Secretary of Defense Environmental Awards
Fiscal Year 2014 – Environmental Restoration - Team
Marine Corps Air Station, Cherry Point, North Carolina

INTRODUCTION

Commissioned in 1942, Marine Corps Air Station (MCAS) Cherry Point initially served as a training base for Marines bound for the Pacific theater during World War II.

Today, MCAS Cherry Point is home to over 9,400 Marines and sailors and 5,200 civilian employees. MCAS Cherry Point hosts the 2nd Marine Aircraft Wing (2dMAW), including 10 flying squadrons and various ground support elements; the Fleet Readiness Center East, Eastern North Carolina's single largest industrial facility; and Halyburton Naval Health Clinic. Cherry Point operates the BT-9 and BT-11 air-to-ground target range complexes and the Mid-Atlantic Electronic Warfare Range, all of which are vitally important to the training missions of each of the military service branches. MCAS Cherry Point also operates a squadron of search and rescue (SAR) helicopters that, in addition to supporting the military training mission, provide essential forest fire fighting assistance, emergency medical evacuation, and SAR support to the regional community.

Cherry Point covers 13,164 acres with an additional 15,980 acres in outlying support areas. MCAS Cherry Point is surrounded on three sides by the environmentally sensitive waters of the Neuse River watershed. The estuarine environment serves as habitat for many species of migratory birds and as a nursery for coastal shore birds and marine life.

BACKGROUND

The MCAS Cherry Point Tier 1 Partnering Team is comprised of representatives from a variety of Federal and State Agencies, as well as remedial engineering and remedial action contract organizations. The Partnering process is what enables these Agencies and Organizations to work as a team to identify and achieve shared goals. MCAS Cherry Point Partnering Team's approach to cleanup activities creates an environment that supports innovation, encourages honesty and openness with both the community and the regulatory agencies, and fosters the sharing of successful technologies and management techniques across program and site boundaries.

MCAS Cherry Point Partnering Team

William Potter, MCAS CHERRY POINT

John Myers, MCAS CHERRY POINT

Bryan Revell, NAVFAC MID-ATLANTIC

Gena Townsend, USEPA

George Lane, NCDENR

Bill Hannah, CH2MHILL

Doug Bitterman, CH2MHILL

Renee Hunt, CH2MHILL

Erica DeLattre, RHEA

MCAS Cherry Point's restoration objectives are aligned with the statutory Defense Environmental Restoration Program goals of "correcting environmental damage that creates an imminent and substantial endangerment to the public health or welfare or to the environment." The Navy seeks to achieve these goals in a technically sound, timely, and cost-effective manner. To this end, the Cherry Point Partnering Team has the following objectives:

- Prevent unacceptable risks to human health and the environment.
- Meet all regulatory requirements and deadlines.
- Share successful cleanup strategies that can be applied across regulatory programs.
- Maximize the use of innovative technologies and management approaches to support the installation mission, reduce costs, increase small business participation, and close sites.
- Improve relations with the community and the regulators by fostering an atmosphere of openness and trust.

The MCAS Cherry Point Partnering Team enjoys noteworthy success in meeting each of these objectives. This success can be attributed to the numerous initiatives the team has implemented over the past few years.

Environmental Restoration Timeline

FY2012	
1Qtr	OU1 Vapor Intrusion Investigation Phase 1 Completed
2Qtr	Land Use Control Assurance Plan Updated
	OU5 Remedial Action Completion Report
3Qtr	Restoration Advisory Board Meeting
	OU3 Remedial Action Completion Report
4Qtr	Update to Community Involvement Plan
FY2013	
1Qtr	OU1 Site 83 Record of Decision
	Restoration Advisory Board Meeting
2Qtr	OU2 Site 10 Interim Remedial Action Completion Report
	Land Use Control Assurance Plan Updated
	Restoration Advisory Board Meeting
3Qtr	OU13 Remedial Action Completion Report
	Update to Restoration Advisory Board Resource Manual
	3rd Five Year Review Update
4Qtr	FY14 Site Management Plan
FY2014	OU1 Central Groundwater Plume Record of Decision
	Installation of the OU1 Central Groundwater Plume Near-Source ISEB Remedy
	Installation of the OU1 Central Groundwater Plume Down-gradient PRB Remedy

Highlighting the Major Events of FY 2012 and 2013 demonstrates the MCAS Cherry Point Partnering Team's commitment to an accelerated restoration schedule.

ACCOMPLISHMENTS

The Cherry Point Partnering Team accelerated cleanup through effective program management, collaborative teamwork, application of innovative technology, and improved risk assessment. The following highlight the Team's recent efforts:

- Development and implementation of an innovative remediation strategy at Operable Unit 1; a 565-acre highly industrialized cleanup site presenting numerous challenges
- Validation through field-scale Pilot Studies of In-Situ Enhanced Bioremediation (ISEB) and Permeable Reactive Barrier (PRB) technologies as potentially viable treatment methods for Trichloroethene (TCE) contamination in groundwater
- Completion of a detailed Vapor Intrusion (VI) Investigation to assess potential migration of chlorinated volatile organic compounds (cVOCs) from contaminated groundwater into overlying industrial buildings at Operable Unit 1
- Continued improvement of Community Outreach Efforts through improved relations with MCAS Cherry Point's Restoration Advisory Board (RAB).

Innovative Remediation Strategy at OU1

Operable Unit 1 (OU1), an industrial area approximately 565 acres in size, is located in the southwestern portion of MCAS Cherry Point. Historic industrial activities at OU1 resulted in the release of chlorinated solvents to groundwater, hereby referred to as the OU1 Central Groundwater Plume. Previous investigations have determined that contaminants exist in concentrations above regulatory standards established to protect human health and the environment. In addition, the OU1 Central Groundwater Plume may have the potential to impact surface waters through migration of groundwater and its subsequent discharge to surface waters adjacent to OU1.

The major source of groundwater contamination at OU1 is a Dense Non-Aqueous Phase Liquid (DNAPL) plume of TCE located beneath a former plating shop. Under normal circumstances, source zone treatment of the DNAPL Plume would be the ideal remedial strategy. However, current operations, extensive subsurface infrastructure, low overhead clearance, dense spacing of equipment and workspaces, and a round-the-clock operational schedule currently prohibit the implementation of an in-situ treatment technology in the source area. Furthermore, the potential exists that any source zone treatment would have the potential to generate increased vapor intrusion risks to current workers. Due to these concerns, practical remedial alternatives to source zone treatment needed to be developed.

Due to the impracticality of Source Zone Treatment, a Feasibility Study was completed to evaluate practical remedial alternatives. The treatment area was divided into two separate treatment zones. Zone 1, the Near Source Zone, comprised the former plating shop and areas of the highest dissolved phase contaminant concentrations. Zone 2, defined as the Downgradient Zone, comprises the rest of the Central Groundwater Plume between Zone 1 and the surface water body of Slocum Creek and contains the lowest concentrations of dissolved phase contaminants. The Remedial Action Objectives associated with Zone 1 consists of a reduction of near source Contaminants of Concern

Contaminant Concentration Map illustrating the Central Groundwater Plume and it's relation to Operable Unit 1, as well as the delineation of the two separate treatment zones.

(COCs) by at least 70% in ten years or less, and reducing the mass flux of contaminants into the central portion of the groundwater plume and preventing discharge of groundwater exceeding NC 2B standards to surface water. The objective of Zone 2 consists of further treatment of the downgradient plume and preventing the discharge of groundwater exceeding the NC 2B standards to surface water.

The components of Zones 1 and 2 are intended to treat near source zones to the extent practicable in order to efficiently reduce COC mass and prevent future discharges to surrounding surface waters. A Zone 1 active remedy would be expected to improve performance of a Zone 2 remedial alternative over time. The Zone 1 treatment would serve to cut the source area off from the downgradient dissolved plume. Biodegradation in the dissolved portion of the plume would then be expected to accelerate since the suspected DNAPL source area would no longer be contributing mass to the downgradient portion of the plume. After a few years, the Zone 1 active remedy may be effective enough to discontinue or reduce operation/maintenance of the Zone 2 remedy. When evaluated as a whole, these two treatment zones represent a comprehensive remedial strategy that insures ongoing mission critical industrial operations as well as consistent reduction of contaminants in groundwater while preventing harmful discharges to surface water.

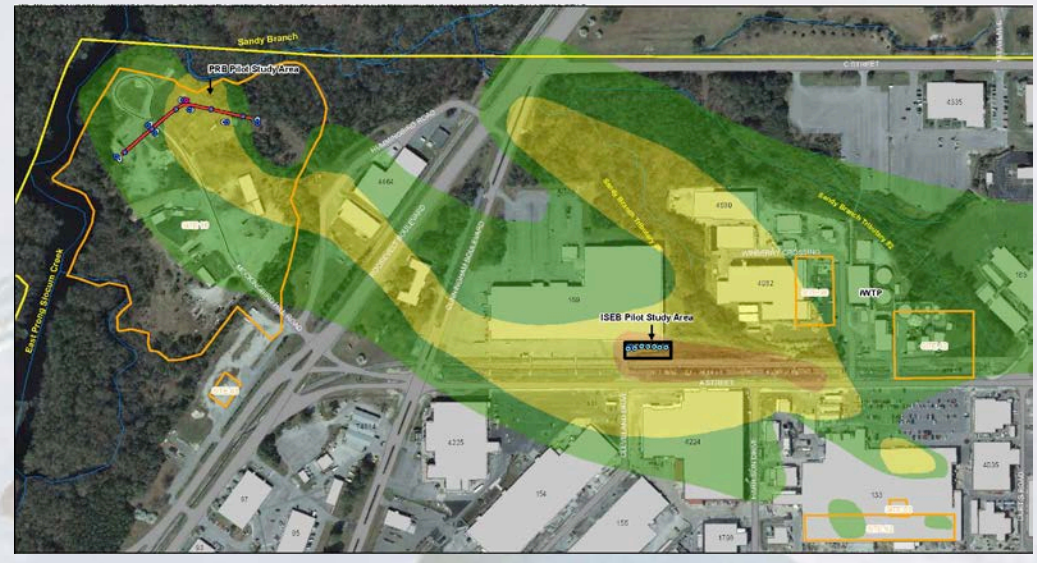
In order to evaluate the site-specific effectiveness of potential innovative technologies, the MCAS Cherry Point Partnering Team agreed to conduct field-scale Pilot Studies within the two separate treatment zones. These studies would provide data for potential optimization of full-scale implementation of the chosen technologies during the Remedial Design (RD) phase should they prove successful. In conjunction, an additional Vapor Intrusion Investigation was also initiated to assess potential migration of cVOCs from contaminated groundwater into overlying industrial buildings located within OU1.

Near –Source In-Situ Enhanced Bioremediation Pilot Study

The OU1 Central Groundwater Plume Feasibility Study identified In-Situ Enhanced Bioremediation (ISEB) as a potentially viable treatment for for the chlorinated solvent contamination within OU1's Near Source Zone 1 Treatment. ISEB is a technology used to promote enhanced reductive dechlorination (ERD) of chlorinated ethenes.

Beginning in August of 2010, the MCAS Cherry Point Partnering Team agreed to conduct an ISEB Pilot Study over a Two-year period. The purpose of the Pilot Study is to assess the potential effectiveness of the ISEB barrier and for potential optimization of full-scale implementation during a future remedial design of the permanent remedy.

The goal of the pilot study was to achieve a 90% reduction of TCE concentrations in the monitoring wells downgradient of the biobarrier and a 75% reduction of overall VOC concentrations.



Two separate Pilot Studies were required for the validation of Innovative Technologies in the two treatment zones. The ISEB Pilot Study addresses the high concentration Near-Source Zone 1 and the PRB Pilot Study addresses the lower concentration Downgradient Zone 2.

Additionally, a goal of the biobarrier will be to reduce the potential for migration of impacted groundwater to the surrounding surface waters at levels that would cause unacceptable risks to human or ecological receptors. Due to site constraints prohibiting a direct source treatment, a Near-Source barrier or biobarrier approach was chosen for the Pilot Study implementation. A barrier formation is typically oriented perpendicular to groundwater flow and relies on natural gradients to bring contaminated groundwater into the treatment zone.

Key tasks associated with the Pilot Study included the initial installation of 14 injection wells and five monitoring wells. After baseline sampling was completed, Phase 1 of the pilot study commenced with the injection of a Slow Release Emulsified Vegetable Oil Substrate (SRS). Once injected, SRS degrades to fatty acids, which are then fermented to hydrogen, the electron donor required for reductive dechlorination. The combination of slow and fast release electron donors (soybean oil and sodium lactate, respectively), is overall relatively insoluble, and is designed to release bio-available hydrogen over a period of up to three to five years, depending on the applied dosage and site conditions.

After several weeks post injection of the SRS substrate, Phase 2 of the Pilot Study began with the injection of a Bioaugmentation culture. Bioaugmentation is the introduction of microorganisms into the subsurface for the treatment of contaminated soil or groundwater and is used to accelerate the biodegredation of contaminants. The culture, containing the natural bacteria Dehalococcoides (DHC), is the only known organisms capable of dechlorination of tetrachloroethene (PCE) and its daughter products into the non-harmful end product ethene.

As specified in the Sampling and Analysis Plan, groundwater monitoring is to be conducted in the 3-, 6-, 9-, 12-, and 24-month intervals. The results of the 24-month sampling, conducted in June 2013, have proved promising:

- TCE reduction goal of 90% has been met within the upper surficial aquifer, with an approximate 56% reduction within the lower surficial aquifer
- Total VOC concentrations reductions of 36-45% have been seen within the upper and surficial aquifers, respectively

Although the target VOC reduction goal was not met, a net decrease in VOC concentrations, along with an increase of daughter product concentrations provides a strong line of evidence that reductive dechlorination of site contaminants is being accelerated by the introduction of the ERD substrate. Lessons learned will provide valuable information for implementation of an effective full-scale design. These Pilot Study test results demonstrate that

Enhanced Reductive Declorination is a suitable remedy for the near-source zone of the OU1 Central Groundwater Plume.

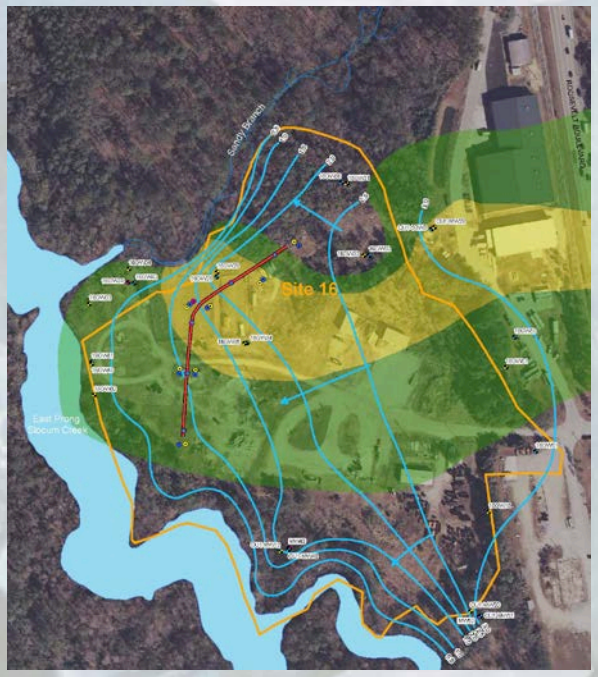
Injection of the Bioaugmentation Culture into surficial groundwater wells to accelerate biodegradation of VOCs

Downgradient Permeable Reactive Barrier Pilot Study

In conjunction with the Near Source Zone 1 ISEB Pilot Study, the OU1 Feasibility Study also identified alternative remedial actions for the downgradient Zone 2 portion of the OU1 Central Groundwater Plume. Installation of a Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB) was determined to be a viable treatment alternative for the downgradient portion of the Plume. The FS concluded that a PRB would have to be installed to a depth of approximately 35-40 feet below ground surface to prevent contamination from migrating and eventually discharging to the surface waters of Slocum Creek.

PRBs are passive groundwater treatment systems that create a subsurface zone to treat contaminants dissolved in groundwater as they flow through. The PRB technology relies on natural hydraulic gradients to bring contaminants into the reactive treatment medium which would ideally be positioned perpendicular to the groundwater flow.

For the pilot study, the reactive media chosen was ZVI, to promote the rapid degradation of chloroethenes to their nontoxic end products. Oxidation of ZVI under anaerobic conditions produces both ferrous iron and hydrogen that are reducing agents for chlorinated VOCs. The degradation process is an abiotic reductive dehalogenation process that occurs on the surface of the granular iron, with the iron acting as an electron source. Under ideal conditions, ZVI PRBs have been shown to be effective in reducing a wide range of dissolved chlorinated solvents in groundwater for up to 20 years or longer, without generation of toxic daughter products.



Site location and orientation of the PRB to intercept migrating groundwater prior to discharge to Slocum Creek.

The 12-month sampling event, completed in October 2013, has demonstrated early success in the reduction of Contaminants of Concern (COCs):

- Total COCs reduced by ~54% and total TCE reduction of ~47% in downgradient wells within the upper surficial aquifer
- Total COCs reduced by ~54% and total TCE reduction of ~94% in downgradient wells within the lower surficial aquifer

These results, along with lessons learned from this Pilot Study, will be instrumental in the design and application of a full scale PRB remedy for the Downgradient portion of the OU1 Central Groundwater Plume.

Vapor Intrusion Investigation

The VI investigation was conducted to assess potential migration of chlorinated volatile organic compounds (cVOCs) from contaminated groundwater and soil vapor into overlying industrial buildings at OU1. A VI investigation consists of four primary steps:

- Step 1 - Identification of Buildings of Interest
- Step 2 - Desktop Risk Evaluation
- Step 3 - Sampling and Analysis
- Step 4 - Multiple Lines of Evidence Evaluation to Assess Potential Risks

Suma Canisters collect Soil-Vapor Samples during Phase 2 of the VI Investigation

During Phase 1 of the Investigation, buildings located above the groundwater plumes or within 100 feet of groundwater monitoring wells with concentrations that exceeded the generic screening levels were selected as buildings of interest. Initially, 80 buildings were identified with OU1 for further investigation.

Detailed building surveys taken during this time included building descriptions indicating size, potential conduits from soil, potential pathways, and potential indoor air sources of contamination. Based on these results, 21 buildings were retained based on possible Vapor Intrusion Risks for further investigation. Phase 1 field activities related to these 21 buildings primarily included exterior groundwater and soil-vapor sampling. A review of the Phase 1 sampling results highlighted 14 buildings that would require an additional Phase 2 investigation due to possible Vapor Intrusion pathways.

The Phase 2 VI evaluation for the retained buildings of interest included subslab soil vapor and indoor/outdoor air sampling. The results of this sampling data were used to develop Base specific screening levels. Once the specific screening levels are determined, they are used to conduct a risk assessment to determine if potential risks for building occupants exceeded target risk levels.

Results of the Phase 2 VI assessment indicated that the VI pathway had been sufficiently characterized for the buildings of interest and that any risks posed were currently insignificant. However, the Partnering Team agreed that additional concurrent subslab soil vapor and Indoor/Outdoor air sampling, that was required to confirm results of Phase 2, would be included as part of an OU1 Central Groundwater Plume post-ROD performance monitoring program. As an additional protective measure, any further construction occurring within OU1 would require a similar VI Investigation as a precaution to protect workers both during and after construction.

Community Outreach Efforts

Restoration Advisory Board

The Cherry Point Partnering Team enthusiastically seeks RAB community involvement in the IR decision-making process through quarterly meetings with the RAB to discuss cleanup issues and to inform the RAB of the current status Environmental Restoration (ER) activities and the recently formed

munitions response program. The Partnering Team maintains an excellent rapport with the RAB and ensures community input is considered during the decision-making process.

MCAS Cherry Point continually seeks to improve community involvement in the ER decision-making process. To enhance community participation and foster an atmosphere of openness and trust, MCAS Cherry Point:

- Provides RAB-sponsored site tours for the public
- Provides the public with unprecedented access to documents and information pertaining to the base's ER program via the ER Public Web Site
- Updated the RAB poster boards used to inform the community of ER activities at public events
- Developed a comprehensive Resource Manual to educate and assist the RAB in their duties and responsibilities

Visit MCAS Cherry Point's Environmental Restoration Program Public Website at:

https://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/installation_map/navfac_atlantic/midlant/cherry_point.html

Community Involvement Plan

The purpose of MCAS Cherry Point's Community Involvement Plan (CIP) is to assist the Air Station in meeting the needs of the local community for information about, and participation in, the ongoing investigation and remedial processes of the Air Station. The CIP identifies community concerns about the investigation and restoration of potentially contaminated sites, as well as outlining community involvement activities to be conducted during the ongoing and anticipated future restoration activities.

During FY 2012, the CIP was updated to reflect the significant progress of previous years, as well as obtaining updated feedback from the community on outreach efforts as well as improved outlets of communication. Interviews were conducted with residents of the Air Station, local members of the surrounding communities, RAB members, City Officials, local business organizations as well as local environmental organizations.

Of those who were familiar with Cherry Point's ER program, feedback was very positive in nature, indicating that current communication efforts are successful. Those individuals who were unfamiliar with Cherry Point's ER program were helpful in identifying potential shortcomings and suggesting additional outlets with which to share information. Media outlets that were suggested included social media sites, local TV and radio stations, and online advertising to reflect the reduced reliance on printed media sources. Updated mailing/contact lists of interested persons; as well the opportunity to extend invitations to potential future RAB members provided further benefit to the interviews.

Together, Cherry Point's Restoration Advisory Board and its Community Involvement Plan ensure communication pathways are open and receptive to the local community for past, present and future remedial activities.