



Secretary of Defense

Environmental Award Fiscal Year 2014

Environmental Restoration – Installation

Marine Corps Installations East – Marine Corps Base Camp Lejeune
Camp Lejeune, North Carolina



INTRODUCTION

Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) was commissioned in 1941 with a mission and values that still hold true to this day: to maintain combat-ready warfighters for deployment and humanitarian missions abroad. The Base covers over 156,000 acres that is utilized by more than 170,000 people including over 63,000 active duty military and 11,000 civilians.



ENVIRONMENTAL AND GEOGRAPHICAL SETTING

MCIEAST-MCB CAMLEJ is located along the Atlantic Ocean within the coastal plain of southeastern North Carolina, within Onslow County, adjacent to the City of Jacksonville. The Base consists of a diverse environmental setting with elevations ranging from sea level to 70 feet above mean sea level. Much of the topography is traversed by swales, wetlands, streams, and creeks that drain into the New River that bisects the Base and includes:

- ★ 72,000 acres of upland forests
- ★ 49,000 acres of wetlands
- ★ 26,000 acres of water
- ★ 7,500 acres of urban/developed land



POLITICAL AND ECONOMIC SETTING

North Carolina is largely a conservative state. MCIEAST-MCB CAMLEJ is the engine that drives the economies of its surrounding communities generating nearly \$3 billion in commerce each year. The City of Jacksonville is the county seat of Onslow County with a primary industry of retail sales and services.



COMMUNITY SETTING

MCIEAST-MCB CAMLEJ enjoys a close relationship with the Base community and neighboring civilian communities by conducting periodic outreach and providing information on the Environmental Restoration Program. The Base and Onslow County work together to ensure quality living for both military and civilians throughout the area.





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BACKGROUND

MCIEAST-MCB CAMLEJ is a leading Department of Defense (DoD) installation, operating at the forefront of environmental restoration programs. By maintaining collaborative relationships with regulatory agencies and the supportive local community, the team has made tremendous progress in investigating and cleaning up over 900 sites to-date, including 49 sites during this achievement period, under several environmental programs; including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) that covers the Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP), Resource Conservation, and Recovery Act (RCRA), and the Underground Storage Tank (UST) program; with a goal to ensure continued protection of those living and working aboard MCIEAST-MCB CAMLEJ.

KEY CHALLENGES

- ★ Conducting investigations and implementing remedies within active training areas, ranges, buildings, and densely populated cantonment areas
- ★ Achieving remedy-in-place status for the most technically challenging sites including large chlorinated solvent plumes and a potential chemical agent disposal area
- ★ Planning for optimization of historical remedies by evaluating how to make systems more efficient and effective, reduce operations costs, and develop a roadmap to site closure



ORGANIZATION, STAFFING, AND MANAGEMENT APPROACH

Base Environmental Management Division (EMD) leads the environmental compliance and restoration

programs to manage over 80 active sites covering over 4,600 acres. The Base is supported by technical, acquisition, and legal professionals across the Naval Facilities Engineering Command (NAVFAC) organization. Experienced Partnering Teams for the CERCLA and for the UST programs consist of representatives of the Base, Navy, North Carolina Department of Environment and Natural Resources (NCDENR), and/or U.S. Environmental Protection Agency (USEPA). The teams meet quarterly and are supported by multiple environmental consulting firms.

COMMUNITY INVOLVEMENT

The Base's community involvement program includes:



- ★ Restoration Advisory Board (RAB) – Meets quarterly to provide an information exchange
- ★ Information Repositories and Administrative Record – Located at Onslow County library
- ★ Public web sites –

• <http://go.usa.gov/Dy5T>

• <http://www.lejeune.marines.mil/OfficesStaff/EnvironmentalMgmt/RestorationAdvisoryBoard.aspx>



- ★ Earth Day – Sponsors annual on-Base events for public outreach
- ★ Community Involvement Plan – Updated every five years to obtain community feedback on how best to continue two-way communication, and meet changing needs of community
- ★ Site tours, public meetings, fact sheets, and announcements published in local and Base newspapers





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ENVIRONMENTAL RESTORATION AGREEMENTS AND PLANS (LATEST REVISIONS)

1989	1991	1995	2009	2010	2011	2014	2014
National Priorities List	CERCLA Federal Facility Agreement	RAB Created	UST Site Management Plan	CERCLA Five-Year Review	CERCLA Community Involvement Plan	RCRA Site Management Plan	CERCLA Site Management Plan

RELEVANT ENVIRONMENTAL RESTORATION DOCUMENTS

Action Documents	Achievement Period	Total
CERCLA Pilot/Treatability Studies	2	16
CERCLA RODs	2	38
CERCLA NFA Decision Documents	3	39
RCRA Interim Measures	2	13
IRP and RCRA LUCIPs	8	37
UST NFA Documentation	44	317
Total	61	487



INITIATIVES

Some of the key initiatives undertaken during this award period were to:

- ★ Conduct vapor intrusion outreach to building occupants to provide information on investigation activities, results, and mitigation systems to protect people who live and work on Base
- ★ Implement a monitoring well database to contain current data for all existing and abandoned monitoring wells to be used as a management tool to help to standardize monitoring well data collected across environmental programs by all environmental contractors performing work at MCIEAST-MCB CAMLEJ
- ★ Support military construction (MILCON) for key infrastructure elements for improvements, development of facilities for the Marine Corps

Forces Special Operations Command, and new air station hangers

- ★ Plan for pilot studies at six IRP and RCRA long-term monitoring sites to evaluate expediting site closure for long-term cost avoidance
- ★ Conduct Munitions Response Site Prioritization Protocol (MRSP) scoring and provide public outreach on three new MMRP sites (UXO-27, 28, and 29)
- ★ Kick-off the next Five-Year Review for 27 sites and an update to the Community Involvement Plan
- ★ Develop schedules and team buy-in to achieve the Navy's goals for remedy-in-place in Fiscal Year 2014 for three sites (Sites 49, 69, and 89), including a large chlorinated solvent plume and a potential chemical agent disposal area
- ★ Share technical evaluation and disseminate lessons learned by presenting a bench scale and treatability study at the Clemson 2014 Hydrogeology Symposium



Photo by Cpl. Damany S. Coleman



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SUMMARY OF ACCOMPLISHMENTS

ACCELERATED ENVIRONMENTAL CLEANUP

Reducing the Munitions Response Site for the Off-Base Surface Danger Zones

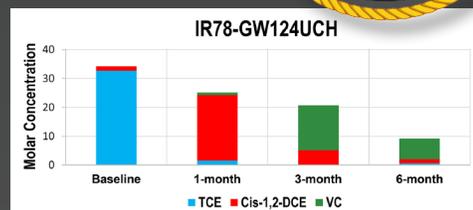
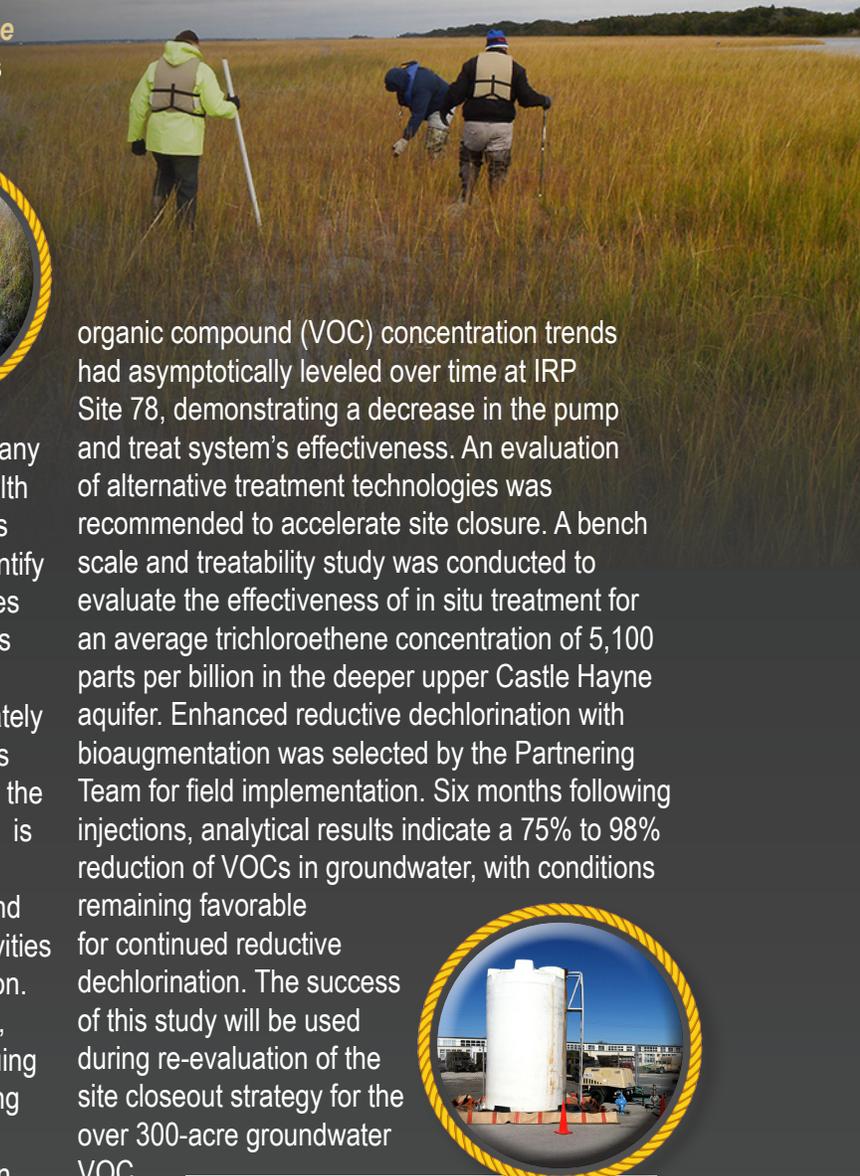
Several years ago, MCIEAST-MCB CAMLEJ discovered that approximately 1,600 acres of some SDZs were located outside the surveyed Base boundary dating back to the 1940s. Although there has been no indication that a safety risk exists from the former off-Base SDZs, the Base conducted an investigation to determine if any further action is necessary to protect human health and the environment. A phased investigation was completed during this achievement period to identify and investigate over 1,000 geophysical anomalies potentially representing munitions and explosives of concern. Based on the results, the munitions response site has been reduced from approximately 1,600 acres to 176 acres to focus future activities on where munitions debris were found. Because the SDZs overlap private and State-owned property, is accessible to the general public, and is currently used for fishing, crabbing, boating, picnicking, and other recreational activities, public outreach activities have been conducted throughout the investigation. These activities include: an initial public meeting, documents made available at local libraries, issuing fact sheets to interested parties, installing warning signs, and creating a web site (www.lejeune.marines.mil/SDZ) with up to-date information. An Engineering Evaluation/Cost Analysis is currently being prepared to evaluate future actions.



Conducting a Treatability Study at IRP Site 78

The Five-Year Review indicated that volatile

organic compound (VOC) concentration trends had asymptotically leveled over time at IRP Site 78, demonstrating a decrease in the pump and treat system's effectiveness. An evaluation of alternative treatment technologies was recommended to accelerate site closure. A bench scale and treatability study was conducted to evaluate the effectiveness of in situ treatment for an average trichloroethene concentration of 5,100 parts per billion in the deeper upper Castle Hayne aquifer. Enhanced reductive dechlorination with bioaugmentation was selected by the Partnering Team for field implementation. Six months following injections, analytical results indicate a 75% to 98% reduction of VOCs in groundwater, with conditions remaining favorable for continued reductive dechlorination. The success of this study will be used during re-evaluation of the site closeout strategy for the over 300-acre groundwater VOC plume.





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INNOVATIVE TECHNOLOGY DEMONSTRATION/VALIDATION AND IMPLEMENTATION

Studying the Effectiveness of a Sediment Bed Passive Flux Meter (SBPFM) CH2M HILL launched an Innovation Grants Program to drive its industry-leading technology innovation. During this achievement period, MCIEAST-MCB CAMLEJ Site 82 was chosen as a candidate to participate in this program to test the effectiveness of SBPFM technology to support the University of Florida's Department of Environmental Engineering Sciences. The ultimate goal is to use this technology to help sites negotiate more reasonable cleanup levels. The SBPFM study was conducted in the adjacent Wallace Creek to test and validate whether the technology can be successful in the field to evaluate mass balance of contaminants and nutrients in the hyporheic zone. Site 82 has known groundwater contamination from VOCs and the hyporheic zone facilitates the exchange of water between the stream (surface water) and the subsurface (groundwater). The SBPFM is a sensor capable of passive and direct characterization of sediment water dynamics and bioavailable contaminant flux. The sensor collects direct in-situ measurements within the hyporheic zone.

The data evaluation is currently being conducted by the University of Florida. Through conducting these field tests, MCIEAST-MCB CAMLEJ and CH2M HILL have been able to support critical steps of the SBPFM research to advance to the science needed for the SBPFM to become a promising groundwater/surface water interface tool.

Using HAPSITE for Potential Source Evaluations To minimize the potential for future risks, MCIEAST-MCB CAMLEJ elected to install a vapor intrusion mitigation system (VIMS) within a portion of a new building adjacent to where former USTs were located and where subslab soil gas VOC concentrations were measured above target levels. In 2013, a Cupolex aerated floor was installed that vents to the exterior to prevent subslab soil gas from entering the building. Quarterly operation, maintenance, and monitoring (OMM) was initiated to confirm that the VIMS is operating as designed to mitigate the vapor intrusion pathway. The initial results indicated that the VIMS was operating as designed by creating a negative pressure field in the Cupolex floor void space. However, measured indoor air concentrations of trans-1,2-dichloroethene and pentane exceeded the USEPA screening levels. No potential indoor sources were initially identified as being used or stored within the building. Based on these findings, vapor intrusion could not be ruled out and additional investigation of the vapor intrusion pathway using a HAPSITE was conducted. A HAPSITE is a portable Gas Chromatograph/Mass Spectrometer (GC/MS) designed for on-scene detection, identification, and quantitation of VOCs. Based on the extensive HAPSITE investigation and literature searches, the concentrations of trans-1,2-dichloroethene and pentane within the building were determined to be related to building materials (i.e., blown-in foam insulation within the cinderblock walls) and not the result of vapor intrusion. As a result, future OMM results for trans-1,2-dichloroethene and pentane are not compared to the USEPA screening levels, since they are most likely due to the building materials.





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PARTNERSHIPS ADDRESSING ENVIRONMENTAL RESTORATION ISSUES BETWEEN DOD AND OTHER ENTITIES

Conducting Pilot Studies at IRP and RCRA

Long-Term Monitoring Sites The Navy and MCIEAST-MCB CAMLEJ worked with the USEPA and NCDENR to evaluate alternate treatment technologies for reducing site-specific constituents of concern in groundwater at six remedy-in-place sites to accelerate the site closure timeframe.

The treatment technologies being evaluated to address remaining asymptotic levels of VOCs, benzo(a)anthracene, and pesticides in groundwater include:

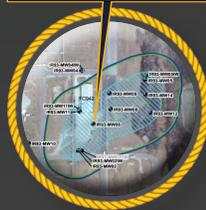
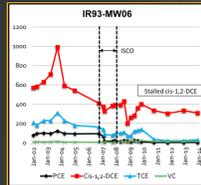
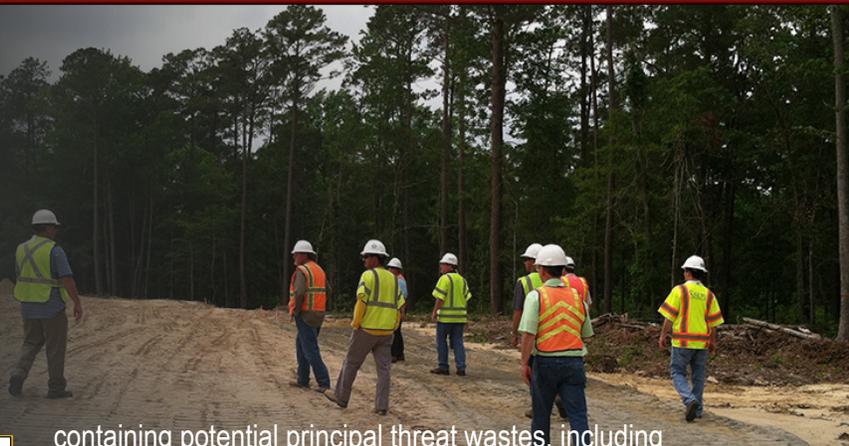
- ★ Injections and passive diffusion of an oxygen-releasing reagent
- ★ In situ chemical oxidation
- ★ Enhanced reductive dechlorination using emulsified vegetable oil
- ★ Bioreactor comprised of mulch, gravel, and emulsified vegetable oil that is equipped with a solar-powered recirculation pump

A methane inhibitor (red yeast rice extract) will also be used at one location to test the effectiveness and evaluate potential applications at sites where there is the potential for a vapor intrusion pathway. If the pilot studies are effective, there is the potential for up to \$150,000 per year of long-term cost avoidance.

REDUCING RISK TO HUMAN HEALTH AND THE ENVIRONMENT

Remedial Action at Potential Chemical Agent IRP

Site 69 In fiscal years 2013 and 2014, a large-scale remedial action was conducted to achieve remedy-in-place at IRP Site 69, a former waste disposal area



containing potential principal threat wastes, including chemical agent and dense non-aqueous phase liquid. Although there is a preference for treatment or removal at sites containing principal threat waste, due to the impracticability of removal or treatment of potential chemical agent that is highly toxic and potentially fatal should exposure occur, and the extraordinarily high costs (over \$24 million), the Base and Navy worked with USEPA and the State to select a passive remedial approach. This approach was designed by Leadership in Energy & Environmental Design (LEED) professionals and included:

- ★ A 4.6-acre multi-layer cap system to prevent potential exposure to buried waste and contaminated soil and provide a barrier for potential receptors and infiltration
- ★ Monitored natural attenuation and long-term monitoring to track changes in groundwater concentrations
- ★ Land use controls to protect receptors from potential contact with buried waste, soil, and groundwater

The cap installation was completed safely within 10 months.





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Soil Screening at MMRP Site UXO-22 To minimize explosive risks from unintentional detonations at the former Defense Reutilization and Marketing Office (DRMO), located within MMRP Site UXO-22, a surface clearance and soil sifting operation was conducted to remove munitions items that remained on-site. The surface clearance and soil sifting activities resulted in the removal of over 79 tons of debris which included 24 tons of metallic debris that was recycled and over 6,000 munitions items that were inspected, demilitarized (if necessary), classified as material documented as safe, and disposed offsite through witnessed smelting. As a result of these activities, the potential for human contact with munitions was significantly reduced.



GREEN REMEDIATION

Successful Passive Remediation at IRP Site 89 Site 89 is the most contaminated IRP site on-Base where a DNAPL source area and 10-acre dissolved-phase chlorinated solvent plume is present. Several treatability studies were conducted from 2006 through 2009 to evaluate the best technology and exit strategy for the site. One of the proven successful technologies, a passive permeable reactive barrier (PRB) using mulch and compost as backfill, was implemented as part of the final remedy in 2013/2014 to treat groundwater downgradient of the source area prior to reaching Edwards Creek. In-creek aerators were also



installed to treat surface water in Edwards Creek. The recent performance monitoring results indicate that concentrations have generally decreased over time within and downgradient from the wall and downgradient surface water results remain below NCDENR screening values. The oxidation reduction potential in the PRB is also being monitored, has been negative over time, and is favorable for reducing conditions. These passive remedies are working to mitigate the groundwater to surface water pathway.

Using Snap Samplers to Reduce Hazardous Waste Generation at IRP Site 89 During initial long-term monitoring at IRP Site 89, three drums of purge water were characterized as hazardous. As a result, alternate sample collection techniques were evaluated to avoid the generation of hazardous waste and cost for disposal. Snap sampler and low-flow groundwater samples were collected from four performance monitoring wells to evaluate the no-purge technology. There was generally good correlation between snap sampler and low-flow results since they were collected in the active treatment area and the high concentrations (one to five orders of magnitude greater than cleanup levels) can increase the variability of results. Because the objectives of the performance monitoring is to monitor treatment system effectiveness, the Team discussed and agreed to use snap samplers until concentrations are reduced to below hazardous levels. The use of snap samplers is less labor intensive and will not result in hazardous waste generation, which equates to approximately \$20,000 of annual cost avoidance.

