Environmental Risk Assessment and Management (Human Health)

This three-day course provides instruction on conducting and managing human health risk assessments that are scientifically tenable and defensible, and how to use this information to make risk management actions that are protective of human health and the environment. The theory and practical application of risk assessment and risk management will be presented, and the course will involve a working case study for oversight of risk assessments.

Environmental Negotiation Workshop

This three-day ISEERB designated workshop provides instruction on the negotiation and communication skills necessary to achieve productive agreements with regulatory and public stakeholders. The class aims to make attendees more knowledgeable and comfortable in the negotiation process, stressing the human, organizational and public aspects of building constructive relationships with stakeholders in order to arrive at mutually beneficial decisions.

Geographic Information Systems (GIS)

GIS can (1) increase program efficiency and cost effectiveness; (2) improve the ability to manage, analyze, and display data from a site and provide a link to historical data; (3) improve the decision-making and data transfer processes; reduce review time, and improve the quality and defensibility of cleanup efforts. This two-day computer-based training course is designed to instruct Remedial Project Managers (RPMs) on how to develop and implement an up-to-date environmental data management system GIS using the ArcView 3.1 computer software program. Advanced computer knowledge required.

Geostatistics

Geostatistics is a tool that determines the spatial correlation within an observed data set and then uses the correlation to better estimate values at nearby locations where data has not yet been collected. This two-day course is designed to train Navy civilian and military personnel to apply geostatistical analysis throughout the project lifecycle of an environmental cleanup site. Attendees will be taught to make full use of spatial correlations and to develop more effective and cost-efficient site sampling plans using the Arc View 3.1 computer software program. Advanced computer knowledge required.

Advanced Environmental Restoration

This four day course provides instruction to ensure that remedial actions are protective of human health and the environment, cost effective, timely and responsive to community reuse needs where applicable. The course assumes attendees have a working knowledge of the Navy's Installation Restoration and related cleanup programs.

Health and Environmental Risk Communication Workshop

This three-day ISEERB-approved course provides attendees with basic knowledge and tools to effectively communicate risk and risk management issues to stakeholders of diverse interests. This includes developing a proactive program to establish and maintain a sound relationship with stakeholders based on trust and credibility. The course is intended for personnel who deal frequently with the community and the media regarding environmental issues.

Statistical and Geochemical Approaches to Establishing Background Data Sets

This workshop provides an overview and specific methodology for using background data as part of the environmental restoration process. Topics include defining types of background; regulatory requirements, sampling strategies, site data collection and analysis, statistical techniques, and geochemical/geological considerations for background.

Want More Information?

Visit http://www.cecos.navy.mil

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

NFESC Remedial Innovative Technology Seminars

The Remedial Innovative Technology Seminar (RITS) program facilitates the transfer of new and innovative technology, methods, and guidance for remediation topics. This year, numerous RPMs, state and federal regulators, Clean and RAC contractors participated in RITS. This year's topics included the following:

1. Optimization of Ground Water Monitoring and Remedial Action Operations (RAO)
2. Enhanced Bioremediation
3. Methyl tertiary-Butyl Ether (MTBE) Remediation
4. Fenton's Reagent and Chemical Oxidation

SMART Technical Guidance

Technical Documents

To assist Remedial Project Managers (RPMs) in completing their restoration projects successfully, DON workgroups and EFD/As create documentation for specific technical areas. Official documentation establishes a consistent, DON-wide approach handling sites with similar cleanup issues. The following paragraphs are concise summaries of the key points for recent guidance documentation.

Human Health Risk Assessment Guidance

In order to streamline the corrective action process at Navy/Marine Corps sites and ensure efficient, consistent protection of human health, DON is developing a written Human Health Risk Assessment (HHRA) guidance for use by RPMs. The draft guidance, published in August 2000, provides a general overview of the issues surrounding human health risk assessment; summarizes the regulatory requirements, goals, and standard three-tiered approach; covers risk communication and risk management for conducting HHRAs, and provides detailed information for managing, planning, designing and effectively communicating HHRA results.

Bioavailability Guidance

Naval Facilities Engineering Service Center (NFESC) recently published guidance on incorporating bioavailability considerations into human health and ecological risk assessments. Part I of the guidance, *Overview of Metals Bioavailability* explains the concept of bioavailability; provides examples of situations in which bioavailability studies are useful and feasible; describes test methodology and steps for bioavailability assessment; and summarizes metal-specific bioavailability information for metals most commonly found at DON sites. Part II, *Technical Background Document for Assessing Metals Bioavailability* contains in-depth technical information for professionals who design and perform bioavailability studies. Study guidelines, data collection methods, special considerations for specific metals, as well as standard operating procedures and suggested study protocols are provided for reference.

RAO/LTM Guidance

In January 2000, the RAO/LTM group completed the "Guide to Optimal Groundwater Monitoring." The guide was written to help RPMs and contractors gain an understanding of steps they can take to optimize groundwater monitoring programs. A similar guide for RAO optimization will be available January 2001. Both guides have been developed based on lessons learned from optimization case studies conducted by the workgroup. The case study reports and guidance documents are posted on the workgroup's website (***http://erb.nfesc.navy.mil*** - Navy Support - Work Groups - RAO/LTM).

Administrative Records Guidance

In FY 2001, the Administrative Records workgroup will publish an updated version of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Administrative Record Management System (ARMS) User's Guide, a step-by-step manual for converting paper documentation to digital format for official record keeping purposes under CERCLA. The current version is available on the web (***http://erb.nfesc.navy.mil*** - Navy Support – Work Groups - Administrative Records Management System (ARMS)) and in printed form (NAVFAC publication UG-20-24-ENV).

Ecological Risk Assessment Guidance

To ensure efficient, consistent protection of the environment, DON has developed draft final ecological risk assessment (ERA) guidance for use by Remedial Project Managers (RPMs). The ERA guidance stresses a three-tiered approach for conducting scientifically defensible ecological risk assessments, as outlined in the CNO policy. The guidance provides RPMs with additional tools to make ERAs more flexible and accurate. Beta-testing has been completed on the draft final guidance, and the document will be finalized in FY 2001.

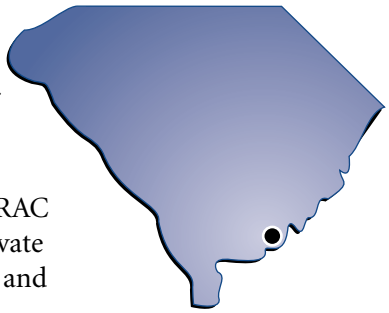
Background Technical Guidance

For remediation purposes, "background" refers to the concentrations of chemicals found at a site that are either (1) naturally occurring or (2) manmade but unrelated to Navy/Marine Corps operations. Information about background conditions can help in establishing site-related human health risks, threats to the environment, requirements for regulatory compliance, and alternative site remediation strategies. In addition, background analyses help to set reasonable remediation target goals. By fostering a higher degree of accuracy in site assessment, background studies create the opportunity to save money on unnecessary cleanup measures and speed up the transfer of remediated property to the public sector.

SMART Contracting

DON depends on innovative contracting methods to improve the speed, cost-effectiveness, and overall efficiency of cleanups. Below are recent examples of innovative contracting vehicles and strategies employed by the IR Program.

Innovative Fixed Price Contract to Accelerate Cleanup Charleston Naval Complex, SOUTHDIV



The Navy recently awarded a contract that promises to provide an innovative approach to accelerating environmental cleanup and transfer of the Charleston Naval Complex (CNC) in South Carolina. Private sector experience has shown that properties may be remediated, transferred, and redeveloped more quickly and at lower cost than has taken place at most BRAC facilities. The primary reason for this is the availability of incentives for private industry that enable improvement of property value through development and cleanup commensurate with that development.

In order to take advantage of these private sector methods, the Navy is outsourcing the CNC cleanup under a fixed price contract secured by indemnification provided by the contractor. Under the terms of the agreement, a private firm will take over almost full management and responsibility for the base cleanup. Insurance is provided by corporate assets and the insurance industry. This landmark contract represents the first use of these methods for cleanup of DoD property of this size and complexity.

The Chief of Naval Operations' Environmental Protection, Safety and Occupational Health Division requested that SOUTHDIV implement this approach at CNC. CNC was closed under BRAC III in February 1995, and is nearing completion of the investigation and characterization of all sites. The extensive investigation reduced the probability of unknown contamination problems, and therefore made a fixed price contract with indemnification plausible.

The contract was awarded in February 2000 to the joint venture of CH2M Hill/J. A. Jones. This indemnified contract is the first of its kind in environmental contracting.

The indemnification for the fixed price contract consists of several elements:

- **Self-Insured Retention (SIR):** The amount of liability the contractor is willing to assume above the total remediation price if the total costs exceed that price.
- **Cost Cap Coverage (CCC):** If the SIR is exceeded, the cost cap coverage (CCC) would pay for any further investigative or remedial costs of known and unknown contamination.
- **Pollution Legal Liability (PLL):** This element would pay claims from exposure to site contaminants or damage to personal property during the life of the contract.

Indemnification provides assurance for the Local Redevelopment Authorities (LRA) that all remediation will occur in a timely manner, and also protects the LRA as subsequent property owner from liability as a result of exposure to contaminants.

This assurance is more evident than the covenants provided under CERCLA, and provides incentives for the LRA to accept a transfer with cleanup in progress and pursue earlier redevelopment opportunities with assistance from a willing contractor. The indemnification can be structured in many ways, depending

on the degree of risk the contractor is willing to assume, the limits of liability the property holder is willing to accept, the premiums the insured are willing to pay and the duration of the coverage.

Regulatory Requirements/Community Involvement

The idea of assuming responsibility for elements of the Navy's environmental restoration program is attractive to private industry given the potential profit from an inherently more efficient approach. Private industry is typically more direct with regulatory agencies, which may result in higher legal costs but lower characterization and remediation costs. The efficiency is more evident in cases where the contractor has control over the disposition of the property, thereby allowing remediation to be designed specifically to manage environmental risks consistent with the actual reuse and development. To a large extent, disposition of property under BRAC is controlled by Local Redevelopment Authorities (LRAs), which eliminates the strength in control and delegates the role of the contractor to a mediator in bringing developers and LRAs together. If the risks are sufficiently small, the contractor has the option of increasing the self-insured retention in order to increase the potential profit margin.

Limitations of Method

Indemnification is not a complete solution to environmental cleanup. Some risks are not insurable, particularly those where the extent of contamination is not well defined or where multiple parties may be responsible for contamination sources. Contaminated sediments in industrialized rivers and estuaries are often excluded from insurance policies due to the potential for liability from continued contamination. Radiological contamination, which has proven difficult to remediate and presents a higher degree of uncertainty in cost, is also excluded. Releases occurring from tenant or lessee operations after contract award are typically excluded unless the insurer is able to dictate the types of chemicals or processes used in the post-Navy operations. One challenge for the Navy will be to determine the appropriate amount of indemnification that is not transferable given the legal liability and the probability of post-remediation contamination being discovered.

Primary objectives of the CNC contract include the following:

1. Make all real property and facilities suitable for deed transfer to the Charleston Naval Complex Redevelopment Authority (CNCRA) by October 2001
2. Obtain regulatory approval for site close-out of each contaminated site
3. Obtain regulatory approval for termination of the RCRA Part B permit
4. Ensure day-to-day contractor compliance with all laws and regulations applicable to the completion of work

To provide incentives for timely transfer and complete remediation during the 20-year contract term, a five percent retainer is held until all sites are ready for transfer and another five percent is retained until site closeout is achieved at all sites.

Cost Avoidance Measures

Although the legal liability under CERCLA and RCRA cannot be transferred, the indemnification option allows the Navy, depending on the limits of the liability chosen, to transfer all or a portion of the financial liability to the private contractor and insurer. This ensures completion of the cleanup at a fixed cost to the Navy.

Project Successes

- The Navy benefits from a significant reduction in cleanup cost obligations and is buffered from future environmental liabilities
- CNCRA is assured of an accelerated cleanup that will allow them to meet their goals for long-term property use, creation of new jobs, and new tax revenue
- Insurance policies protect potential developers from the risk of remediation delays and will encourage quicker conversion of the property to productive new use
- The community is guaranteed that if new contamination is discovered, the situation will be quickly resolved
- The project demonstrates the Navy's commitment to the environment and interest in seeing BRAC facilities quickly returned to positive use

Lessons Learned

The prevailing philosophy has been that the government must retain all risk and liability as property owner and permittee. With the expected success of the CNC project, it appears that the fixed price indemnification contract may be an effective vehicle for accomplishing restoration, accelerating property transfer, and fixing the cost for the government for certain sites. As investigation and characterization of more DoD industrial sites approaches completion, the uncertainty of the cost to remediate such sites is reduced—which in turn makes the sites more attractive to the insurance industry as a reasonable liability to accept through environmental restoration contracts.

Broad Agency Announcement

The Broad Agency Announcement (BAA) program was developed by the environmental department of the Naval Facilities Engineering Service Center (NFESC) as a streamlined contract mechanism that gives Remedial Project Managers (RPMs) at the Engineering Fields Divisions and Activities (EFD/As) access to innovative environmental technologies and new methodologies from contractors. The technologies and contractors are pre-screened and evaluated by NFESC, providing the EFD/As the ability to acquire environmental services without developing an extensive scope of work or sending out sole source/ competitive solicitations. Contractors with new technologies or cleanup methods submit abstracts explaining the merits and objectives of their offerings on a web-based submission form (***http://erb.nfesc.navy.mil/***). Abstracts are evaluated by technical experts, and the abstracts that meet BAA criteria are included on the Defense Environmental Information Exchange (DENIX) web site (restricted to Federal Government employees) (***http://www.denix.osd.mil/denix/DOD/News/Navy/BAA/technologies.html***). The goal of the BAA program is to discover more efficient methods of site remediation than currently available technologies.

SMART Cleanup and Sampling Technologies

DON is constantly seeking new technology that will enable site restorations to take place faster, consume less energy, and provide better results at lower cost. The Naval Facilities Engineering Service Center (NFESC), and SPAWAR Systems Center San Diego (SSC SD) spearhead this effort through the Engineering Field Divisions and Activities, researching and demonstrating new remediation methods that could prove useful for DON installations.

Site Characterization and Analysis Penetrometer System

Remediation of Non-Aqueous Phase Liquids (NAPLS) and Dense Non-Aqueous Phase Liquids (DNAPLs) can be a difficult process. Lack of accurate information about the precise location of contaminants at a given site, and the way in which contaminants are distributed in the soil (free phase, dispersed microglobules, adsorption to soil particles), can result in ineffective remediation strategies.

SCAPS truck.

To better characterize NAPL and DNAPL sites, SSC SD is exploring the use of Site Characterization and Analysis Penetrometer System (SCAPS) at Navy/Marine Corps IR sites. SCAPS involves using a direct push sensor probe that combines a laser-induced florescence (LIF) sensor with a video imaging system. When inserted into a potentially contaminated ground area, the LIF sensor causes polycyclic aromatic hydrocarbons (PAHs) to emit light. The video imaging system collects high-resolution images of soil in contact with the probe, providing direct visual evidence of any PAH compounds present. This evidence allows IR site personnel to accurately focus their remediation efforts.

Rapid Sediment Characterization Tools

Detailed site investigations at DON sediment sites require extensive sampling and subsequent laboratory analysis for both metal and organic contaminants. However, traditional sampling and analysis methods do not always provide all the information necessary to support the risk assessment process in a cost and time-effective manner. Samples are often collected without prior knowledge of the nature and extent of contamination, and the high cost of laboratory analysis can limit the number of samples taken. Therefore, zones of contamination can sometimes be missed or incorrectly estimated.

To improve this process, SSC SD is making Rapid Sediment Characterization (RSC) tools available for use at DON marine sediment sites. RSC tools use real-time or near real-time screening techniques to quickly determine the extent, physical characteristics and/or biological effects of contamination. When balanced and supplemented by standard, certified analysis, RSC tools can streamline many aspects of the ecological risk assessment process, delineating areas of concern, filling in information gaps, and assuring that expensive certified analyses have maximum impact.

RSC technologies demonstrated and/or currently available at DON marine sediment sites include the following:

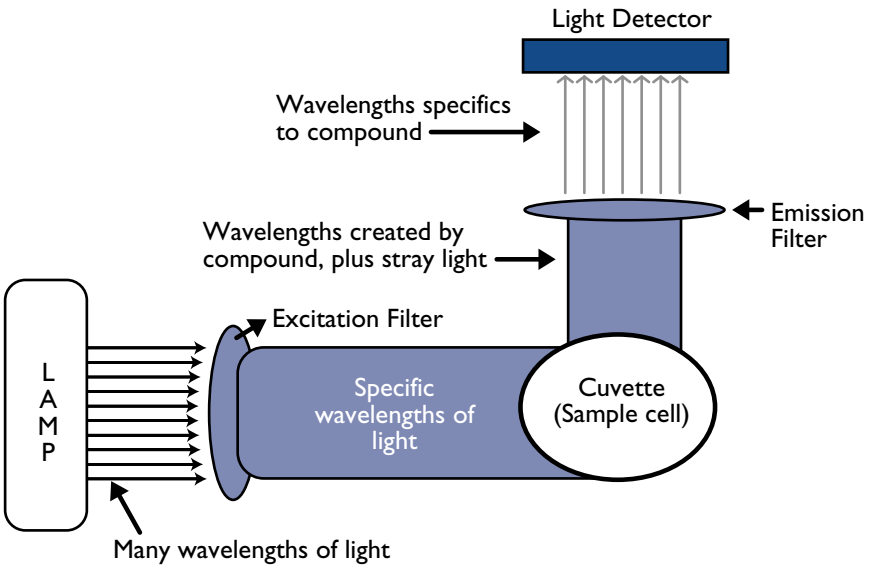
X-ray Florescence Spectrometry (XRF)

This technique measures the florescence spectrum of x-rays emitted when metal atoms are excited by an x-ray source. The detected energy of emitted x-rays reveals the identity of metals in the sample, and the intensity of emitted x-rays is related to metals concentration. XRF can analyze a wide range of elements, and can detect concentrations from parts per million to percent levels. Field portable XRF (FPXRF) units can be calibrated in numerous ways, can provide near real-time measurements with minimal sample handling, and allow for extensive, semi-qualitative analysis on site. FPXRF has been certified by the U.S. EPA as a field screening method for metals in soils.

X-ray bench

UV Florescence Spectroscopy (UVF)

This screening method is based on the measurement of florescence observed following excitation of organic solvent extracts of sediments. In general, the method is used to measure fluorescent organics (especially Polycyclic Aromatic Hydrocarbons, or PAHs), though some care must be taken to reduce signals from natural organic compounds that fluoresce. In order to achieve detection limits appropriate for benchmark criteria, UVF measurements must be made on solvent extracts rather than directly on the wet, solid sediment sample. Solvent extraction requires additional time, therefore requiring up to half an hour for total analysis. Detection limits range from one part per million (ppm) to five ppm total solid-phase PAH.



UVF spectroscopy diagram

Immunoassays

An immunoassay is a technique for detecting and measuring a target compound through use of an antibody that binds only to that substance. Quantification is generally performed by monitoring solution color changes with a spectrophotometer. The technology can be used to measure concentrations of a variety of organic contaminants including polychlorinated biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs) and organic pesticides. Detection limits range from hundreds of parts per billion (ppb) to low ppm levels (3,4).

Laser Particle Scattering

Laser Particle Scattering uses small-angle laser scattering to obtain the size distribution of particles suspended in water, and the presence of fine-grain particles often suggests the presence of contaminants. The system records the intensity distribution of light scattered by particles, enabling grain particle concentration and size spectrum to be detected.

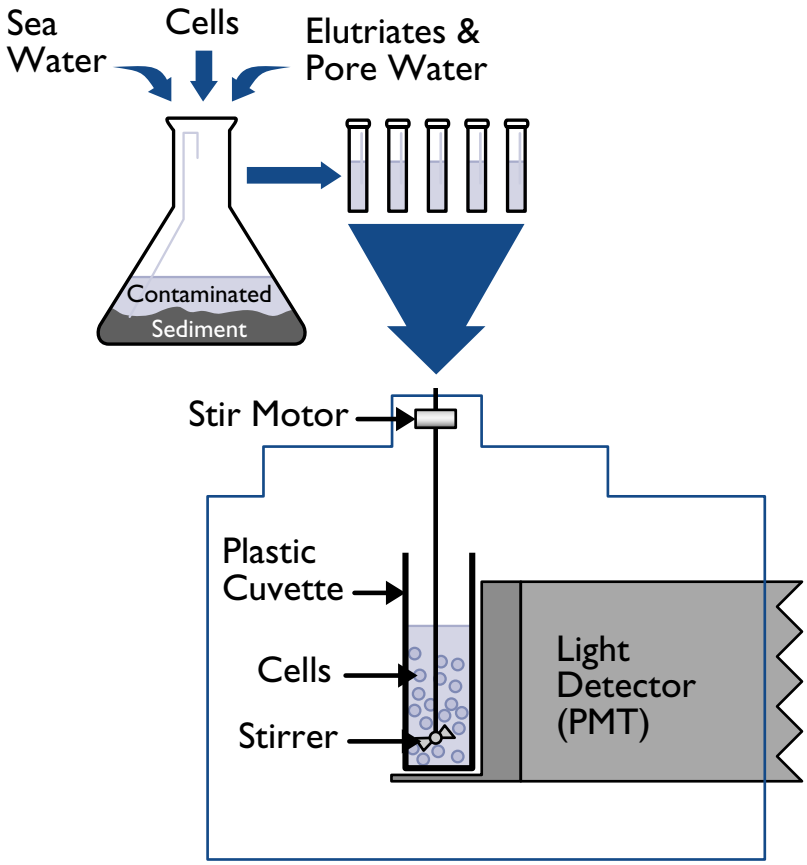
Commercial instruments are available for making measurements on-location (submersible), in the laboratory, on the manufacturing line, or in a small boat. This information can help to delineate contaminated areas. Also, particle grain size can be used to normalize other measurements and sometimes predict when bioassays may be ineffective due to confounding factors.

IR Moisture Analyzer

Moisture content measurements can be made quickly in the field or laboratory using commercial infrared drying instruments. Measurements are typically made by spreading a five-gram sample of wet sediment on an aluminum sample dish, placing it in an analyzer, weighing it, drying the sample, and then re-weighing the sample. Drying time is typically five to 15 minutes. These results are used for conversion of data from wet weight to dry weight and for comparison with benchmarks and reference values. In some cases, percent moisture can be used as an approximation of grain size.

QwikSed Bioassay

The Qwiklite and QwikSed bioassays measure the inhibition of light emitted by marine bioluminescent dinoflagellates (e.g., *Gonyalux polyhedra*) exposed to a test solution of effluents, elutriates, or sediment pore waters. Any decrease in light output relative to controls suggests bioavailable contaminants or other stressors. The bioassays are capable of measuring a response within 24 hours of test setup and can be conducted for a standard four-day acute test or a seven-day chronic test. QwikSed can be used to evaluate sediment toxicity. If the contaminated sediment is found to require cleanup, QwikSed can be used to assess the toxicity reduction following the cleanup effort.

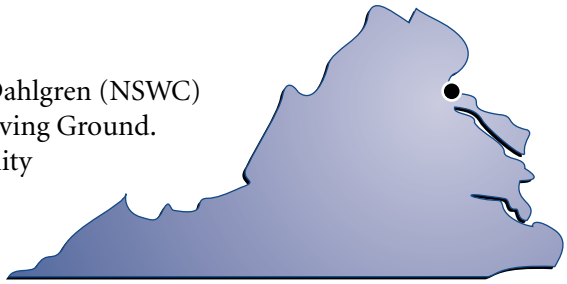


QwikSed Diagram

SMART Cleanup Success Stories

Landfill Cap Protects Environment

NSWC Dahlgren, EFA CHES



Naval Surface Warfare Center Dahlgren (NSWC) started in 1918 as the Naval Proving Ground. Through World War II, the facility proofed and tested major naval guns and projectiles. Today, the 4,319 acre base provides research, development, test evaluations, engineering, and fleet support for surface warfare and surface ship combat systems, ordnance, special warfare and strategic systems.

Legacy Landfill

Site 9 landfill

Site 9 contains an inactive landfill that was used as a Disposal Burn Area from the 1930s to the 1980s. Located on the shore of Gambo Creek, the 12.3 acre site also includes a marsh area cap and a dead-end channel where the creek was converted from a tidal open water creek to a tidal wetland marsh as a result of filling operations. During the landfill's use, some existing surface water areas also became wetlands. Portions of the marsh area were identified as containing buried waste and contaminated sediment, and were designated as sanitary landfills under North Carolina State Codes.

Sampling Conducted

Soil, groundwater, surface water and sediment samples were collected and analyzed to determine the nature and extent of Site 9 contamination. Exploratory trenches were dug and soil borings conducted to establish upgradient and wetland waste limits. The contaminants in the various media included semivolatile organics, metals, pesticides and ordnance.

RAB Involvement

The NSWCDL Restoration Advisory Board (RAB) includes members of the local community, Navy, EPA Region III and the Virginia Department of Environmental Quality. The Navy briefed RAB members before, during and after the project. Regulators were briefed during regularly scheduled "partnering" meetings, where project status and issues were discussed. The partnering process helped to resolve issues quickly, minimizing the potential for construction holdups.

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

Remedy in progress

The Remedy

The remedy selected involved four major components:

- Landfill cap
- Marsh cap
- Slurry wall
- Shoreline protection

Woven geotextile marsh cap

The upland landfill cap was designed to exceed sanitary landfill design requirements (i.e., slopes, permeability, drainage and thickness) due to the close proximity of Gambo Creek and ecological receptors. Ecological impacts were also considered in the design of the downgradient marsh cap. The marsh cap was designed as a flat zone to enhance recharge, rather than an impermeable barrier that would promote runoff. Woven geotextile was used to cap the waste and ensure constructability of the marsh cap. Shoreline protection was provided by gravel-bound reno mattresses at the perimeter of the marsh cap to help secure the geotextile and prevent exposure and damage from storm tidal surges. An upgradient slurry wall was constructed to redirect groundwater movement around the capped landfill. The slurry wall was keyed in to the clay confining unit, at least two feet below the site.

Regulator Concerns

Major issues discussed with regulators included the characteristics of the geotextile, reno mattresses and drainage layer outlets. Adjustments were made in the field to incorporate the latest field information with the most optimal materials and construction methods available. Due to the soft marsh sediments, a crane was used to place sediments in the backwater channel without using an excavator. Explosive Ordnance Disposal (EOD) coordination was required to remove over 1,200 pieces of inert and live ordnance from the site. In late summer of 1999, Hurricane Floyd delivered 11.9 inches of rain in a 36 hour period, testing all aspects of our stormwater controls. Inspection after the storm showed minimal damage to the remedial site.

Cost Avoidance

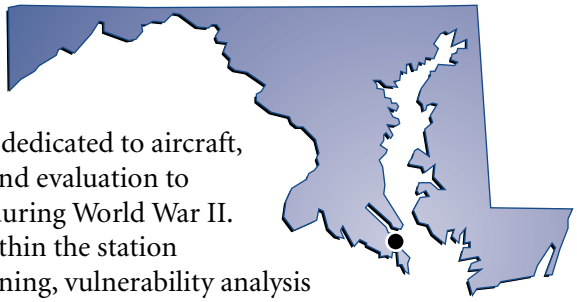
As a result of using an experienced contractor, effective oversight, partnering, and a normally dryer season, the $3 million project had a cost avoidance of $150,000. A portion of this savings was used to remediate other sites, and the remaining funds are being used to build additional tidal wetlands in the sediment basin and offset overall Site 9 wetlands loss.

Cap Complete

The landfill cap was completed November 1999. The sediment basin is in the process of being converted into a tidal wetland upon full vegetation establishment on the cap.

Vegetated Soil Cover Creates Future Recreation Space

NAS Patuxent River, EFA CHES



Naval Air Station (NAS) Patuxent River was commissioned on April 1, 1943, dedicated to aircraft, weapons and ordnance testing and evaluation to support the Navy's capabilities during World War II. Over the years, new divisions within the station eventually took on test pilot training, vulnerability analysis of enemy aircraft, radar and aviation electronics development, and research into Navy-specific takeoff and landing technology. With the standup of the NAWC Aircraft Division at the station in 1992, the facility now serves as the Navy's full spectrum research, development, test and evaluation (RDT&E), engineering, and fleet support center for air platforms, including flight simulation, pilot training, aircraft acoustics, and numerous other specialties.

Disposal Areas

Fishing Point Landfill and the Rifle Range Landfill are located in the north-central part of Naval Air Station (NAS) Patuxent River, near the river and west of Harper's Creek. Fishing Point Landfill consists of about 23 acres covered by sparse grasses and small trees, and was used to dispose of liquid and solid wastes generated by the station between 1960 and 1974. Rifle Range Landfill is approximately two acres of flat, sparse grasses with a steep slope on the west side, and was a disposal site for trash and construction debris from the mid-1950s until 1960. Previously, Fishing Point was a thriving recreation spot, known for its beach shoreline, swimming, fishing and hunting. Due to beach erosion and environmental concerns resulting from the landfill, Fishing Point was later closed to the public.

Action Team

A partnering team was formed, consisting of members from NAS Patuxent River, Environmental Protection Agency (EPA) Region III, Engineering Field Activity Chesapeake, and the Maryland Department of the Environment (MDE). This group, known as the Patuxent Installation Restoration Action partnering team, worked together with the Restoration Advisory Board (RAB) to develop the cleanup remedy and reuse plan for the site.

Keeping Citizens In the Loop

Community involvement was critical in selecting the final remedy. During a public meeting and comment period, the community was encouraged to provide the Navy feedback on the possible cleanup alternatives. Navy considered these comments before plans were finalized.

Soil Cap Solutions

The remedy chosen was a vegetated soil cover for each landfill, in order to minimize human and wildlife contact with the landfill contents. Stabilization measures would be incorporated along the western shoreline of Fishing Point Landfill, preserving habitat along the shoreline and maintaining access to the western beach. Stringent health and safety requirements consistent with Occupational Safety and Health guidelines would be implemented to protect site workers, station personnel and residents.

Recreational Reuse Options

Since these measures would contain the landfills and ensure safe access to the former recreation areas, the partnering team developed a site plan to build more access roads, parking areas, beach access walkways and camp sites to allow convenient and versatile use of the land as a recreational area.

ROD Signed

Captain Paul Roberts, Commanding Officer of NAS Patuxent River, and Abraham Ferdas, Director of Hazardous Waste Cleanup for EPA Region III, signed a Record of Decision (ROD) for the cleanup sites on February 8, 2000. The ROD details the remedial action chosen by the Navy and EPA, with the concurrence of MDE. Community responses received during the public comment were included as part of the ROD. Roberts and Ferdas gathered with NAS Patuxent River and EFA CHES environmental personnel, EPA representatives, and community members from the Patuxent River RAB for a site tour and signing event.

ROD signing, February 8, 2000

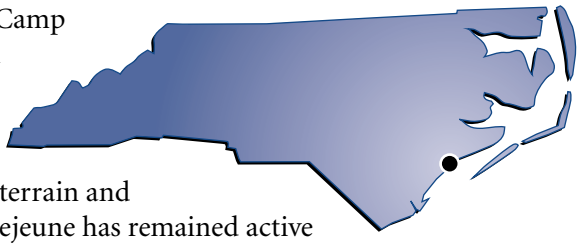
Work in Progress

Construction of the vegetated soil covers for both landfills began in the spring of 2000. Completion is expected by March 2001.

For more information about the project, access http://nas.nawcad.navy.mil/environmental.

DON Demonstrates Innovative SEAR Technology

MCB Camp Lejeune, LANTDIV



Marine Corps Base (MCB) Camp Lejeune, Jacksonville, North Carolina was founded in 1941 as a home training base for Marines. With over 11,000 acres of diverse terrain and fourteen miles of beaches, Lejeune has remained active over the years as a training ground for amphibious operations to support warfighting, peacekeeping actions, and noncombatant evacuation exercises. The base is home to an active duty, dependent, retiree and civilian employee population of nearly 150,000 people. The base generates $2 billion in commerce each year, coming from payrolls and contracts to support the structure required to train and equip modern Marines.

Dry Cleaning Solvents

The storage and past disposal of tetrachloroethylene (also known as perchloroethylene, or PCE), a standard dry cleaning solvent, as well as Varsol™, an older petroleum distillate-based solvent, led to contamination of Site 88 at MCB Camp Lejeune. Both of these contaminants are chlorinated solvents. Although many methods exist for cleaning up chlorinated solvents, effective treatment is often limited by the presence of Dense Non-Aqueous Phase Liquids (DNAPLs). DNAPLs produce elevated concentrations of contaminants, and because they are denser than water, they pose the added risk of downward migration of solvents into underlying aquifers. DNAPLs can also become bound in soil pores and can therefore be difficult to remediate. As a result of the DNAPL solvent contamination in soils and water within Site 88, MCB Camp Lejeune and LANTDIV sought alternative, more effective means for cleaning up the site.

The Technique

With sponsorship from the Department of Defense Environmental Security Technology Certification Program (ESTCP), Naval Facilities Engineering Service Center (NFESC) performed field validations on a new technology known as SEAR, or Surfactant-Enhanced Aquifer Remediation. SEAR involves injecting a surfactant (essentially a detergent) solution into the soil and groundwater to increase the solubility of the solvents. The solvents can then flow to extraction wells, where they are collected and removed from the site.

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

Test Site Chosen

NFESC worked with LANTDIV to select MCB Camp Lejeune as a potential site for testing the SEAR technology. Before beginning the project, NFESC and LANTDIV informed the Restoration Advisory Board (RAB) and the local community about the project objectives. A technology demonstration plan was presented to the regulators, and a special tour of the contaminated site was organized prior to the demonstration.

Positive RAB Relationship

The RAB at MCB Camp Lejeune includes representatives from Naval Facilities Engineering Command (NAVFAC), EPA, the North Carolina Department of Environment, Health and Natural Resources, DON's RAC and CLEAN contractors, and members of the local community. The base enjoys a very good working relationship with the RAB.

Test Conducted

During the test, research engineers injected a solution of surfactant, isopropyl alcohol, and calcium chloride through the DNAPL-contaminated shallow aquifer zone. The injection continued for 58 days. Water flooding occurred before and after the injection, making the surfactant flooding period last a total of 143 days.

Results

The surfactant solution significantly enhanced the solubility of the PCE, and allowed the contamination to flow to the extraction wells as expected. PCE concentrations at the extraction wells measured up to 2,800 mg/l-much higher than PCE's standard water solubility of approximately 240 mg/l. The demonstration treated more than 100 cubic yards of contaminated soil and groundwater , or an aquifer pore volume of about 6,600 gallons. The technology demonstrated that SEAR is capable of removing DNAPLs from high permeability soils. DNAPLs trapped in low-permeability soils at MCB Camp Lejeune were not removed by SEAR. The technology also successfully recycled and re-injected the surfactant solution, proving that chemicals can be effectively reused in the process. When scaled up for larger projects, recycling the surfactant can yield significant cost avoidance.

Navy Optimizes Plume Monitoring

NAS Brunswick, NORTHDIV

Naval Air Station (NAS) Brunswick is located within the town of Brunswick, Maine, five miles inland from the Atlantic Ocean. The 7,259 acre station was first commissioned in April 1943, and its current mission is to provide facilities, services, materials and aircraft for submarine warfare.

Pump and Treat Cleanup

The "eastern plume" at NAS Brunswick has been attributed to past solvent disposal practices at three Installation Restoration (IR) Program sites. The plume primarily contains chlorinated organic compounds, including trichloroethene (TCE), perchloroethene (PCB), and 1,1,1-trichloroethane (TCA). In 1998, a final Record of Decision (ROD) was signed for the remediation of the plume by extraction and treatment (pump and treat). The plume is currently in the Remedial Action Operation phase of the IR program.

Extensive Remediation/Monitoring System

The remediation system consists of six extraction wells, a clarification/filtration unit, and an ultraviolet chemical oxidation system for destruction of volatile organic compounds (VOCs). Another important part of the system is the network of monitoring wells located within the plume and along its boundaries. These wells are used to monitor the progress of remediation and to notify the Navy if the plume migrates toward critical boundaries.

Ultraviolet chemical oxidation unit

Data Review/Geostatistic Analysis

The original groundwater monitoring network consisted of 36 wells that were sampled on a tri-annual basis, and samples were analyzed for the entire spectrum of VOCs and metals. The annual cost for the monitoring program were approximately $500,000. The project team, consisting of representatives from Northern Division (NORTHDIV), NAS Brunswick, EPA Region I, and the Maine Department of Environmental Protection (MEDEP) reviewed data from monitoring reports and the result of a geostatistical analysis of the monitoring data to evaluate the monitoring program. The team determined that some of the monitoring points were providing redundant and predictable data, and that the program should be optimized to reduce unnecessary costs.

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

The project team met for three days to review the data trends at each sampling location. If no purpose could be identified for a given based on historical data, the well was eliminated from the program. In addition to the redundant monitoring data detected by the geostatistical analysis, the analysis identified some areas where data gaps existed.

Using the Data Quality Objectives (DQO) process and the results of the geostatistical analysis, the team was able to streamline the monitoring program. Changes include the following:

- Monitoring reduced from three to two times per year
- Number of monitoring wells reduced from 36 to 22, including the addition of five new wells where data gaps were identified
- Reporting was streamlined:
  - Semi-annual reports contain monitoring data only
  - Annual reports contain discussion of contaminant trend analysis, reducing comment and comment resolution time
  - Reports are delivered on CD-ROM, reducing hard copies from 23 to 5
- Analysis and reporting was reduced to seven VOCs and metals of concern

Building Trust With RAB/Regulators

Regulatory involvement was part of the optimization process from the very start. The regulatory partners were invited to attend geostatistical training along with the Navy, which fostered familiarity and trust with the process. Likewise, mutual trust was developed within the team during the three-day DQO meeting. By the end of the meetings, there was a common understanding that the goal was not to cut corners in the program, but to minimize unnecessary data collection and reporting and to streamline the program. The Restoration Advisory Board (RAB) was regularly informed of the process, and the team promptly addressed any concerns from the local community. This team effort resulted in a stronger partnership between the Navy, regulators and the public.

Mere Brook, downgradient of plume. Water/vapor analysis confirms that no contaminants are migrating to the stream.

Cost Avoidance

Streamlining of the monitoring program at NAS Brunswick resulted in an annual cost avoidance of 50%, totaling $250,000 per year.

Thermal Desorption Remediates Creek Site

NAF Adak, EFA Northwest

From World War II through 1997, military operations were conducted on Adak Island, a small island within Alaska's Aleutian Island chain. As a result of these operations, some areas of the island became contaminated by hazardous substances. The U.S. Environmental Protection Agency (EPA) placed the former Naval Air Facility (NAF) Adak on the National Priorities List (NPL) in 1994. This action made cleanup of contamination on Adak a national priority. Under the Defense Base Realignment and Closure Act (BRAC), the military mission of NAF Adak ended in 1997. Since that time, the Navy has been involved in environmental cleanup, restoration, and closure activities to allow for the eventual lease and transfer of Adak for use by The Aleut Corporation (TAC).

Quick Start Cleanup

Sweeper Creek was selected for remediation because some of its sediments had been contaminated with polychlorinated biphenyls (PCBs) and petroleum hydrocarbons that had entered the creek. The Navy's CLEAN contractor prepared a cleanup work plan for removal and treatment of the impacted sediments on March 15, 1999. Work began the same day.

Excavation Challenges

Two sections of Sweeper Creek were targeted for cleanup. Each section was about 30,000 square feet in area, and each was to be excavated to remove the contaminated sediments. Excavation of the creek bed required construction of dams above and below each work area, so that water could be diverted from the creek channel. In addition, the work areas themselves had to be dewatered as much as possible before excavation to minimize resuspension and transport of the PCBs. Once the creek bed was dewatered, the impacted sediments were excavated with standard earthmoving equipment. A local Anchorage, Alaska contractor handled the earthmoving assignment with equipment it already had stationed at Adak.

Dams built for temporary water diversion

Creek bed excavation

As excavation proceeded, testing was conducted periodically to determine PCB levels in the remaining creek bed sediments. Excavation was halted when the tests showed PCB concentrations below 1 part per million remaining. The two excavations removed 5,392 cubic yards of contaminated sediments.

Thermal Desorption Used

The contaminated sediments were treated by thermal desorption, which involved feeding the contaminated soil into a rotary drum and heating it to approximately 700 degrees F. Some of the desorbed volatile organic compounds (VOCs) were used to fuel the burner, while the others "cracked" into low-boiling-point hydrocarbons. The hydrocarbons were exhausted to an after-burner, where temperatures above 1,500 degrees F destroyed them with an efficiency of 99.99 percent. In this way, thermal desorption reduced concentrations of petroleum hydrocarbons and PCBs to an environmentally safe level. Treatment of the excavated sediments from Sweeper Creek was concluded on November 12, 1999. The treated sediments were used on the island as daily cover for Roberts Landfill.

Thermal treament unit

Following successful excavation of the contaminated sediments, the creek bed was backfilled with clean material, recreating the original gradient and contour of the creek bottom. Once the creek bed was backfilled and contoured to match its original condition, the diversion dams were removed, allowing Sweeper Creek to flow unrestricted again in a newly restored, clean creek bed.

Regulator/Developer/RAB Involvement

Other agencies and organizations involved in the cleanup include the U.S. Environmental Protection Agency (EPA), the Alaska Department of Environmental Conservation (ADEC) and the Adak Reuse Corporation, which has responsibility for planning future uses for the island. In addition to these groups, a Restoration Advisory Board (RAB) was formed to provide a link between the community and the cleanup team. Members of the board come from the local Adak community, the EPA, and EFA Northwest.

Other Remediation Nears Completion

The cleanup of Sweeper Creek was only one of many cleanups conducted at NAF Adak. Numerous areas of NAF Adak's 77,000 acres were contaminated with petroleum hydrocarbons, hazardous chemicals, solid waste, and unexploded ordnance. After expenditures of nearly $200 million, oil and chemical contamination on NAF Adak has been almost completely remediated. Once the cleanup is complete, Navy will transfer the base to the U.S. Department of Interior (DOI). The DOI will exchange land on Adak for other lands held by The Aleut Corporation.

The successful cleanup and restoration of Sweeper Creek represents a major step in helping the Navy achieve its goal of cleanup and transfer of the former NAF Adak.

Sweeper Creek, restored

Innovative Leasing Agreement Expedites Reuse

NAS Agana/TTE, PACDIV

The Tamuning Telephone Exchange (TTE) fronts Marine Drive, the main commercial thoroughfare in Tamuning, Guam. TTE was used by the Navy as a central telephone office for NAS Agana and other naval activities. This prime commercial facility became available when closure of NAS Agana under Base Realignment and Closure (BRAC) III actions eliminated the need for TTE.

The Officers Family Housing Area (OFHA) is located on 88 acres in the western portion of Naval Air Station (NAS) Agana. The former housing units are situated at the top of the Tamuning cliff band. This location permits spectacular panoramic views of Agana Bay and the Philippine Sea. The property is highly sought after due to the exceptional location of the facilities on the parcel.

Pacific Division worked closely with the Government of Guam's Local Reuse Authority (LRA) to identify these two Navy-owned properties for reuse under a leasing agreement. This lease agreement will allow the properties to be reused before transfer and deed documents are finalized. Both sites fit the reuse profile for immediate benefit to the local community and as revenue-generating ventures for the Government of Guam.

Prime Properties Become Available

In 1994, the TTE and OFHA were included on the Guam Land Use Plan (GLUP) '94 List, and were closed under BRAC IV as authorized.

Areas of Future Growth

The Navy's history with telephone service in Guam extends back to 1953, when the Department of the Interior and the Navy agreed to joint use of the Navy telephone system. Transfer of the TTE facility continues this tradition of providing telephone service to residents of Guam, and will enable Guam Telephone Authority (GTA) to meet its demands with the excess capacity from Navy facilities. The transfer is especially timely due to the explosion of Internet popularity; increased demands are being placed on existing telephone lines and many households are having second telephone lines installed to support Internet use. GTA is planning to use the onsite structures as a remote switching center, warehouse, and business office.

The OFHA is in high demand for planned exclusive, high-income residential use. Existing commercial structures, such as the old Navy Exchange, are suited for office space development due to their proximity to the Guam International Air Terminal.

Investigation and Cleanup

TTE has been used as a commercial facility in the past. The Navy conducted a remedial investigation at TTE to determine if the site was contaminated due to the presence of underground storage tanks (USTs) and battery storage areas. Clean closure was obtained for the UST sites and a limited removal action for lead contamination was completed in the battery storage area, before the parcel was made available for lease. Strong interaction between the Navy Remedial Project Managers (RPM) and regulators allowed for accelerated cleanup.

The investigation at the OFHA parcel concentrated on the potential presence of lead-based paint (LBP) on the existing structures and paint chips within the soil surrounding the structures. Public Works Center, Guam personnel completed a LBP survey and abatement, which resulted in the housing and surrounding property complying with residential reuse.

Leasing Option Preferred

To expedite return of these properties to the local community, the Navy pursued a leasing agreement with the Government of Guam. The lease agreement could be executed quickly and would result in earlier occupancy. Property transfer by deed will require more time to prepare legal documents. The leasing agreement enables interim operations on the TTE and OFHA parcels while deed language is being finalized and approved.

Cost Avoidance

Navy caretakers have been maintaining TTE and OFHA since the parcels were closed. By leasing the parcels to the Government of Guam, the Navy will realize savings in security and maintenance of the facilities. The TTE facility will enable GTA to handle overflow and expand telephone services without the outlay of significant capital expense, enabling GTA to pass these savings on to telephone customers. The homes and infrastructure (roads and utilities) for planned residential reuse of the OFHA parcel are already in place, which will result in lower redevelopment costs to the Government of Guam. This enables the Government of Guam to offer housing in a premium location at a competitive rate.

The transfer of TTE and OFHA parcels increases revenue potential for the Government of Guam. Cooperation between the Navy and the local community is essential to the economies in areas with multiple base closures. The cooperation between the Navy and the Government of Guam has helped reduce the impact of base closures on Guam's island economy.

Landfill and Seawall Cap Completed

former Naval Station Guam, PACDIV

The Orote Landfill Site is located in the former Naval Station (NAVSTA) Guam, in the Apra Harbor Complex on the southwest side of Guam. The complex completely surrounds both inner and outer Apra Harbor, from the Orote Peninsula on the southwest to the Glass Breakwater on the north. This is the only natural deep-water harbor on the island.

History

The Orote Landfill occupies approximately 9.4 acres of land on the southern portion of the Orote Peninsula. The landfill is located in a sinkhole and extends outward from the sinkhole to a cliff above the Philippine Sea. Approximately 150-200 feet of the landfill perimeter is located at the crest of the 45-foot high cliff bordering the Philippine Sea. The landfill was used from approximately 1944 to 1969 for the disposal of residential, industrial and construction wastes. The face of the cliff that surrounds the landfill was reportedly the most active disposal area. Flammable material was burned, and the ashes were buried on the cliff above the nearby cove. Nonflammable material was either buried behind the cliff or bulldozed over the cliff onto the beach. The beach contained a large amount of rusted metal and other debris. Erosion of the unstable cliff had been observed as a source of beach debris.

Contaminants at the site include metals, solvents, fuel hydrocarbons, polychlorinated biphenyls (PCBs), pesticides, asbestos from construction debris, and low levels of dioxins.

Extensive Cooperation

The Navy worked with EPA Region IX, Guam Environmental Protection Agency (Guam EPA), U.S. Fish and Wildlife Service (USFWS), National Oceanographic and Atmospheric Administration (NOAA), the U.S. Army Corps of Engineers, Guam Aquatic and Wildlife Resources, Guam Coastal Management Program, University of Guam, the Restoration Advisory Board (RAB), and PACDIV's CLEAN and RAC contractors to develop a remediation strategy.

Erosion Problems

The unprotected cliff was observed to have retreated approximately 34 feet at the crest due to wave erosion as of July 1997, creating the potential for exposed landfill materials to migrate to the Philippine Sea. Also, it would be necessary to stabilize the cliff before a landfill cap could be constructed. The design of a seawall was expedited to stabilize the cliff line.

Corrective Measures Considered

Five types of walls were evaluated, including various configurations of vertical concrete walls and revetment slopes armored with large boulders and concrete cubes. Of these alternatives, the armored revetment slope was chosen as the most favorable option.

Durable Seawall Design

The purposes of the seawall are to protect the site from further erosion, enable a landfill cap to be placed on the landfill, and to cap the landfill debris currently exposed on the cliff. A 100-mil thick High Density Polyethylene (HDPE) liner was provided in the design to prevent waves from coming into contact with landfill materials. The seawall was designed to withstand 100-year storms with wave heights of 40 feet, such as those that might be generated by large typhoons. The sizes of the concrete cubes, nine-ton and 24-ton, were selected based on scale model studies done by the Danish Hydraulic Institute. The size was selected to allow the seawall to sustain less than five-percent damage during a large storm. The base of the seawall, or toe, was designed using rock anchors.

Seawall constuction

The landfill cap design includes a low-permeability (40 mil PVC) liner and a vegetative layer designed to accommodate native plants and trees. A pilot test was begun in September 2000 to assess the effectiveness of this proposed revegetation effort, and the pilot test data is now being evaluated to determine which trees and plants will be the best options for revegetating the cap area.

Landfill cap liner installation

Project Nearing Completion

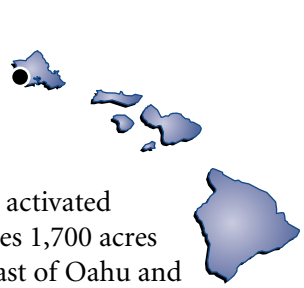
Construction of the seawall began in March 1999. The revegetation pilot test was completed in August 2000. The seawall rock anchors are currently being placed, and both the seawall and the landfill cap are slated for completion in 2001.

Landfill perimeter, pre-seawall

Seawall in place, 90% complete

SET Technology Demonstrated at Navy Site

NRTF Lualualei, PACDIV



Naval Radio Transmitting Facility (NRTF) Lualualei was activated in 1936 as a transmitting facility. NRTF Lualualei occupies 1,700 acres in Lualualei Valley, a large valley between the leeward coast of Oahu and the crest of the Waianae Mountain Range. The land surrounding the facility is predominantly rural, with numerous small farms. The nearest town, Maili is located on the coast approximately 1 mile west of the facility. NCTAMS Wahiawa and Naval Radio Transmitting Facility (NRTF) Lualualei are both a part of NCTAMS PAC. Today, Naval Computer Telecommunications Area Master Station, Pacific (NCTAMS PAC) operates and maintains communication facilities and equipment for Navy shore installations, and fleet units.

History

Remediation efforts on PCB-contaminated soil at various naval facilities led to the interest in demonstrating treatment technology that could address PCBs. In the past, the electrical power distribution networks used transformers insulated with oil containing PCBs. Transformers were annually tested to measure their insulative properties. Samples were taken from each transformer, tested, then poured on the ground near the transformer. After 1977, transformers containing PCBs were phased out from Navy facilities because their effects on humans and the environment were found to be harmful.

PCB Excavation Initiated

In 1998, excavation of PCB contaminated soil around the former transformer sites at Naval Computer NCTAMS PAC and the former Naval Air Station began. The excavated soils from the various transformer sites are being consolidated at NRTF Lualualei and on Navy retained land at the former NAS Barbers Point. There is also a third upcoming project to excavate PCB contaminated soil around former PCB transformer sites at Pearl Harbor Naval Complex. An Engineering Evaluation/Cost Analysis (EE/CA) is being prepared to evaluate various PCB treatment technologies where the treatment goal is 1 ppm PCB. The preliminary data from the treatment technology demonstration was used in the development of the EE/CA.

"Solvated Electron Technology" Demonstrated

An on-site demonstration of a PCB treatment technology was conducted at the NRTF Lualualei stockpile location in November and December of 1999. The demonstration was conducted in cooperation with the U.S. Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) Program. The Navy was responsible for the

SET demo in progress

design mobilization, and implementation of the innovative technology. EPA SITE Program will evaluate the effectiveness of the technology. The technology that was demonstrated was a dechlorination process technology called Solvated Electron Technology (SET). SET is a non-thermal, mobile treatment system which destroys halogenated organic compounds. Contaminated soil is mixed with a "SET solution" of anhydrous ammonia and metallic sodium. The chemical reaction removes halogenated ions from the PCBs and produces sodium chloride, sodium hydroxide and non-halogenated hydrocarbons.

Demo Primarily Successful

During the on-site demonstration of the SET technology, the vendor mobilized a 100 pound unit to the site. After system setup, the vendor began the demonstration of 50 pound batches from nine different transformer sites. To show consistency, there were three batches from each of the nine different transformer locations. During the demonstration, the vendor was able to achieve the treatment goal of 1 ppm in the beginning batches. As the soil type and concentration range changed, the results varied and started to be out of the treatment goal. The vendor was able to perform some modifications to the equipment out in the field to reduce the treatment time and to bring some of the treated soil within the treatment goal in most of the runs. The vendor was unable to complete all of the batches, as technical problems toward the end of the demonstration required demobilization of the equipment. Despite the various challenges that the vendor faced in adjusting the system operations to treat the Hawaiian soils, the demonstration was able to show that the technology is capable of achieving the cleanup goal of 1 ppm.

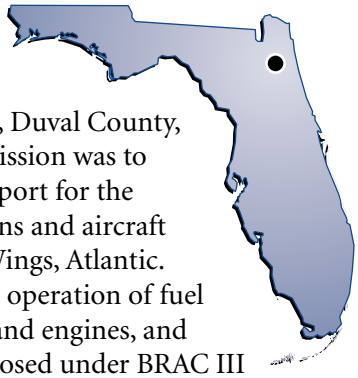
Ammonia sample collection

A follow-on treatment of some of the untreated batches and retreatment of some of the batches that did not reach the treatment goal was completed in August of 2000. The SITE evaluation of the technology will be published in September 2001.

Untreated soil (left) vs. treated soil (right)

Deep-Air Sparging Eliminates Solvents

NAS Cecil Field, SOUTHDIV



Naval Air Station (NAS) Cecil Field covers 31,366 acres in rural southwest Jacksonville, Duval County, Florida. Established in 1941, the facility's mission was to provide facilities, services, and material support for the operation and maintenance of naval weapons and aircraft for the Sea Based Antisubmarine Warfare Wings, Atlantic. Tasks performed at NAS Cecil Field include operation of fuel depots, maintenance and repair of aircraft and engines, and special weapons support. The facility was closed under BRAC III in September of 1999.

Cleanup Required

In 1985, Navy identified disposal areas throughout the base, including landfills, lagoons, waste piles, burn areas, and spill areas. The majority of these sites received spent solvents, paint wastes, and wastes containing chromium and lead. Both soil and water in the surface and subsurface were potentially contaminated. A Base Closure Team (BCT) consisting of representatives from the Navy, the state of Florida, EPA Region IV and contractors, evaluated the cost and schedule of effective treatment options for the contaminated sites as part of the base closure process.

Treatability Study

Pilot-scale treatability study system

Sampling and analysis determined that groundwater contamination from trichloroethylene (TCE) and other chlorinated solvents existed at a depth of 94 feet below the water table. The BCT elected to remove the contaminants with a method known as air sparging and soil vapor extraction (AS/SVE), a proven technology for remediation of chlorinated solvents. The technology relies on in-situ air stripping of volatile organics and collection of soil vapors containing the organic compounds. Since application of AS/VSE is not a common practice at such great depths below the water table, the BCT elected to perform a pilot scale treatability study to determine the applicability of this technology for the NAS Cecil Field site and establish design criteria for full-scale design. The pilot study evaluated vacuum extraction in two wells and one pair of injection wells—one injection well screened at 58 to 60 feet below ground surface (bgs) and one screened at 95 to 100 feet bgs. The study indicated that the system was capable of removing groundwater contaminants at depths of 100 feet bgs.

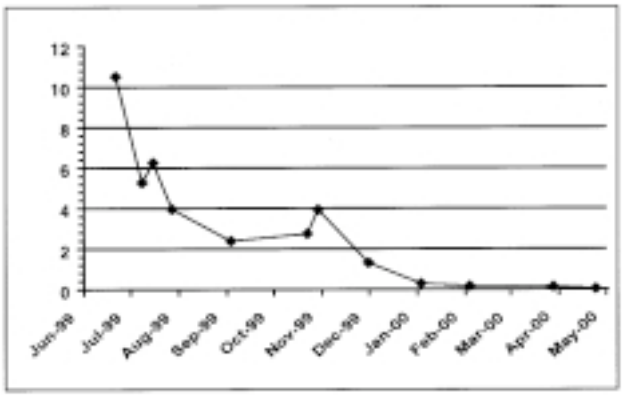
Scaling Up

Based on the results of the treatability study, design of the full-scale system included three pairs of injection wells, 19 soil vapor extraction wells, and offgas treatment using granular activated carbon (GAC). Modeling showed that by reducing source area concentrations to below 1000 micrograms per liter and then allowing natural attenuation to complete the remediation, downgradient receptors would be protected. The system was placed in operation in June of 1999 and was expected to operate for three years based on modeling results for reduction of TCE.

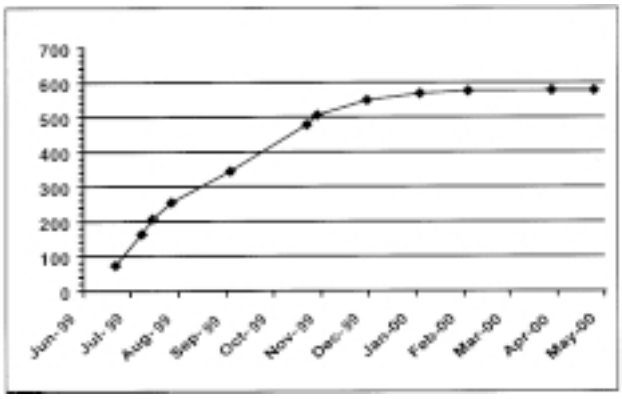
Full-scale system

Exceptional Results

As measured in the SVE system offgas, over 10 kg per day of VOCs were removed during the first week of operation. After 10 months, the extraction rate of VOCs declined to below 0.1 kg per day. During the 10 month operation period, 4,577 kg of VOCs were removed. As of May 2000, the highest remaining monitoring well concentration in the treatment area was 318 μ/L, which is below the active remediation goal of 1000 μ/L. The system was shut down in May 2000.



VOC extraction rate (kg/day), SVE offgas



Total VOC gas removal (kg)

Community/Regulator Involvement

The community has been continually involved in the project through partnering and Restoration Advisory Board (RAB) participation. The RAB consists of representatives from the local community, Navy, state of Florida, EPA Region IV, the City of Jacksonville, local water board, U.S. Fish and Wildlife, and the U.S. Geological Survey.

Construction Challenges

The AS/SVE technology relies on distribution of air beneath contamination in groundwater in order to remove contaminants through stripping as air bubbles migrate toward the surface. Since contamination was present at such great depths, alternative construction materials were required for the air sparging system. Air compressors operating at high pressures and high flow rates were required to overcome the water column to allow sufficient air to be injected. Additional attention to well placement was necessary to ensure that the entire source area was remediated and that contamination was not forced away from the treatment zone.

Cost Avoidance

By focusing active remediation on the area of highest contaminant concentrations, maximum efficiencies were realized by installing a smaller system that was capable of removing a large amount of mass. This approach minimized the cost per pound of contaminants removed. Through modeling, an active remediation goal was established that would be protective of downgradient receptors. This resulted in a shorter duration for active remediation and greatly reduced long-term management and remedial action operation (LTM/RAO) costs over traditional active remedies such as pump and treat. Use of the pilot treatability study made it possible to select and install the most efficient full-scale system.

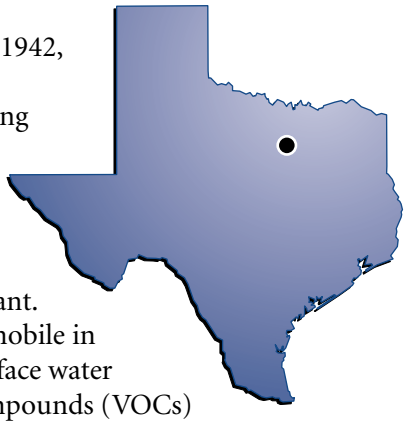
Based on the May 2000 groundwater data, cleanup goals for the AS/SVE system have been met and the system has been shut down. Groundwater monitoring will continue in order to assess potential rebound effects, and the system will be periodically restarted in a pulse operation mode if warranted.

Time and Cost Reduction

Use of air sparging to treat contaminants at these depths was an innovative application of technology, yielding significant time and cost avoidance over other options. Facilitated by effective modeling, the system has achieved the goal in less than half of the expected operation time. In addition, reductions in the VOC concentrations below 1000 μ/L will significantly reduce the timeframe for monitored natural attenuation of residual contaminants.

In-Situ/Ex-Situ Perchlorate Remediation a Success

NWIRP McGregor, SOUTHDIV



Naval Weapons Industrial Reserve Plant (NWIRP) McGregor was established in 1942, employing approximately 500 workers. Over its 50-year history it served as an industrial complex, performing degreasing operations, building and demilitarizing weapons, and manufacturing solid-fuel rocket propulsion systems. The plant is now inactive.

Environmental Issues

Ammonium perchlorate is an oxidizing agent and is used as solid rocket propellant. Because ammonium perchlorate is a salt, it rapidly dissolves in water, becomes mobile in groundwater, and persists for many decades under typical ground water and surface water conditions. In addition, as a result of degreasing operations, volatile organic compounds (VOCs) such as trichloroethylene (TCE) were released to groundwater and migrated as a co-contaminant with perchlorate at the site.

Interim Stabilization Measures

Area M consisted of an industrial complex that manufactured solid rocket motors. During the manufacturing process, perchlorate and VOCs were released to soil and groundwater. When perchlorate was found to be migrating offsite, the Texas Natural Resource Conservation Commission (TNRCC) required interim stabilization measures (ISM) to be implemented. The Navy fast tracked construction of an ISM and offsite migration was abated. The ISM included the installation of high permeability cutoff and collection trenches to intercept perchlorate-contaminated groundwater. Treatability studies were performed to evaluate the effectiveness of in-situ and ex-situ groundwater and soil biological treatment. Soil and groundwater bench scale testing indicated that anaerobic biological treatment could degrade perchlorate.

Trenching machine

Two Test Systems Installed

Within eight months, bench scale testing was completed and two successful pilot/full-scale groundwater systems (ex-situ and in-situ) were constructed. The ex-situ system involved a 2,600 gallon fixed bed biological reactor that was capable of treating over 40 gallons per minute using acetate as the carbon source. The in-situ system included over 5000 feet of trenches that were backfilled with a variety of carbon sources. Both systems reduced perchlorate from approximately 20,000 µg/L to below laboratory detection limits. In addition, initial results from the in-situ system indicated that TCE and other chlorinated hydrocarbons were being degraded concurrently with perchlorate. Because of its success and operational ease, the in-situ biotreatment system was selected to abate the offsite migration of perchlorate in groundwater. This system intercepts and degrades perchlorate-contaminated groundwater before it exfiltrates to surface water.

A-line cutoff trench construction

Based on bench scale results, a treatment cell was constructed to treat 1,500 cubic yards of perchlorate contaminated soil. The soil was blended with a carbon source and amendments before being placed in the cell and then the cell was flooded to create anaerobic conditions.

Regulatory Requirements/Community Involvement

This remediation project was successfully executed with the full support and input of the (TNRCC) and the U.S. Environmental Protection Agency (USEPA). Both agencies reacted quickly to conceptual ideas and provided guidance when needed. Furthermore, a NWIRP McGregor Restoration Advisor Board (RAB) that includes individuals from the Navy, TNRCC, U.S. EPA, McGregor city officials, and local concerned citizens has been regularly updated on remediation and environmental issues that are occurring on the facility.

Construction Challenges

- Working under a compressed time frame
- Technology transfer between the CLEAN II and RAC contractors
- Incorporating modifications to design to implement rapidly changing technology

Cost Avoidance Measures

The expedited treatment of contaminated groundwater using innovative technologies has resulted in a significant cost avoidance for the Navy. By utilizing treatability study testing the Navy was able to determine the most effective solution to remediate perchlorate contamination in the groundwater. The in-situ groundwater treatment system's operation and maintenance (O&M) costs are approximately $5,000 per year. Comparatively, other treatment systems have been estimated at more than $100,000 per year for O&M. The groundwater in-situ remediation system is expected to reduce the remedial duration to five to seven years, which is significantly shorter than other systems.

Anerobic landfarming in lined treatment cell

By utilizing an innovative anaerobic landfarming approach for soil remediation, the Navy eliminated costs associated with offsite disposal. As a result, the Navy realized a cost avoidance of over $500,000 by treating perchlorate-contaminated soil biologically onsite rather than shipping it off site to a hazardous waste landfill.

Project Successes

- The Navy worked diligently to institute innovative perchlorate remedial technologies that have successfully abated perchlorate contaminated groundwater and surface water from migrating offsite.

- The Navy successfully fostered a synergistic relationship between regulatory and local communities. This has allowed the Navy to complete the transfer of almost 2,500 acres of land to the City of McGregor for economic redevelopment as authorized by special legislation sponsored by Congressman Chet Edwards.

- As a result of the cost avoidance and the innovative technology advancement program at NWIRP McGregor, the Navy was able to install a four-acre pilot-scale phytoremediation plot to assess its effectiveness for removing perchlorate from soil and groundwater.

- The Navy guided site-adapted technologies "seamlessly" between the CLEAN II and RAC contractors.

In tackling this project, Navy developed a remedial tool that can be applied at other military installments to economically treat groundwater and soil contaminated with perchlorate.

New Sampling Method Yields Better Data, Lower Cost

NSA Mid-South, SOUTHDIV

A new groundwater sampling method for volatile organic compounds (VOCs) is yielding better quality analytical data at a lower cost for Naval Support Activity (NSA) Mid-South in Millington, Tennessee.

The Technology

Passive diffusion sampling was first demonstrated in the Navy by the NSA Mid-South partnering team. In August 1998, the BRAC Cleanup Team (BCT) decided to test the innovative sampling method as a means of reducing cost and time associated with long-term monitoring of VOCs in groundwater.

Diffusion sampler

Pilot Study

A pilot-scale test was implemented to determine the accuracy and applicability of the method. Diffusion samplers were installed in three wells at NSA Mid-South where chlorinated solvents had historically been measured using conventional sampling methods (i.e., three well-volume purge and low-flow, micro-purge techniques). The Navy found that the analytical data from the diffusion sampling method correlated well, provided representative sampling at discrete depths, and was much less expensive than the traditional sampling methods.

Ramping Up

Based on the success of the pilot test, the team proceeded to full-scale implementation of the diffusion sampling method to perform required annual monitoring of 65 wells for VOCs in groundwater. Conversion to diffusion sampling allowed a cost avoidance of over 85 percent of the annual sampling costs compared to traditional micro-purge sampling methods. SOUTHDIV has now successfully deployed the diffusion sampling method at six other installations.

Sampling well monitoring

Regulatory Requirements/Community Involvement

Effective partnering by the BCT at NSA Mid-South has facilitated project reviews, enhanced decision making, and helped to accomplish the common goals of restoring sites and making property ready for transfer to the community. The community participates through Restoration Advisory Board (RAB) meetings. The proactive teaming relationship

provides an effective forum for all parties to introduce new technologies and methods. EPA introduced the diffusion sampling method, which was originally developed by the U.S. Geological Survey (USGS) and General Electric Gas Turbine.

Construction Challenges

The diffusion sampler method is actually much simpler and faster than traditional groundwater sampling methods. The method consists of suspending a weighted, polyethylene bag containing deionized/organic-free water in a well at a selected depth and left long enough to allow water in the sampler to come to equilibrium with concentrations of volatile contaminants in the groundwater flowing through the well screen. Equilibrium occurs in as little as 48 hours, but the sampler may be left in place longer if desired.

Retrieving sample

When the diffusion sampler is retrieved, the sample is transferred to the appropriate sample container. Stainless steel weights that position the diffusion sampler in the well screen may either be dedicated to the well or decontaminated for use at another location. A new diffusion apparatus may be installed as the old one is removed. To provide a vertical profile of contaminant concentrations which may differ along the screened interval, diffusion samplers of discrete lengths (e.g., one or two feet) may be "stacked" within the well screen.

Limitations

The primary limitation of the method is its inability to detect non-volatile compounds such as metals. However, at many sites requiring long-term monitoring, VOCs are the contaminants of concern.

Cost Avoidance Measures

For long-term monitoring of VOC contaminated groundwater, the diffusion sampling method has proven to be more cost-effective than traditional groundwater sampling techniques. Although the low-flow, micro-purge sampling technique developed in recent years is a more accurate and economical method than the conventional three-volume purging technique, it still has considerable costs associated with the rental or purchase of pumps, portable electric generators, and water quality monitoring instruments. Likewise, labor costs for the micro-purge method are significant due to extended time in the field. The diffusion sampling method virtually eliminates many of these costs and greatly diminishes others.

For example, the equipment cost for the low-flow, micro-purge method to sample 20 wells averaging 80 feet deep is approximately $120 per well (excluding labor and investigation derived waste (IDW) costs) for the initial sampling event and approximately $35 per well for subsequent sampling events (including only the rental costs). Conversely, using the diffusion method, the equipment cost for sampling the same 20 wells is approximately $7 per well for the initial sampling event, and approximately $1 per well for subsequent events (purchase of protective sleeving and twine). The result is a cost avoidance of at least 90 percent in equipment costs using the diffusion sampling method.

Labor costs and time in the field are also greatly reduced using the diffusion sampling method. With the diffusion method, samplers can be installed/retrieved and samples collected in approximately 30 minutes per well, whereas more traditional pumping methods may average from 60 to 90 minutes per well to set up the equipment and collect the samples. For example, to collect groundwater samples from the 65 wells being monitored at NSA Mid-South using a traditional pumping method would have taken four people approximately two weeks. Using the diffusion sampling method, the same crew sampled the same number of wells in only two days – an 80-percent avoidance in labor costs.

Additional cost avoidances are realized from minimizing the generation of IDW and related testing and disposal costs. At NSA Mid-South, annual sampling costs for the groundwater monitoring of 65 wells have been reduced by more than 85 percent using the diffusion sampling method. Similar cost avoidances are now being realized at six other installations within Southern Division. Navy teaming efforts with the Air Force Center for Environmental Excellence (AFCEE) and the Interstate Technology and Regulatory Cooperation (ITRC) should result in widespread implementation at other DoD installations. The potential cost avoidance, if implemented NAVFAC-wide at sites involving long-term monitoring of volatile organic compounds, is expected to be tens of millions of dollars over the life of the Navy's cleanup program. The primary advantages of the passive diffusion sampling method are as follows:

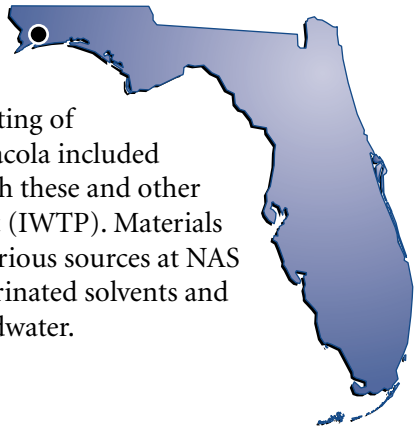
- A more representative sample is collected because the groundwater is less disturbed.
- Lower labor and equipment costs due to shortened field time and little or no standard sampling method related equipment purchases/rentals.
- Less IDW since well purging prior to sample collection is unnecessary.
- Hard-to-reach wells become more accessible because very little equipment needs to be taken to a well in order to conduct sampling.
- The potential for cross-contamination is virtually eliminated because no decontamination procedures are necessary between wells.
- Improved quality of the resulting analytical data. In some cases, the diffusion method allowed for the detection of compounds that either had not previously or consistently been detected using traditional pumping methods.
- Vertical profiling of contaminants by using short length diffusion samplers "stacked" within the screened interval of a well.

Information Sharing

Diffusion sampling is an efficient, viable alternative to conventional groundwater sampling techniques for volatile organic compounds. Based on the successful demonstration at NSA Mid-South, NAVFAC Southern Division is leading a Navy effort to gain widespread acceptance of this innovative groundwater sampling method that should save the Navy several million dollars in long-term monitoring costs. The successful results from NSA Mid-South were presented at several Navy forums, including the Navy and Marines Cleanup Conference and the Alternative Restoration Technology Team (ARTT) meeting in January 2000. In addition, Navy is partnering with the AFCEE and other organizations to spread the word about the technology.

Navy Streamlines Groundwater Monitoring

NAS Pensacola, SOUTHDIV



Naval Air Station (NAS) Pensacola, Florida was established in 1826, consisting of 5,800 acres and over 16,000 employees. Industrial operations at NAS Pensacola included aircraft maintenance and metal plating services. Wastewater associated with these and other activities was processed through an Industrial Wastewater Treatment Plant (IWTP). Materials treated at the IWTP, such as degreasers and paint strippers, leaked from various sources at NAS and resulted in discharges to the sludge drying beds and surge pond. Chlorinated solvents and other compounds subsequently leaked into the underlying soil and groundwater.

History

In 1987, the sludge drying beds and surge pond were excavated, backfilled, and capped, and a groundwater extraction system was installed to recover contaminated groundwater and prevent its migration to Pensacola Bay as conditions of the RCRA permit. The original monitoring program focused on site contaminants that consisted of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Assessment of the groundwater has been ongoing since 1987. In January 1992, the monitoring frequency was reduced from quarterly to semiannually. Nineteen wells were monitored for 119 parameters. A Remedial Investigation and Feasibility study (RI/FS) of the IWTP was completed in 1995 and the resulting Record of Decision (ROD) specified that contaminated groundwater would continue to be addressed under the RCRA Permit.

The Streamlining Approach

In 1995, the Navy began reviewing the site history and data to identify alternatives to the groundwater remediation and monitoring approach. The following actions were taken to reduce monitoring costs associated with the site:

- Change the contractor and contract type from cost plus to fixed price.
- Reduce the number of monitoring wells from 19 to 15.
- Eliminate the need to monitor analytes that have not been detected for three years.
- Shift some of the routine maintenance tasks for the groundwater extraction system from contractor to installation personnel.

Recovery Efforts Modified

The groundwater pump and treat (P&T) system was comprised of seven recovery wells and was activated in February 1987. The comprehensive data review in 1995 indicated that groundwater contamination had been reduced to levels near or below the specified protection standards, Maximum Contaminant Levels (MCLs), across most of the site. However, relatively high concentrations of trichloroethene (TCE) averaging about 3,000 to 4,000 µg/l had persisted in the intermediate depth monitoring well (GM-66). Concentrations in monitoring wells were observed to decrease to below MCLs within 250 ft of GM-66, approximately 300-ft upgradient of Pensacola Bay. As a result of the data analysis, the P&T system was optimized in 1995 by reducing the number of recovery wells from seven to three and was focused on recovery of groundwater near GM-66. Additionally, the analysis indicated that natural attenuation processes were helping to contain and remediate the plume.

Considering Natural Attenuation

In 1996 the monitoring program was again revised to include an assessment of the natural attenuation processes. Based on the favorable quarterly data from the first year of assessment, the Navy and the regulatory agency, Florida Department of Environmental Protection (FDEP), agreed to temporarily discontinue operation of the pump and treat system to determine whether contamination was attenuating naturally. The combination of source reduction and Monitored Natural Attenuation (MNA) was proposed as an alternative to the existing P&T system. Additionally, the revised permit included a reduced number of wells and analytes that require monitoring.

Construction Challenges

The use of the Fenton's Reagent method of chemical oxidation was an innovative application for in-situ groundwater treatment. Identifying and determining whether geochemical and other site-specific aquifer characteristics are compatible with the Fenton's chemistry method proved to be essential to successful remediation. Also, secondary effects of in-situ chemical oxidation must be accounted for since the reaction is exothermic and generates heat and pressure. The heat and pressure may cause mounding and turbulence in the groundwater and result in mobilization of contaminants into or from the unsaturated area and peripheral areas of the treatment zone.

Fenton's Reagent injection equipment

Cost Avoidance Measures

The implementation of the modified remedial strategy is resulting in significant time savings and cost avoidance. The original P&T remedial strategy would require at least 20 years to meet cleanup goals. With an annual operating and monitoring cost of $70,000 and $100,000 per year, respectively, the total cost for the P&T strategy over 20 years would be $3,400,000.

The modified remedial strategy includes the Fenton's Reagent for in-situ treatment of the source area, MNA for treatment of residual contamination, and permanent discontinuation of the P&T system. The modified strategy will require approximately three to five years to meet the cleanup goals and is expected to be complete by 2004. With treatment costs of $250,000 and annual monitoring costs of $100,000 per year, the total cost of the modified strategy would be $750,000. This results in a life cycle cost avoidance of at least $2,650,000 over the original P&T remedy.

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

Project Successes

For the site-specific conditions at NAS Pensacola, in-situ chemical oxidation using the Fenton's Reagent method has proven to be a successful and economical technology for aggressively reducing groundwater source area concentrations of CVOCs. Coupled with the monitoring program and analyses of the natural attenuation capacity, the Remedial Action Optimization has (1) ensured the protection of the downgradient receptor, Pensacola Bay, (2) ensured effectiveness and timeliness of MNA as the final, polishing remedy, (3) eliminated the need for the existing P&T system, and (4) substantially reduced long-term remedial action operation and monitoring costs.

Monitoring effectiveness of process

Lessons Learned

- Site specific advantages and limitations of any treatment technology should be evaluated as part of the feasibility study.
- Aquifer characteristics that may affect treatment using in-situ chemical oxidation should be determined prior to implementation of the technology.
- Evaluate existing systems to determine if they continue to be effective.
- Evaluate historical data to determine if there is evidence of ongoing natural attenuation.
- Perform remedial action optimization on a regular basis to ensure a cost-and schedule-effective remediation.
- The combination of active remediation for source reduction and MNA for residual contamination is a cost-effective, timely remedial strategy that should be considered for optimization of existing systems as well as for new sites.

Conclusion

The Navy, in conjunction with regulators, successfully optimized remedial action operations at the former sludge drying bed and surge pond site with diverse technologies and remediation approaches. The RAO Optimization has resulted in improvements in the monitoring program, modification to the remedial strategy, accelerated site cleanup, and significant cost avoidance.

SOUTHDIV Fosters Quality Improvement

In an effort to continually improve the efficiency of the cleanup process, SOUTHDIV implemented quality improvement and assurance business practices in the early to mid-1990's. The system has provided a comprehensive and effective approach for restoring and closing out sites and transferring property in a cost-effective and timely manner. Key elements of the system include:

1. Effective partnering with State and EPA regulators in Regions 4, 5, and 6 and other stakeholders, which has resulted in a spirit of cooperation and trust in working toward the common goal of remediating sites in a cost-effective manner while fully protecting human health and the environment. Effective partnering relies on frequent communication that is open and honest and provides an ideal forum to introduce and implement innovative technologies and methods.
2. Management committed to planning and executing a quality, cost-effective restoration program.
3. Empowered, well trained, proactive RPMs with training in technical and regulatory requirements to better equip them to perform their jobs at the project level, including partnering with regulators and local activities.
4. A Technical Support Branch that provides in-house technical expertise to leverage the capabilities of RPMs. The technical branch serves as a central focal point for staying abreast of cost-effective technologies and methods and evolving regulatory requirements. The technical staff supports RPMs by identifying their site-specific needs and helping them and their partnering teams to implement appropriate technologies and methods to achieve cost-effective site closeouts. Recurring and programmatic technical issues are channeled into a Quality Improvement Forum (QIF) for resolution and program-wide consistency.
5. A QIF, which consists of team members from the Technical Branch, Navy Contracting Officers Technical Representative (COTRs) and contracting personnel, and each RAC and CLEAN contractor. The QIF resolves recurring or programmatic issues and publishes resolution and/or policies to ensure consistency and program-wide improvement.
6. An Environmental Project Validation Team (EPVT), which consists of restoration branch managers, RPMs, and technical staff from the Technical Support Branch. In the EPVT process, RPMs and their regulator/activity partners prioritize and submit their projects for the upcoming budget and execution plan. The EPVT reviews and prioritizes projects for available funds primarily on the basis of cost-effectiveness and risk while considering the importance to stakeholders and other criteria. Although primarily for budgeting and planning, EPVT reviews also provide a means of checks and balances for quality assurance.

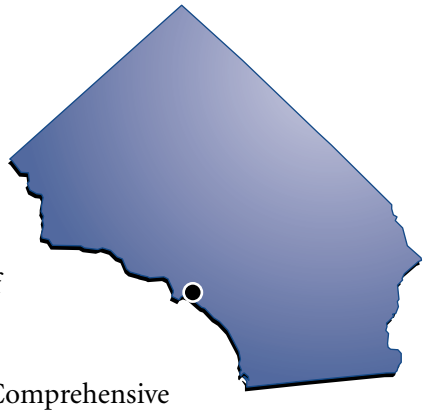
With this approach, SOUTHDIV's quality improvement system provides technical information resources and encouragement for RPMs, contractors, and partnering teams to pursue cost-effective cleanup solutions.

Island Property Conveyed
NAS Alameda, SWDIV

In 1936, the Navy acquired property at the West End of the Island of Alameda to begin construction of the Naval Air Station (NAS) Alameda. This property just across the harbor from Oakland has grown to approximately 1,710 acres of upland area, mainly through a series of Bay fill events. Today this piece of land represents one third of the island's total area. An additional 1,120 acres of submerged land is also part of the Navy's property. After 58 years of service to the Fleet, all of these acres which made up NAS Alameda and the Fleet, Industrial Supply Center (FISC) Alameda Annex, will be conveyed to the City of Alameda, the Alameda Reuse and Redevelopment Authority, the Alameda Unified School District, and the United States Fish & Wild Service as required by the Base Realignment and Closure Act.

The first portions of this property were conveyed in the summer of 2000. All of the appropriate documents have completed to execute an early transfer of the entire 147 acres that make up the FISC Alameda Annex, and an economic development conveyance of the 73 acres known as East Housing section of the former Naval Air Station. A formal signing ceremony between the City and the Navy took place in June 2000. Actual deeds conveying the property were executed the following month.

Record of Decision Signed at Former Station
NS Long Beach, SWDIV



On July 7, 2000, the Record of Decision (ROD) for two sites was signed by the Department of the Navy, the California Department of Toxic Substances Control, the California Regional Water Quality Control Board, Los Angeles Region, and was endorsed by the United States Environmental Protection Agency. The two sites are: Site 1, the location of the former Mole solid waste operations area; and Site 2, the location of the former chemical materials and waste storage area. Both include a plume of solvents in groundwater.

The ROD presents the selected remedial actions for these sites, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA regulates the cleanup of sites containing hazardous waste. The ROD provides information about the alternatives considered for remedial action, and identifies the remedies chosen with the rationale for their selection.

A combination of institutional controls (in the form of deed restrictions), long-term groundwater monitoring, and treatment technologies (in the form of in-situ air sparging with soil vapor extraction) constitute the selected remedial actions. The remedial action also includes the removal and disposal of debris from an area overlying the groundwater plume.

The selected remedial actions support the current, surrounding and most likely future land-use as described in the Local Redevelopment Authority Reuse Plan.

Enhanced Bioremediation Demonstrated NFD Point Molate, EFA West

Naval Fuel Depot (NFD) Point Molate began operations in 1940, providing supply and support services such as fuel storage, handling and transfer to fleet and shore activities. The 423-acre facility lies along the eastern shore of the San Francisco Bay, two miles northeast of the City of Richmond, California. The depot was closed under BRAC IV and ceased operations on September 30, 1995.

Hydrocarbon Concerns

As a result of NFD Point Molate's mission, petroleum products are a typical soil contaminant. The Bay Area Defense Conversion Team (BADCAT) chose the facility as a demonstration site for an enhanced bioremediation process to clean up hydrocarbon (petroleum) contaminated soil. Although bioremediation of petroleum is not a new practice, longer hydrocarbon chain products such as diesel and bunker-C oil are not broken down efficiently by many biological processes.

Who is BADCAT?

BADCAT is a unique consortium of government, private companies, economic development and public awareness organizations. The team focuses on demonstrating new technologies at closing Navy facilities in the San Francisco Bay Area to expedite Navy land transfer, encourage the use of innovative environmental technologies to accelerate the cleanup process, and stimulate growth with the region's environmental industries. Each demonstration is fully funded by the technology vendor. BADCAT establishes the demonstration protocol, provides peer review of plans and reports, coordinates stakeholder outreach, facilitates the regulatory verification process, and publicizes the technology.

BADCAT member groups include the Bay Area Economic Forum (BAEF), Bay Area Regional Technology Alliance (BARTA), the California Environmental Protection Agency, the U.S. Environmental Protection Agency (EPA), Department of Energy (DOE), Chevron, the San Francisco State University Center for Public Environmental Oversight (CPEO), the U.S. Navy, and other experts and technologists.

Cleanup Challenges

Traditional bioremediation processes use anaerobic microbes and are relatively ineffective in breaking down bunker-C oil. The cleanup contractor demonstrated an ex-situ approach to bioremediating soil, targeting the typical "problem compounds" found at the activity by using both aerobic and anaerobic microbes. This allows biodegredation to

occur with and without the presence of oxygen. The end product of this natural process is clean soil, carbon dioxide, water and cell material.

Depositing soil in cell area for treatment

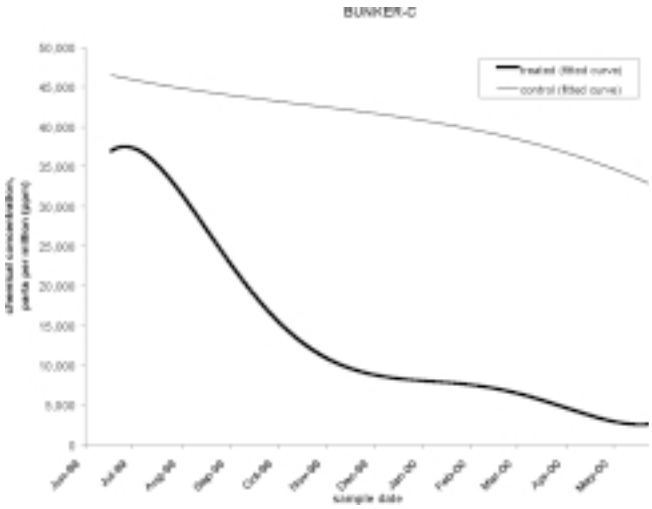
The Demo

For the demonstration, about 40 cubic yards of soil were excavated and placed into an on-site treatment cell about 350 feet away from the excavation. The simply constructed cell consisted of plastic sheet lining and berms formed from hay bales. After introducing the nutrients and bacteria, the pile was mechanically mixed monthly with a backhoe and sampled. In addition, a control pile was maintained for comparison, which was also mechanically mixed. The project goal is to reduce soil contamination from 47,000 parts per million (ppm) of total petroleum hydrocarbon to below 1,000 ppm using EPA test method 8015M. The graph below shows the effects of the process on bunker-C contaminated soil and control piles for the first year of the project.

During the remediation process, BADCAT hosted a technology acquaintance day for the public. Over 500 invitations were sent to the stakeholder community, including local citizens, environmental professionals, governments, Restoration Advisory Board (RAB) members, regulators and the media. The outreach effort included a brief technology seminar and a tour of the remediation treatment cell for the attendees.

Advantages of the New Method

Often, engineered soil remediation systems merely transfer the contaminant out of the soil, and the contaminant still must be recaptured and handled. Such systems require capital equipment purchase, operation and maintenance costs. Even conventional aerobic bioremediation systems may require an additional system to oxygenate the soil. Compared to the costs of traditional soil excavation and disposal at a landfill, the on-site treatment method offers the advantages of eliminating soil hauling fees, landfill disposal fees, and the long-term liability associated with transferring the contaminant soil to a landfill. Also, since the remediated soil can be used as backfill for the excavation, the purchase and transfer of clean soil is unnecessary.



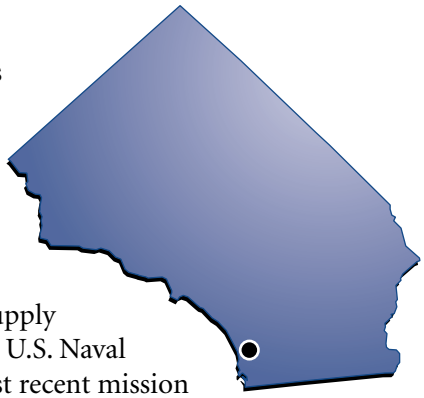
Chemical concentration graph

Cost Avoidance

The contractor estimates the cost for this type of bioremediation at $30 per ton. By comparison, a landfill near the NFD Point Molate site charges $40 per ton to dispose of hydrocarbon contaminated soil. With transportation fees and purchase costs for clean soil included, the total price could easily be over $70 per ton. In addition, future liability for landfill disposal of hydrocarbon contaminated soil remains unknown. Thus, the on-site aerobic/anaerobic bioremediation treatment of soil has the potential for immediate cost avoidance as well as providing "insurance" against future environmental impacts.

Navy Implementing Phased Transfer

NCTS Stockton, EFA West



Naval Computer and Telecommunications Station (NCTS) San Diego Detachment, Stockton is located on Rough and Ready Island in the city of Stockton, CA. The island is approximately 75 miles east of San Francisco and 40 miles southeast of Sacramento. During World War II, the 1,433 acre site was developed as a major supply depot. In 1945 it was commissioned as the U.S. Naval Supply Annex, Stockton. The facility's most recent mission was to provide support to fleet and shore commands through reliable and secure communications, quality information technology, and cryptologic services. The facility was slated for closure by Navy Region Southwest in 1996.

Potential Cleanup Challenges

At NCTS Stockton, past hazardous waste disposal, pesticide storage, fire fighting training and maintenance activities have contributed to soil and groundwater contamination. Primary contaminants include petroleum hydrocarbons, metals, volatile organic compounds, radium, pesticides, semi-volatile organic compounds and polychlorinated biphenyls (PCBs).

Legislation for Expedited Transfer

In February 1996, Congress passed Public Law 104-60, Section 2871, to allow the Navy to convey property and waterfront assets to the Port of Stockton for the purpose of expanding the port's maritime operations. A creative, phased approach to the transfer was developed that allows an expedited transfer of significant portions of the facility to the port, while the remainder is remediated through the Environmental Restoration Program.

Baseline Survey Suggests Phasing

Navy conducted an environmental baseline survey (EBS) for NCTS Stockton. The results pointed to a three-phase approach for property transfer:

Phase I: parcels found to be uncontaminated
Phase II: parcels about which more information might result in a quick finding of suitability to transfer
Phase III: parcels where the 71 identified IR sites were located

This approach would allow expedited transfer of the Phase I and II parcels while the Phase III parcels were remediated. During the environmental baseline survey, the facility was divided into 158 parcels. Parcel boundaries were based on land use, known contamination, and proximity of buildings. Initially, 89 percent of parcels were determined to be ready for immediate transfer.

RAB Involvement

The Restoration Advisory Board for NCTS Stockton includes representatives from the State of California; Department of Toxic Substances Control; Regional Water Quality Control Board and Integrated Waste Management Board; the City of Stockton, the Port of Stockton and San Joaquin County Public Health Services. The group agreed that a phased approach could be used to expedite the transfer of the facility.

Conversion Management Team

The Navy also established a Conversion Management Team (CMT), chaired by a senior EFA West civilian, to address the many issues surrounding the closure and transfer of NCTS Stockton. The community outreach efforts of the CMT included formal and informal meetings, and fact sheets in addition to the efforts of the RAB.

Cleanup Tech TBD

The technological approach to be used on the environmentally encumbered parcels will be developed in feasibility studies. Monitored natural attenuation, as well as innovative technologies such as soil washing, which was demonstrated at the site, are being considered.

Phased Transfer in Progress

In June 2000, the first 89 parcels (approx. 549 acres) were transferred under Phase I, and all other parcels (approx. 884 acres) were leased to the Port of Stockton. This required preparation of an Environmental Assessment (EA), a Finding of Suitability to Transfer (FOST), a supplemental EBS, and a Lease in Furtherance of Conveyance (LIFOC). In Phase II, approximately 500 of the 884 leased acres will be removed from the leased area and transferred using a Phase II specific FOST and SEBS, as soon as those parcels are fully evaluated and deemed suitable for transfer (planned for April 2001). The Phase III transfer is planned for 2004.

"The phasing enabled the Navy to transfer significant portions of the facility to the community initially," said Richard Powell, EFA West. "This way, the Port of Stockton didn't have to wait until 2006 to get land to reuse."

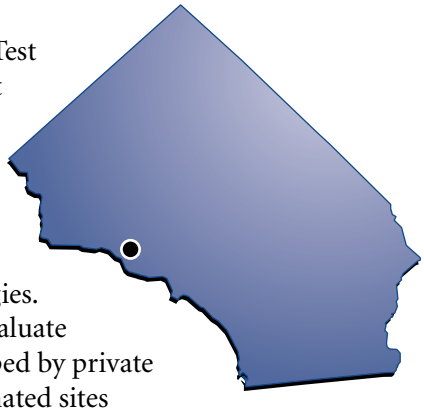
Community Plans for Development

The community has ambitious plans for redevelopment of the property. According to the Stockton RAB meeting notes from 10/19, 'With the takeover of {Rough and Ready} Island, the Port envisions the start of a new era of operations and opportunity for an inter-mobile transportation center. . . a new market for businesses and an employment base for the community of Stockton.' The Port already has several business tenants and foresees additional corporations relocating to the property to take advantage of lower costs and less traffic congestion. Businesses are considering the existing land as an opportunity for development and handling of containerized cargo.

NCTS Stockton, aerial view

NFESC Tests MTBE Remediation Technology

CBC Port Hueneme, NFESC



National Environmental Technology Test Sites (NETTS) are a cooperative effort among the Department of Defense (DoD), the U.S. Environmental Protection Agency (EPA), and the Department of Energy (DOE) to conduct field demonstrations on environmental remediation technologies. The objective of the programs is to evaluate innovative technologies being developed by private industry for potential use at contaminated sites worldwide. The effort is supported by the DoD Strategic Environmental Research and Development Program (SERDP), the Environmental Security Technology Certification Program (ESTCP), and several other federal, state and industrial sponsors. At Port Hueneme, California, the Environmental Restoration Division of the Naval Facilites Engineering Service Center (NFESC) manages one of these NETTS projects.

The Mission

The Port Hueneme NETTS program emphasizes technologies that target fuel hydrocarbon contamination in soil and groundwater. With guidance and support from the Environmental Office at the Construction Battalion Center base at Port Hueneme, NFESC has hosted numerous environmental cleanup and assessment technology demonstrations, several of which are now available for application through DoD.

The work at Port Hueneme focuses on four areas:

1. Characterization and monitoring
2. Chemical and physical remediation processes
3. Enhanced and introduced biological remediation processes
4. Natural attenuation and ecological risk assessments

The program provides demonstration platforms for both in-situ and ex-situ technologies. The in-situ demonstrations are performed on a gasoline plume containing MTBE (methyl tertiary butyl ether) and BTEX (benzene, toluene, ethylbenzene, and xylene compounds) that began at the Navy Exchange gasoline service station and has traveled downhill about 5000 feet. Ex-situ demonstrations are accomplished at a specially designed treatment facility, located nearby on base. The Port Hueneme test site has been an ideal location for technology demonstrations because the plume is contained on base and has not posed a threat to drinking water sources or the environment.

Site Planning

Investigation

Cleanup

Site Closeout

For a Sustainable Future

Air Sparging Evaluation

The Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) offices recently funded a Joint Air Force Research Laboratory (AFRL) and NFESC project to evaluate the effectiveness of air sparging, which involves injecting pressurized air into a contaminant area to speed up the breakdown of chemicals. After 450 days of executing this process at Port Hueneme, greater than 99% gasoline removal was achieved. MTBE concentrations were brought down to non-detect levels throughout most of the demonstration site. A document entitled "Air Sparging Design Paradigm" is currently being prepared, and will provide details on air sparging principles such as site characterization, pilot testing, system design, process monitoring, installation, operation, and costs.

Direct-Push vs. Conventional Wells

NFESC is conducting a comparative investigation at the site to evaluate the performance of select direct-push installed monitoring wells versus conventionally drilled monitoring wells. Both types of wells have been installed on the leading edge of the MTBE plume to compare how representative samples are, hydrogeologic factors, and long-term installation and monitoring costs. Data collected so far suggests that direct-push wells could be used successfully for compliance purposes in certain hydrogeologic conditions. This could translate into a potential cost avoidance for DoD.

Bioremediation Testing

NFESC is also hosting a project in which Equilon's Westhollow Technology Center is teaming with Arizona State University to evaluate an aerobic in-situ process for bioremediation of MTBE. This field trial, which is the first of its kind for treatment of MTBE, focuses on the use of a mixed bacterial culture (MC-100) as an in-situ barrier to downhill MTBE migration. Data collected indicates that the in-situ bio-barrier is reducing the groundwater contamination concentrations from a range of 2,000 to 10,000 μg/L (parts per billion) to less than 15 μg/L.

Stakeholder Involvement

All Port Hueneme NETTS projects are overseen by the NETTS Advisory Committee, including members from Naval Facilities Engineering Command (NAVFAC) Headquarters, the State of California Environmental Protection Agency, DOE, U.S. EPA, academia, and the remediation industry. The Construction Battalion Center (CBC) Environmental Office assures that relevant information regarding NETTS activities is provided to the Oxnard Plain Restoration Advisory Board (RAB). This board consists of community, regulatory and Navy members who meet to discuss the Installation Restoration environmental cleanup program at CBC and nearby Point Mugu. Opportunity for comment on all projects is provided to RAB meeting attendees.

Information Sharing

Where appropriate, engineering design, fabrication and procurement guidance is provided by NFESC and the NETTS management team. NETTS provides regulators, the NAVFAC remediation community and the general public with information to facilitate transfer of the technologies for commercial use. This is accomplished by NFESC personnel through technology transfer efforts such as short technical courses or seminars, on-site visitor's days, field assistance, conference exhibits, demonstration videos and technical data sheets.

NAVY AND MARINE CORPS

Installation Restoration