Spring 2003

# RPM News

▲ Remedial Project Manager News ▲

"Communicating Navy Installation Restoration Program News and Information Among All Participants"

## In This Issue



SPRING 2003

# Enhanced Free Product Removal and Remediation of Contaminated Soil

## 13 Area Gas Station, MCB Camp Pendleton, CA

*Figure 1. Overview picture showing treatment compound in foreground (including fluid storage system, vapor extraction manifold, and oxidizer) and gas station in background.*

### Abstract

The Navy is currently operating a vacuum-enhanced free product recovery and soil vapor extraction (SVE) system at the 13 Area Gas Station, Marine Corps Base (MCB) Camp Pendleton, California (Figure 1). Soil and groundwater beneath the site are impacted with gasoline and related hydrocarbons (e.g., benzene and methyl tert-butyl ether [MTBE]), and there has been a substantial volume of free-floating product (light non-aqueous phase liquid [LNAPL]) on top of the groundwater surface. The LNAPL has historically measured greater than 7 feet thick in some locations. Initial estimates of free product beneath the site ranged from 16,500 to 80,000 gallons. Impacted soil volume was estimated at 41,500 cubic yards. The current remediation goals at the site are free product removal and soil remediation to mitigate impact to groundwater in excess of established water quality objectives.

Several challenges, including complex site hydrogeology and operational logistics, were encountered at the 13 Area Gas Station that complicated free product removal and soil vapor recovery:

- Site soil is weathered and cemented, resulting in a very low natural fluid recovery rate and low soil vapor permeability. Pilot testing data showed low formation permeability to groundwater and soil vapor.

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- The site is the most active and largest revenue-generating gas station on the Base. It was imperative for the gas station to remain in operation while the remediation system was being installed. The location required a product removal technique that had minimal impact on gas station operations.
- Water-level data showed that the site is roughly bisected by a north/south-trending fault, resulting in two perched groundwater tables with flow gradients in opposite directions away from the site. West of the fault, the uppermost groundwater occurs at depths ranging from approximately 40 to 100 feet below ground surface and flows westward. East of the fault, the depth to water ranges from approximately 15 to 20 feet and flows generally southeastward. The upper (east) zone has historically been recharged by leaking water lines, and the lower (west) zone is believed to be recharged by groundwater flowing across the fault near the center of the site.

## Site History

MCB Camp Pendleton is located in San Diego County, California, and covers approximately 125,000 acres of land bordered on the west by the Pacific Ocean. The 13 Area Gas Station is located in the southeastern portion of MCB Camp Pendleton. The site includes an active gasoline service station and service bays where vehicle maintenance is conducted. The 13 Area Gas Station was constructed in 1955 on previously undeveloped land. Until June 1997, the station maintained seven underground storage tanks (USTs) ranging in size from 1,000 to 12,000 gallons that stored gasoline, diesel, and waste oil. In June and July 1997, the USTs and associated piping were removed and replaced with six new USTs storing gasoline and diesel fuel.

Operation of a free product skimming and pumping system began at the site on 30 October 1995. Because of low formation permeability, hydrocarbon recovery was slower than estimated and had leveled off after 6 months. To improve the efficiency of free product extraction, a vacuum-enhanced free product removal system, incorporating two internal combustion engines, was installed and began operation on 23 May 1996. Remediation construction activities were completed at the site with the installation of a full-scale free product removal and SVE system. The full-scale system began continuous operation on 26 December 1996. To further improve the efficiency of vacuum extraction, a thermal oxidizer was installed and began operation on 22 September 1997. The remedial system is shown in Figure 1.

## Remedial System Technology

The vacuum-enhanced free product recovery and SVE system is designed to extract gasoline product from groundwater in eight recovery wells, seven groundwater wells, eight vertical vapor extraction wells, and six horizontal vapor extraction wells. Free product is volatilized and removed by vacuum extraction through an underground piping network to an aboveground treatment system. The hydrocarbon-laden vapors are routed to a thermal oxidizer, where the hydrocarbons are destroyed by combustion. The thermal oxidizer blower also generates the vacuum that is applied to the wells. This accelerates the product recharge rates within the vapor extraction wells.

To increase the rate of free product recovery, air induction tubes were installed in wells that extend into the groundwater. The air induction system within each well consists of a 1/2-inch-

diameter polyvinyl chloride tube that extends through the well cap into the well down to a depth approximately 1 foot into the groundwater surface. The top end of the tube in the well box is open to atmospheric pressure. When the well is under a vacuum, the pressure differential between the vacuum in the well and the atmospheric pressure in the air induction tube causes ambient air to be drawn through the tube and into the groundwater. Hydrocarbon volatilization occurs as the lower density air bubbles rise through the groundwater and free product layer.

Free product is collected by nine pneumatic well pumps and transferred underground through a secondary containment piping network to an aboveground storage system. Sixteen wells are connected to the piping network. Recovered fluids are pumped into an aboveground concrete storage tank. When the storage tank becomes full, the system automatically shuts down, and the accumulated fluids are removed by vacuum truck for off-site disposal. Breathing losses from the storage tank is controlled using two activated carbon units, connected in series, before venting to the atmosphere in compliance with County of San Diego Air Pollution Control District requirements.

## Remedial System Installation

To overcome the challenge of keeping the 13 Area Gas Station operative during installation of the remediation system, six key vapor extraction wells were installed by horizontal drilling. Horizontal drilling allowed the placement of the remedial wells below the numerous utilities and fuel pipes crossing the active gas station, without having to interrupt service or close down site operations. In addition, system installation was performed in a carefully coordinated, phased approach to ensure that access to the gas station was never denied to customers, and to minimize closure of individual gas dispensing islands.

The remedial system was later expanded into impacted areas that were not initially addressed due to the presence of active USTs during initial system installation. In order to determine the optimal number, location, and configuration of additional remedial wells, a state-of-the-art Groundwater Modeling System (GMS) was used to evaluate the extent of soil contamination and complex groundwater flow (complicated by the fault at the site). Figure 2 shows the GMS representations of soil contamination from 1996 and 2002, respectively.

## Remedial System Operation

The implementation of a vacuum-enhanced product recovery approach has improved contaminant removal rates by a factor of eight compared to the original pumping system alone, thus reducing the remediation time and resulting in cost avoidance for the Navy. Approximately 40,370 gallons of free product gasoline have been removed from the groundwater surface beneath the site since 30 October 1995. Figure 2 shows a significant reduction in the extent of LNAPL between 1996 and 2002.

## Summary

The following bullets describe several challenges that were encountered and solutions that were devised during the course of the project.

- To overcome the low soil permeability, product recovery was enhanced by vacuum extraction (to improve liquid pump rates), and air induction tubes (to improve volatilization and vapor recovery rates), resulting in greatly increased product recovery rates, which will lead to a shortened overall remediation time (and reduced overall cost).
- Being the most active and largest revenue-generating gas station at MCB Camp Pendleton, it was

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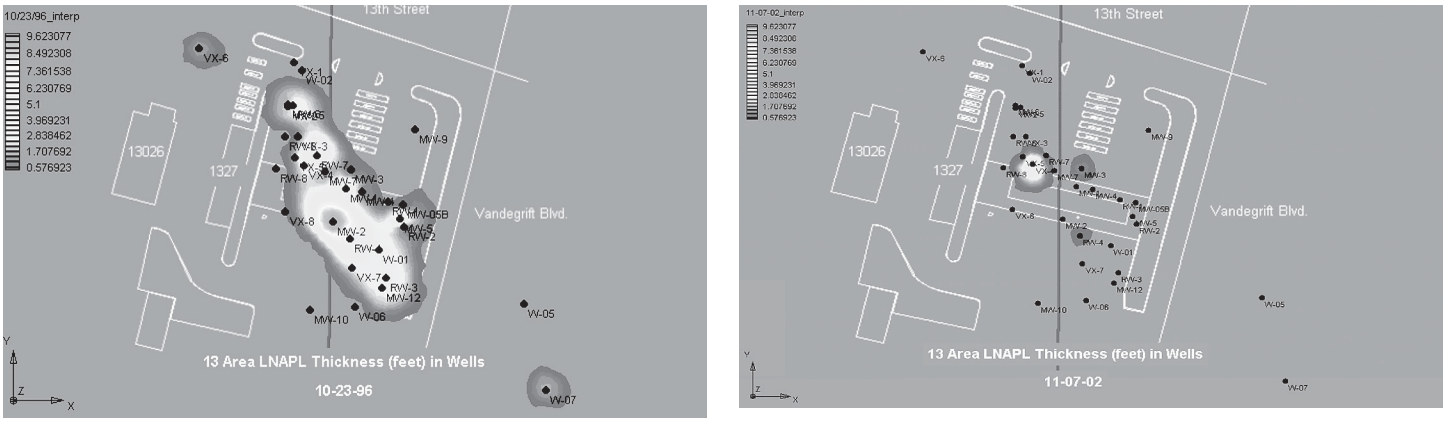


*Figure 2. Comparison of extent of LNAPL between 1996 (left) and 2002 (right).*

*"Enhanced Free Product Removal" continued from page 3*

imperative for the 13 Area Gas Station to remain in operation while the remediation system was being installed. Therefore, horizontal drilling was used to install several key vapor extraction wells to allow placement of these wells below the utility lines and fuel pipes located beneath the gas station. This approach minimized closure of individual gas dispensing islands, ensuring that access to the gas station was never denied to customers. The gas station has remained fully operational during the entire site assessment, system construction, operation, and monitoring phases of remedial action.

- Site groundwater flow is complex due to a fault that bisects the site. During expansion of the site remedial system into contaminated areas not initially addressed, GMS was used to evaluate the complicated groundwater flow and extent of soil contamination, in order to determine the optimal number, location, and configuration of additional remedial wells.

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# New ITRC Products To Help With Cleanup

The Interstate Technology and Regulatory Council (ITRC) created a variety of products in 2002 to help state regulators, Federal agencies, consulting firms, and stakeholders understand and more effectively deploy innovative environmental technologies. These products included a regulatory overview of technologies for treating dense, nonaqueous-phase liquid (DNAPL) source zones; case studies of radioactively contaminated Department of Energy (DOE) sites; technical and regulatory guidance for using in situ bioremediation (ISB); and a CD of diffusion sampler resources.

## DNAPL Source Reduction: Facing the Challenge (DNAPLs-2)

In this document, the DNAPLs Team of ITRC examines the current regulatory climate for deploying technologies to efficiently treat DNAPL source zones. The report outlines the pros and cons of partial source removal and challenges assumptions about the infeasibility of removing DNAPLs from certain geological settings where recent advances have made significant source reduction more feasible and cost-effective. The report acknowledges the technical difficulties and uncertainties surrounding DNAPL source zone reduction and supports further research to study the impacts of reduced source zone mass on groundwater quality and risk to human health and the environment.

## Determining Cleanup Goals at Radioactively Contaminated Sites: Case Studies (RAD-2)

This document was written to facilitate accelerated closure at our nation's nuclear weapons production sites by enhancing consistency and streamlining decision making. Produced by ITRC's Radionuclides Team, the document discusses the requirements of Federal regulations and agencies, explains variations in risk assessment approaches, and examines the development of cleanup levels at a dozen radioactively contaminated DOE sites. Each case study has information about the site's background, history and the nature of contamination, remedial actions that have occurred, and contact information. Common elements in the case studies are applicable regulations, risk assessment approaches and calculations, and cleanup levels used or proposed.

Determining Cleanup Goals facilitates a common understanding among states, stakeholders, sites, and agencies of how various cleanup levels have been and could be derived, making the process more efficient, defensible, and consistent.

The Radionuclides Team believes that consistency in developing cleanup goals will encourage selection and deployment of appropriate environmental characterization and remediation technologies.

## A Systematic Approach to In Situ Bioremediation in Groundwater (ISB-8)

This document includes a decision tree that defines parameters and criteria for the feasible and effective implementation of ISB in general and also includes separate modules for using ISB to biologically treat nitrate, carbon tetrachloride, and perchlorate contamination. The ISB Team of ITRC developed this technical and regulatory guidance to demonstrate that this systematic approach can be applied to any specific contaminant or site for enhancing decisions about using ISB.

The decision trees, or flow diagrams, in the document help site decision makers systematically examine site parameters and criteria for the effective characterization, testing, design, and monitoring of ISB technologies. While the contaminants and breakdown products at contaminated groundwater sites may differ, there are some general site characteristics for determining the efficacy of ISB. The document presents the primary decision points for determining if natural processes can be effective in achieving remediation goals in a reasonable time frame or if engineered approaches should be implemented to accelerate bioremediation. The decision trees in the document point to sections of the document having more detailed information on specific elements.

## Diffusion Sampler Resource CD

While ITRC products have traditionally been documents and training courses, in 2002 the organization debuted its first CD as a means of disseminating information on an innovative technology. The Diffusion Samplers Team took this momentous step with the production and release of the ITRC Diffusion Sampler Resource CD, which contains nearly 70 articles and presentations on various diffusion samplers, as well as an ITRC training video and an Air Force Center for Environmental Excellence field sampling video.

## New Products for 2003

In 2003, 15 ITRC technical teams are producing guidance documents and conducting training on the deployment of innovative environmental technologies. ITRC technical teams have produced more than 40 guidance documents, all of which are available online at the ITRC web site at *www.itrcweb.org*. Click on "Guidance Documents" and select from the topical list to download a wide variety of ITRC guidance documents. To obtain a copy of the diffusion sampler CD, e-mail your request to *itrc@wpi.org* or call (540) 557-6071.

ITRC is a state-led group that works to overcome regulatory barriers to the deployment of innovative environmental technologies. ITRC participants come from the ranks of state regulatory agencies, Federal agencies concerned with environmental cleanup, environmental consulting firms, and technology vendors. These diverse ITRC participants work together in technical teams to develop documents and training to help regulators develop a consistent and streamlined approach for regulating innovative technologies. ITRC products also help environmental consultants improve the way innovative technologies are deployed.

The ITRC Board of Directors is chaired by G. Ken Taylor (*taylorgk@dhec.state.sc.us*), director of the Hydrogeology Division of South Carolina's Bureau of Land and Waste Management.

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# Five-Year Review Report

## MCAS Yuma, Arizona

### Introduction

The First Five-Year Review Report dated 18 November 2002 outlines the performance of institutional controls implemented in Operable Unit 2 (OU-2) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Areas of Concern (CAOCs) 1, 8A, and 10 at Marine Corps Air Station (MCAS) Yuma, Arizona. The institutional controls were selected in the OU-2 Record of Decision (ROD) signed on 02 December 1997.

### Background

MCAS Yuma is located southeast of the city of Yuma, Arizona. It is an active facility used primarily by the United States Marine Corps for aviation training. During its past operation, MCAS Yuma has generated industrial wastes, some of which were disposed in landfills, burn pits, and other areas located throughout MCAS Yuma.

OU-2 consists of contaminated soils at the Station from the ground surface to a depth of 10 feet below ground surface. The remedial investigation for OU-2 assessed the impact of hazardous substance releases on human health and the environment. Of a total of 18 CAOCs investigated, 12 CAOCs were recommended for no further action because they did not pose a threat to human health or the environment. The remaining six CAOCs (1, 4, 7, 8A, 9, and 10) were recommended for remedial actions to address any potential threat to human health from exposures to asbestos, metals, or organic compounds in the soil. The remedies for CAOCs 4, 7, and 9 involved the removal of visible asbestos-containing material (ACM) and ACM-containing surface soil, verification inspections, and off-site disposal. The remediation of these three CAOCs was completed 07 June 1999. The remedies selected were to restrict land use to industrial/commercial for CAOCs 1 and 10 and to its current use as an inactive landfill facility for CAOC 8A. The human health risks for these land use scenarios were determined to be within the United States Environmental Protection Agency (U.S. EPA) acceptable range.

The purposes of this Five-Year Review were to evaluate the performance of the remedies implemented in OU-2 CAOCs 1, 8A, and 10 and to recommend actions for improvement if these remedies have not performed as designed. The review was conducted in accordance with the Navy/Marine Corps Policy for Conducting CERCLA Statutory Five-Year Reviews (November 2001) and the U.S. EPA Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001). The review comprised document and data review, site inspections, Station personnel interviews, regulatory comments review, and report development.

### Review Summary

The results of the review indicate that the intent of the remedy for CAOCs 1, 8A, and 10, (i.e., protection of human health by restricting land use) has been achieved with the signing of the OU-2 ROD in December 1997 and formal inclusion of the institutional controls for OU-2 in the 2001 MCAS Yuma Master Plan, the 2002 Final Land Use Control Implementation Plan (LUCIP), and the 2002 MCAS Yuma Station Order 5090. These institutional controls have been successfully employed by the MCAS Yuma Environmental Department to limit the land use of CAOCs 1, 8A, and 10 and to review dig permit applications and new construction plans involving OU-2 sites and other Station sites and range locations.

MCAS Yuma Station Order 5090, signed on 10 January 2002, formally directed tenants and contractors to incorporate the Land Use Controls (LUCs), as provided in the MCAS Yuma Master Plan and the Final LUCIP, into their existing land use planning and management programs. The Final LUCIP provides revised LUCs for OU-2 and the steps to be taken in implementing them.

To fulfill the requirement of site registration with the state of Arizona as specified in the OU-2 ROD, the Navy has provided proposed "modified Declaration of Environmental Use Restrictions" (DEURs) for CAOCs 1, 8A, and 10 in the Final LUCIP. Although the proposed "modified DEUR" is not a "covenant running with the land," the Navy believes that the recording of each "modified DEUR" satisfies the substantive intent of Arizona Revised Statute 49-152(E), given the Navy's other responsibilities under CERCLA and Federal property law. The Final LUCIP also stipulates that the Arizona Department of Environmental Quality (ADEQ) will be informed of any future plans to transfer the properties to non-Federal ownership. Therefore, recordation of the "modified DEURs,"

together with the LUC provisions in the MCAS Yuma Master Plan and the Final LUCIP, will restrict the use of CAOCs 1, 8A, and 10 and provide a proper notice to any future non-Federal property owners of the contamination.

The First Five-Year Review Report was due on 02 December 2002, five years after the triggering action date established by the signing of the ROD. The Department of Navy (DON) will publish notices in the *Yuma Sun* and *Desert Warrior* stating that the First Five-Year Review Report is completed and available to the public at the Yuma County Public Library. In addition, the DON will distribute a factsheet to the current Restoration Advisory Board members and other community members regarding the conclusions of the five-year review.

### Conclusions

The remedies at OU-2 are and will continue to be protective of human health and the environment because exposure pathways that may result in unacceptable risks are being controlled as follows:

1) Institutional controls are in place to restrict exposures to contaminants in soil at CAOCs 1, 8A, and 10 through MCAS Yuma Station Order 5090 (issued on 10 January 2002). This order formally directed tenants and contractors to incorporate the LUCs provided in the MCAS Yuma Master Plan and the Final LUCIP into their existing land use planning and management programs.
2) The "modified DEURs" for CAOCs 1, 8A, and 10 have been proposed to satisfy the requirements specified in the OU-2 ROD for registration of the sites with the state of Arizona.
3) The MCAS Yuma Environmental Department will continue to review and coordinate all plans for future activities at CAOCs 1, 8A, and 10, in consultation with U.S. EPA and ADEQ, as necessary, to ensure continued compatibility with the land use restrictions specified in the OU-2 ROD.

The next five-year review for MCAS Yuma OU-2 will be completed in 2007. Consecutive five-year reviews will be conducted for OU-2 as long as the site soil conditions do not allow for unlimited land use and unrestricted exposures.

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# GIS Workgroup Update

The NAVFAC Installation Restoration (IR) Geographic Information System (GIS)/Data Management Workgroup has been established to develop and coordinate a corporate methodology using common business practices for enhancing and facilitating the use of IR data through GIS and web-based applications in a consistent and cost effective manner. The goal is to develop a system which will be used by all the Engineering Field Divisions/Activities (EFD/As) and Naval Facilities Engineering Service Center (NFESC) to manage all IR Program data. The database will have applications to allow Remedial Project Managers (RPMs) to access, share and evaluate IR data using web-based and desktop applications, making evaluation and visualization of data easier and more cost effective. No more lugging around 7-volume remedial investigation reports to team meetings, and no more lost or unusable data when changing contractors.

The standardized database structure, Phases I and II, will be completed in April 2003. Development of Phase III, System Administration Tools, has begun.

*For more information, view the website:*
*http://enviro.nfesc.navy.mil/erb/support/work_grp/gis/main.htm*

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# DoD Conducts Pressure-Driven Bioventing Demonstrations

## Introduction

Natural pressure-driven bioventing, a technology that provides an option for remediating hydrocarbon-contaminated soils, was tested recently at several Department of Defense (DoD) sites through an Environmental Security Technology Certification Program (ESTCP) funded project. This technology is a variation of conventional bioventing, a proven, cost-effective technology that has been applied at numerous DoD and Department of Energy (DOE) installations. Results indicate that, in general, natural pressure-driven bioventing has the potential for application at sites with relatively high permeability and soils with lower moisture content, and may be applicable at other locations based on site-specific conditions.

## What is bioventing?

Bioventing is a technology used to remediate organic contaminants (such as petroleum hydrocarbon compounds found in fuels) that are biodegradable under aerobic conditions. This technology involves injecting ambient air into the vadose zone, which provides indigenous microorganisms in the soil with sufficient oxygen to increase their metabolic activity. This activity in turn promotes conversion (i.e., mineralization) of the contaminants into inert substances. "Conventional" bioventing relies on a blower to force air into the soil. In contrast, "natural pressure-driven" bioventing relies on changes in atmospheric pressure to move air into the soil; because little external input is required, the term "passive" bioventing is commonly used to describe this technology.

Passive bioventing systems work through use of vent wells, both to focus air into the contaminated zone and to enhance the natural tendency for air to move through soils. Every day, the atmospheric pressure changes in predictable cycles due to the heating and cooling of the atmosphere by the sun. The random passage of weather systems also creates atmospheric pressure changes. The responses of soil gas at depth to the changes in atmospheric pressure set up the movement of air between the atmosphere and the soil. (This effect is often noticed at the entrance of large cave systems as the cave "breathes" in response to atmospheric pressure changes.) A typical vent well "breathes" in both directions when left open, inhaling when atmospheric pressure rises and exhaling when the pressure drops (Figure 1a). However, for passive bioventing systems, the vent well

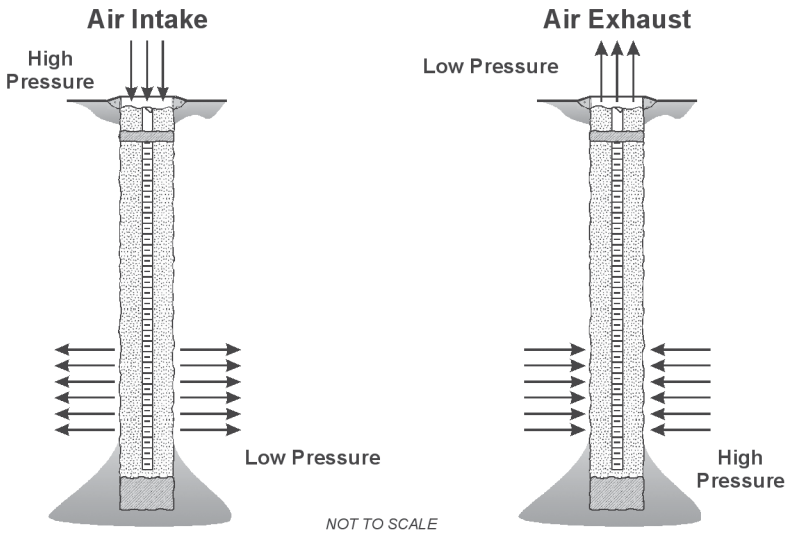


*Figure 1a. Air exchange through a typical vent well.*

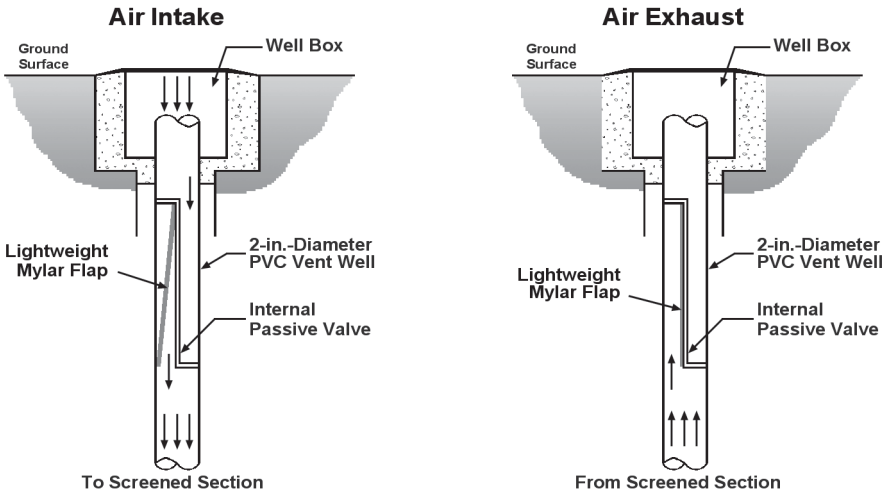


*Figure 1b. Operation of a passive bioventing valve.*

is prevented from exhaling, and thus losing oxygenated air back to the atmosphere. To achieve this, low backpressure one-way check valves, termed "passive bioventing valves," have been developed to increase the potential oxygenation of the soil by allowing air to flow only into the soil during periods of rising atmospheric pressure (Figure 1b).

Natural pressure-driven bioventing offers several potential benefits over conventional bioventing, including increased reliability through simplicity of design, reduced operation and maintenance (O&M) requirements, and reduced energy consumption. Also, the technology can be used at remote sites where electrical power is unavailable and its installation is cost prohibitive. Passive bioventing is also likely to be less disruptive to facility operations than other technologies with aboveground requirements.

## DoD Demonstrations

Recently, tests have been conducted at various DoD and DOE sites within the United States to evaluate the applicability of passive bioventing technology across variable site conditions. Early test sites included Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, California; Hill Air Force Base, Ogden, Utah; and DOE Savannah River Site, Aiken, South Carolina. All of these sites have very deep vadose zones (100 to 200 ft below ground surface) with very low soil moisture. Results from these sites indicated that passive bioventing was a viable technology and further evaluation was necessary to test the limits of its application.

Next, a long-term field demonstration of passive bioventing was conducted at Castle Airport (formerly Castle Air Force Base (AFB)), near Merced, California. The depth to groundwater at Castle Airport during the demonstration was 60 ft below ground surface. A variety of subsurface installations were used, including vent wells, soil gas monitoring points, and in situ oxygen sensors. Test data were collected through a data acquisition system, like the one shown in Figure 2. The average flowrate into the primary vent well was 3,400 cubic feet of air per day. Although this volume is less than would be attainable by conventional bioventing, it proved to be capable of promoting significant aerobic biodegradation at distances from the injection well that could be used to design a cost-effective remediation system.

*Figure 2. Example vent well equipped with monitoring equipment to collect performance data.*

The results of the Castle Airport test were very encouraging, as significant airflow was observed into soils screened as shallow as 25 to 35 ft below ground surface. This suggested that passive bioventing may be useful at a broader range of sites than was previously anticipated, including sites of shallow depth that have low-permeability soil layers, or sites that contain artificial surface coverings (i.e., asphalt roads or parking lots) that overlie permeable contaminated zones.

Most recently, short-term (i.e., two weeks long) passive bioventing tests were performed at 10 locations throughout the eastern United States. In contrast to site conditions at previous test locations, the amount of vadose zone available for bioventing at most of these sites was limited by shallow depths to groundwater. Additionally, at two of the sites–Fort Stewart, Georgia, and Robins AFB, Georgia–further investigations were conducted on vent well design and construction. Results indicated that, although low airflow rates were measured at all of the sites, the differential pressures created between the atmosphere and the subsoil achieved much smaller airflow rates than at previous test sites. These reduced airflow rates would not, in most cases, yield a radius of influence in the high-moisture soils that was substantial enough for passive bioventing to be a cost-competitive alternative to conventional bioventing.

## Summary

Natural pressure-driven bioventing has limited potential at sites with shallow vadose zones and higher soil moisture content. However, it should be considered as a potential remedial alternative at sites where soil conditions include lower moisture content, a thick highly-permeable zone (with a deep water table), or a permeable region in the vadose zone which is capped by a low-permeability layer. Also, passive bioventing becomes a particularly attractive option at those sites if electric power is not readily available on site, or if the power is too expensive to procure. Because passive bioventing has limited application, remedial project managers (RPMs) should receive further technical guidance prior to selecting this technology as a remediation alternative for their site.

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# Rapid Sediment Characterization and Advanced Chemical Fingerprinting –

## Application in Contaminant Source Identification in Sediments

Defining the nature and extent of anthropogenic contamination in sediments can be difficult. This is particularly true in waterways and coastal areas where multiple point sources coexist along with persistent non-point sources (i.e., urban background), a situation that leads to complex mixtures of contaminants in nearby sediments. Because of the substantial liability associated with the remediation or recovery monitoring sediments, it is important that Navy remedial project managers (RPMs) have a clear understanding of the source(s) of the contaminants, in particular whether there are non-Navy contaminant sources contributing.

Toward this end, a project being conducted by personnel from Space and Naval Warfare Systems Command (SPAWAR) (San Diego), Engineering Field Division, Atlantic (EFDLANT) (Norfolk), and Battelle Memorial Institute (Duxbury) is addressing this issue through the cost-effective combination of rapid sediment characterization (RSC) and advanced chemical fingerprinting (ACF) techniques. The objective of this project is to produce a User's Guide for RPMs that describes and demonstrates the process by which the Navy can defensibly determine the nature, extent, and source(s) of anthropogenic contamination in sediments near existing or former Naval facilities.

The advantages of combining RSC and ACF are clear. RSC can cost effectively screen a large number of sediments within a study area, thereby providing excellent spatial coverage, including the identification of "hot spots" and contaminant trends. The RSC results also provide a basis for selecting a subset of sediments for more expensive ACF, a suite of analytical techniques developed for the purpose of distinguishing sources of contaminants. The validity of the approach is being tested through a study of the sources of polycyclic aromatic hydrocarbons (PAH) in the Southern Branch of the Elizabeth River near the Norfolk Naval Shipyard (NNSY) and other Naval properties (Figure 1). This urban waterway, one of the most contaminated on the East Coast, has a long Naval and industrial history, including the occurrence of former wood treatment facilities with sizable documented creosote releases. The on-going study has combined historical research with RSC (i.e., immunoassay screening of PAH in nearly 200 sediments) and ACF (i.e., high resolution gas chromatography/flame ionization detector (GC/FID) and alkylated PAH analysis of 50 sediments) in an effort to establish the source(s) of PAH throughout the study area, particularly those sediments proximal to naval operations. The RPM User's Guide and accompanying Elizabeth River PAH demonstration study will be made available on the NFESC website on its completion this Spring.

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*Figure 1. Study area for the demonstration study intended to determine sources of PAH to sediments in the Southern Branch of the Elizabeth River, in the vicinity of the Norfolk Naval Shipyard and other Navy properties. Also listed are nearby potential PAH sources.*

# Five-Year Review Report

## MCLB Barstow, California

### Introduction

The Five-Year Review Report dated 18 October 2002 outlines the status of Installation Restoration (IR) Operable Units (OUs) 1 through 6 for the Marine Corps Logistics Base (MCLB) Barstow, California. OUs 1 and 2 are in the remediation phase. OUs 3, 4, 5, and 6 have been completed. The Five-Year Review is statutory for OUs 3, 4, 5, and 6 and policy for OUs 1 and 2.

### Background

The Five-Year Review Report has been prepared by the United States Department of the Navy (DON) in support of the Installation Restoration Program (IRP) being conducted at MCLB Barstow, California. Soil and groundwater at MCLB Barstow have been impacted and are currently being cleaned up under the IRP. MCLB Barstow was placed on the National Priority List in 1989.

MCLB Barstow includes two separate facilities – Yermo Annex and Nebo Main Base. For the purposes of the IRP, the Base has been divided into a total of seven OUs. Each OU is divided into a number of Comprehensive Environmental Response, Compensation, and Liability Act Areas of Concern (CAOCs). OUs 1 and 2 pertain to groundwater contamination beneath the Yermo Annex and Nebo Main Base, respectively. Groundwater contamination is primarily due to dissolved volatile organic compounds (VOCs). OUs 3 and 5 pertain to soil contamination at the Yermo Annex, and OUs 4 and 6 pertain to soil contamination at Nebo Main Base. Soil contamination is primarily due to VOCs, metals, pesticides, polychlorinated biphenyls, and polynuclear aromatic hydrocarbons (PAHs).

Records of Decision (RODs) were signed in 1997 for OU 3 and OU 4 (as a pair), and in 1998 for OU 1 and OU 2 (as a pair) and OU 5 and OU 6 (as a pair). A seventh OU, OU 7 covers sites that were not covered under OUs 1 through 6. The ROD for OU 7 has not yet been signed, and it is therefore not subject to this five-year review.

Remedial actions (RAs) have been implemented at CAOCs OUs 3 through 6 and are being implemented at OUs 1 and 2. This five-year review evaluates the remedies implemented at each of the CAOCs at OUs 1 through 6.

### OU 1

OU 1 is the groundwater at Yermo Annex and includes three dissolved VOC plumes [CAOC 26, Yermo North (CAOC 16), and Yermo South]. Portions of the Yermo North and Yermo South extend off Base. These plumes are being remediated by the CAOC 16 and CAOC 26 air sparging/soil vapor extraction (AS/SVE) systems, and the Yermo Annex Groundwater Extraction and Treatment System (GETS). Treatment systems are in place at one on-Base drinking water well and two off-Base drinking water wells. OU 1 includes groundwater monitoring for CAOCs from other OUs, specifically CAOCs 15, 16, 17, 20, 23, 26, and 35. The CAOC 26 AS/SVE system has met its ROD objective of reducing VOC contamination in soil and groundwater at CAOC 26 to acceptable levels, and has been shut down. The CAOC 16 AS/SVE system and the Yermo Annex GETS are in operation, and are meeting their objectives – VOC mass in groundwater and soil are being reduced, and VOC levels are decreasing.

All of the remedies at OU 1 are protective of human health and the environment. Issues identified at OU 1 include the effect of declining water levels on the GETS, need for additional AS wells at CAOC 16, and evaluation of dissolved VOCs at depths below the GETS wells outside the Base. Background levels of metals in groundwater require evaluation. Four proposed off-Base extraction wells have not been installed due to the decreasing levels and extent of off-Base VOCs.

A technical memorandum will be submitted in support of this strategy. On approval of the technical memorandum, an Explanation of Significant Differences (ESD) will be submitted. The exposure assumptions, toxicity data, cleanup levels, and Remedial Action Objectives (RAOs) used at the time of the remedy selection are still valid. New information that could call into question the effectiveness of the remedy includes temporary increase in dissolved VOCs in groundwater beneath the Yermo Annex in December 2001 (these reduced to historic levels based on subsequent sampling). Methyl tert-butyl ether (MTBE) has been detected in groundwater beneath the southwest portion of the Yermo Annex. This has a potential impact on the GETS, which has been modified to address MTBE. There are no formal Operation and Maintenance manuals for the off-Base residential well and on-Base drinking water well treatment systems. These will be prepared.

*continued on page 12*

*"Five-Year Review Report" continued from page 11*

## OU 2

OU 2 is the groundwater at Nebo Main Base, and includes two dissolved VOC plumes (Nebo North and Nebo South). A portion of the Nebo South plume extends off-Base. It also includes groundwater monitoring associated with CAOC 7 (in the southern portion of Nebo Main Base) and for evaluation of pesticides (dieldrin) at Nebo North, specifically at CAOCs 1, 2, 3, and 14 (dieldrin was not detected). An interim GETS is in place at Nebo North (on standby status). The VOC plume at Nebo North remains stable, with concentrations showing a decrease over time.

An AS/SVE treatability study is planned for Nebo North based on the results of the Extended Resource Conservation and Recovery Act (RCRA) Facility Assessment (which indicated elevated levels of VOCs in soil gas). The treatability study will be followed by full-scale implementation, if found to be necessary and feasible. For Nebo South, an interim remedy consisting of a GETS was proposed in the ROD, but not implemented, as it may promote off-Base migration of VOC contamination that is currently on-Base.

A technical memorandum will be submitted in support of this strategy. On approval of the technical memorandum, an ESD will be submitted. An AS/SVE pilot test is under way, which indicates that AS/SVE is a feasible technology for Nebo South. Dissolved VOC contamination was detected in the southwest portion of Nebo Main Base (several thousand feet away from the Nebo South plume).

Additional wells are planned for the ongoing AS/SVE pilot test at Nebo South, which will allow evaluation of the relation between the Nebo South plume and the VOCs at groundwater monitoring well NPZ-14. The exposure assumptions, toxicity data, cleanup levels, and RAOs used for this OU at the time of the remedy selection are still valid. There is no new information that could call into question the effectiveness of the remedies at this OU.

## OU 3

OU 3 is the shallow soils at Yermo Annex for which data existed prior to the Remedial Investigation (RI) and includes CAOCs 18, 20, 23, and 34. Institutional Controls (ICs) were implemented for CAOCs 18, 20, 23, and 34, and continue to be protective of human health and the environment. Caps were constructed at CAOCs 20 and 23, and continue to be protective of human health and environment.

## OU 4

OU 4 is the shallow soils at Nebo Main Base (for which data existed prior to the RI) and consists of CAOCs 2, 5, 9, 10, and 11. Of these, CAOC 10 is now being evaluated under OU 7. CAOC 10 was originally eliminated in 1994 as not requiring any action, but was subsequently found to require further investigation. No Further Action (NFA) was selected at the remaining CAOCs, although Base Master Plan modifications were required (and completed) for CAOCs 2, 5, and 11. The remedies continue to be protective of human health and the environment.

## OU 5

OU 5 is the shallow soils at Yermo Annex (for which data did not exist prior to the RI) and consists of CAOCs 15/17, 16, 19, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 35, and 36. Of these, CAOC 25 was eliminated from the RI as not requiring additional investigation/remediation. NFA was selected at CAOCs 19, 22, 24, 25, 27, 28, 29, 30, 31, and 32. ICs were selected and implemented for CAOCs, 15, 16, 17, 18, 21, and 26. A cap and ICs were selected and installed for CAOC 35. The remedies continue to be protective of human health and the environment.

## OU 6

OU 6 is the shallow soils at Nebo Main Base (for which data did not exist prior to the RI) and includes CAOCs 1, 3, 4, 6, 7, 8, 12, 13, 14, and 33. Of these, CAOC 33 was eliminated from the RI as not requiring further investigation. NFA was selected at CAOCs 4, 6, 8, 12, 13, and 14. ICs were required at CAOCs 1 and 3. A native soil cap and ICs were selected and implemented at CAOC 7. The remedies continue to be protective of human health and the environment. Groundwater at CAOC 6 is covered under OU 2.

RAs at OU 3, 4, 5 and 6 have been completed and have been deemed to be "operating properly and successfully" by the Federal Facilities Agreement (FFA) regulatory agencies (United Stated Environmental Protection Agency, California Department of Toxic Substances Control, and California Regional Water Quality Control Board). They were closed with Remedial Action Reports in August 2000 and June 2002. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There is no new information that could call into question the effectiveness of the remedies at these OUs.

## Summary

In summary, the remedies at all of the CAOCs were found to be protective of human health and the environment. Issues were identified for OUs 1 and 2. Recommendations and identified milestones to address these have been provided as part of the five-year review.

In the spirit of partnering, a draft version of this document was provided to the FFA regulatory agencies on 18 October 2002 for their information.

## Discussion

Issues identified for OUs 1 and 2 and recommendations to address these issues have been reviewed and will be followed up as necessary.

According to the National Contingency Plan and Final Chief of Naval Operations (CNO) Policy on Five-Year Reviews, issued in November 2001, Five-Year Review reports are to be completed and signed within five years of the trigger date for the site when, upon the completion of the remedial actions at a site, hazardous substances, pollutants, or contaminants will remain above levels that allow for unlimited use and unrestricted exposure.

The OUs 1 and 2 ROD, signed 22 April 1998, requires the review of OUs 1 and 2 after five years. According to Navy policy, the trigger date for the statutory Five-Year Review of OUs 3 and 4 is the remedial action mobilization date for CAOCs 20 and 23, or 9 September 1998. The trigger date for the statutory Five-Year Review of OUs 5 and 6 is the signing of the OUs 5 and 6 ROD date, 23 January 1998, driven by CAOC 16. Therefore, the due date of this combined Five-Year Review was determined to be 23 January 2003.

Once the document is signed, the DON will publish notices of the completion of the Five-Year Review in three local Barstow papers advising the public that the Five-Year Review report is available for review. In addition, the DON will publicize the report findings in a fact sheet to persons listed on the MCLB Barstow community relations distribution list. A copy of the document will be placed in the information repository for public viewing. Copies will also be provided to the FFA regulatory agencies for their information.

*For more information, contact:*
*(619) 532-1448*

# DNAPL Remediation Technologies Survey

## The U.S. Navy is Still Looking for Participants

This is a reminder that the Naval Facilities Engineering Services Center (NFESC) is still looking for participants to fill in the web-based DNAPL Remediation Technologies Survey. The data collected from the survey will be used to help develop a decision matrix that compares and evaluates various chlorinated solvent DNAPL source remediation technologies. The technology evaluation will address technology performance and application cost for various site and source conditions as well as remedial goals.

The objective of this survey is to collect information on innovative and demonstrated DNAPL source remediation technologies (e.g., thermal, chemical, surfactant, bioremediation, excavation, encapsulation, etc.) that have been tested or applied at sites with contaminated groundwater.

So far we have approximately 100 participants and have collected information on roughly 50 sites. If you have already begun a survey, but have not yet completed it, please remember that your access to the information already entered expires after 30 days.

You will benefit from filling out this survey by:

- having access to the final report upon publication which will contain information such as: remediation technology theory and application, an evaluation of technology performance and development status, and an indication of remedial costs and technical practicability/ impracticability;
- helping to expand the state of the knowledge of DNAPL remediation and identify potential new research areas; and
- having access to the list of technology experts and vendors generated from a list of survey respondents.

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*For further information, and to access the survey, please go to the following web address:*

***https://projects.geosyntec.com/navy_rocs/***

*For additional information about the survey, or if you have any questions, comments or concerns, please contact:*

*(805) 982-1616* *(519) 822-2230*

# RITS Spring 2003

## Remediation Innovative Technology Seminar

The Remediation Innovative Technology Seminar (RITS) provides training on new and innovative technologies, methodologies, and guidance under the Navy's Environmental Restoration Program. RITS is sponsored by the Naval Facilities Engineering Command (NAVFAC) in coordination with its geographic Engineering Field Divisions (EFDs) and Activities (EFAs), and its Naval Facilities Engineering Service Center. The RITS training serves as one of many ways the Navy promotes innovative technologies, cost-avoidance strategies, and lessons learned.

### Topics for this offering are:

**Coastal Contamination Migration Monitoring** - This topic describes the development of two new monitoring methodologies to address sites located adjacent to harbors, bays, estuaries, wetlands and other coastal environments. The first technology, the ***Trident*** probe, was developed to screen sites for areas where groundwater (freshwater) discharges to a saline bay or estuary. The second technology, the ***Ultraseep*** meter, was developed to quantify groundwater flow to coastal waters and make direct measurements of flux and contaminant concentration at a particular location.

**Toxicity Identification Evaluation (TIE) & Assessing Risk to Amphibians** Two recently developed risk assessment tools will be studied in this session. One, the Toxicity Identification Evaluation (TIE) protocol, is used to make decisions regarding the source of toxicity when there are various contaminants of potential concern (CPOCs). NAVFAC case studies will be presented. The second tool provides more appropriate endpoints for toxicity tests by assessing potential risk to amphibians exposed to sediment. The state of the science will be highlighted along with laboratory study results.

**Dense Nonaqueous Phase Liquid (DNAPL) Detection and Characterization Techniques** - Proper DNAPL characterization greatly improves the remediation technology selection process. In order to assist remedial project managers (RPMs) in making sound decisions, this session will describe specific DNAPL properties affecting fate and transport, and focus on the unique problems DNAPL contaminants present. Various methods for identifying, characterizing, and monitoring DNAPLs will be compared. Case studies will illustrate where DNAPL was found in various heterogeneous media.

**Estimating Timeframes of MNA** - Under suitable conditions, monitored natural attenuation (MNA) can be a cost-effective strategy for restoring aquifer systems contaminated with chlorinated ethenes or petroleum hydrocarbons. This topic will summarize a decision-making framework and methodology for assessing MNA and estimating timeframes required for natural attenuation processes to work. An interactive computer program - Natural Attenuation Software (NAS) will be demonstrated.

While the RITS is developed primarily for the Navy's Environmental Restoration and Base Realignment and Closure (BRAC) environmental professionals, it is also available to other Department of Defense (DoD) personnel, the Navy's environmental cleanup contractors, and environmental regulators.

## Agenda

| | |
|---|---|
| 0800 - 0830 | Welcome and Introductions |
| 0830 - 1000 | Coastal Contamination Migration Monitoring |
| 1000 - 1130 | Toxicity Identification Evaluation (TIE) & Assessing Risk to Amphibians |
| 1130 - 1230 | Lunch |
| 1230 - 1430 | DNAPL Detection and Characterization Techniques |
| 1430 - 1600 | Estimating Timeframes of MNA |

# Schedule

| EFD/A | 2003 Date | Location |
|---|---|---|
| EFA Northeast | 1 April, Tuesday | Renaissance Hotel Philadelphia Airport<br>500 Stevens Drive<br>Philadelphia, PA 19113<br>(800) 468-3571 (610) 521-5900 |
| Atlantic Division | 3 April, Thursday | Norfolk Waterside Marriott<br>235 East Main Street<br>Norfolk, VA 23510<br>(800) 228-9290 (757) 627-4200 |
| Southwest Division | 22 April, Tuesday | Holiday Inn on the Bay<br>1355 North Harbor Drive<br>San Diego, CA 92101<br>(800) 877-8920 (619) 232-3861 |
| EFA Northwest | 24 April, Thursday | Silverdale on the Bay Resort (aka WestCoast Silverdale)<br>3073 NW Bucklin Hill Road<br>Silverdale, WA 98383<br>(800) 325-4000 (360) 698-1000 |
| Southern Division | 29 April, Tuesday | Sheraton North Charleston Hotel<br>4770 Goer Drive<br>North Charleston, SC 29406<br>(888) 747-1900 (843) 747-1900 |
| EFA Chesapeake | 1 May, Thursday | Hyatt Regency Crystal City<br>2799 Jefferson Davis Highway<br>Arlington, VA 22202<br>(800) 633-7313 (703) 418-1234 |
| Pacific Division | 6 May, Tuesday | HRSC Training Center Room #3<br>94-810 Moloalo Street 2nd Floor<br>Waipahu, HI 96797<br>(808) 671-1643 ext 208 or 209 (Registrar) |

# Registration

Register on the web, or by e-mail, phone, or fax no later than one week prior to the date of the seminar you plan to attend. Provide the following information:

- Seminar Date & Location you plan to attend
- Name
- Organization/Company
- Telephone
- Fax
- E-mail

**Due to space limitations, registration for Contractors is limited to those currently working under the Navy's environmental restoration program. If you are a Contractor, please provide us with your Contract Number and Primary Navy Technical Point of Contact.**

Web: *http://enviro.nfesc.navy.mil/erb/support/rits/main.htm*
E-mail: *rits@nfesc.navy.mil*
Voice: (805) 982-5575 DSN 551-5575
Fax: (805) 982-3694 DSN 551-3694

- *You must make your own lodging arrangements.*
- *There is no cost to attend the seminar.*
- *No form DD1556 is required.*

# Reminder

Get a head start on your article for upcoming issues of RPM News.

Please provide a complete current and/or updated article from a previous story. A complete article includes text, photographs, figures, captions, etc. Because EFD/As sometimes submit multiple articles, send a separate e-mail for each article. Tentative deadlines for each upcoming issue of RPM News:

**SUMMER 2003**
April 28

**FALL 2003**
July 28

**WINTER 2003**
October 28

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