

FY 2013 Secretary of Defense

# ENVIRONMENTAL AWARDS

ENVIRONMENTAL RESTORATION, INSTALLATION:  
BEALE AFB 9 CES ENVIRONMENTAL INSTALLATION PROGRAM

## INTRODUCTION

Beale Air Force Base (AFB) comprises approximately 23,000 acres located in northern California approximately 10 miles east of the towns of Marysville and Yuba City and 45 miles north of Sacramento. It is surrounded by residential, agricultural, and undeveloped areas. Beale AFB is part of Air Combat Command and is home to the 9th Reconnaissance Wing with a detachment of the 7th Space Warning Squadron and the California Air National Guard. Nearly 3,000 people live on base, while the combined military and civilian workforce numbers approximately 7,000 people. The primary responsibility for the Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP) programs lies with the 9th Civil Engineer Squadron acting through the Environmental Element.

## BACKGROUND

### Environmental Restoration Challenges

Historical waste generation and disposal activities at Beale AFB resulted in environmental contamination, including industrial operations, pesticide use, fire protection training, fuel management, spill management, and waste disposal. Industrial operations consist mainly of aircraft and vehicle maintenance and repair activities. Wastes generated include jet fuel, waste oils and lubricants, acid and alkaline cleaning solutions, various solvents, paint strippers, and paints.

The cleanup actions at Beale will meet or exceed milestones established as a part of the overall Department of Defense (DoD) cleanup goals for the Air Force. The Beale IRP consists of 41 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Environmental Restoration Program (ERP) sites, 10 Resource Conservation and Recovery Act (RCRA) IRP sites, and three Leaking Underground Fuel Tank (LUFT) IRP sites. Cleanup efforts have been completed at 16 of the sites. For 20 of the IRP sites, the soil component has been de-coupled from the groundwater component, resulting in 20 soil-only IRP sites scheduled to be completely remediated within the next six years and one new consolidated groundwater IRP site for the longer term remediation of trichloroethylene (TCE) contaminated groundwater. The consolidated groundwater site covers over one square mile of contaminated groundwater plumes with low concentrations of TCE. One very difficult site has TCE as a dense non-aqueous phase liquid (DNAPL) contained within a three acre slurry wall. Three IRP sites are complicated by fractured bedrock. In addition to TCE, site co-contaminants include

other chlorinated hydrocarbons, fuels, methyl tertiary butyl ether (MTBE), perchlorate, and metals. Wetlands and vernal pool issues requiring extensive coordination with the United States Wildlife Service (USFWS) also require additional labor and cost requirements for both the IRP cleanup and MMRP cleanup programs.

Beale MMRP sites have munitions, lead, and potential explosive chemical residues. Beale has conducted a MMRP Comprehensive Site Evaluation (CSE) with related field work completed at the end of fiscal year (FY) 13. This resulted in 70 "No Further Action" Munitions Response Sites (MRSs), seven small arms range MRSs with soil excavations completed and in final closeout process, and 16 MMRP MRSs programmed for final CERCLA cleanup. The 16 remaining MRSs are programmed for Air Force close out within five years.

Beale AFB is also responsible for environmental restoration at three remote sites, the Lincoln Receiver Station, Point Arena Air Force Station (AFS) in caretaker status, and the former Tulelake Over the Horizon Back Scatter (OHBS) Radar Site, leased from the U.S. Forest Service. At the Lincoln Receiver Station interim removal actions have been completed and the site is programmed for Response Complete (RC) in 2016. At Point Arena AFS, interim removal actions are complete and an environment decision document is in progress. At Tulelake a Corrective Measures Study is in progress for the future removal of 11 miles of treated wood fencing and programmed for Air Force closeout in 2017.

### Regulatory Framework

Beale AFB is not on the National Priorities List, hence the Air Force is the lead agency for remediation activities. The Central Valley Regional Water Quality Control Board and the Department of Toxic Substances Control (DTSC) are the regulatory oversight agencies representing the State of California. Site remediation activities fall under four regulatory programs: CERCLA, RCRA, LUFT, and the California Integrated Waste Management Board (CIWMB). CIWMB applies to closed landfills, LUFT applies to Underground Storage Tank (UST) sites, RCRA applies to recent site and fuel contamination only sites and CERCLA applies to sites with TCE, chlorinated compounds, metals and other non-fuel contaminants. RCRA, LUFT, and CIWMB regulations are applied to sites when possible because they require much less paperwork to complete restoration.

## Beale Restoration Organization

The Environmental Installation Restoration Office consists of a Restoration Program Manager (RPM), an MMRP Program Manager, and a program support contractor at Beale AFB. The Air Force Civil Engineering Center (AFCEC) Program Manager and AFCEC Contracting Officers Representative are at Lackland AFB and manage restoration contracts for Beale AFB. An Army Corp of Engineers Contract Manager for MMRP is in Omaha, Nebraska. Beale's restoration office manages the restoration of all CERCLA, RCRA, MMRP, and LUFT sites on Beale AFB, the Lincoln Receiver Site, Point Arena AFS, and Tulelake OHBS radar site. Two principle restoration contractors conduct base-wide environmental restoration. Regulatory oversight includes a full time regulator from both the State Department of Toxic Substances Control and the California Regional Water Quality Control Board. The restoration office also works closely with the California Department of Fish and Wildlife and the USFWS for multiple project sites that include or are near vernal pools or other sensitive habitats.

The Environmental Installation Restoration Office has diverse responsibilities. They include programming, projects, costs and schedules, providing field oversight, initiating program changes, updating the Air Force Environmental Database (EESOH-MIS) with appropriate Beale information, escorting regulators and reviewing primary and secondary documents that require both Air Force and regulatory agency approval. It also coordinates environmental field work with the airfield managers, traffic control, wing Safety, fire department, security forces, the natural resources section (wetlands and vernal pools), and base construction. Other duties include reviewing all excavation permits and coordinating restoration contractor access to the base. The Environmental Installation Restoration Office also coordinates Restoration Advisory Board (RAB) events and adjacent landowner issues with public affairs, decision documents with the legal office, and the decision document signature circuit.

## Management Approach

The Air Force has managed the ERP at Beale AFB via fence-to-fence Performance Based Restoration (PBR) contracts for several years. The first PBR performance period was completed at Beale AFB in November 2011. This base-wide ERP project completed remedial investigations, feasibility studies, and interim decision documents at 20 ERP sites. In addition, six Soil Vapor Extraction (SVE) systems and five biovent systems achieved their cleanup objectives and were shut down during this project. The project came in nearly \$1 million under budget and achieved all of the performance objectives established at the beginning of the project, with cost savings split between the Air Force and the contractor.

The Air Force subsequently awarded a second PBR contract on 30 June 2012 for a period of eight years for 34 IRP sites at or near Beale AFB. The Air Force will achieve substantial reduction of long-term environmental liabilities and life-cycle costs through the accelerated achievement of Site Closeout (SC) and optimization for all sites while complying with applicable federal, state, and local laws and regulations; and applicable base-specific orders, agreements, or rules.

General performance objectives pursuant to the Air Force's goals include the following, in order of priority: SC; RC; and Remedy-in-Place (RIP). For any site that does not or cannot achieve SC during the eight-year period of performance, an Optimized Exit Strategy (OES) will be developed that establishes optimization procedures and performance metrics to shorten the time needed to achieve SC after the PBR project is completed.

The Air Force conducted a base-wide MMRP CSE and excavated lead containing soil at seven small arms range sites. Field work on a FY12 contract for a munitions and explosives area of concern cleanup on the golf course is scheduled for completion in 2014. This project will conduct intrusive excavation while maintaining public safety and allowing the golf course to collect all of its \$180,000 annual revenue.

The restoration of 16 remaining MMRP active sites is programmed to be completed under a follow-on PBR contract.



A mortar round found during the Phase II Comprehensive Site Evaluation is detonated in place or relocated to a safe remote location for detonation. This activity occurred several times during 2012 and 2013. Typical munitions found included WWII mortar rounds, artillery shells, grenades, 20mm rounds, and 2.36 inch rockets.

## Performance Strategies

The Air Force has also developed Minimum Performance Objectives (MPOs) for each of the 35 sites included in the new FY12 PBR task order. Key elements of the performance strategy include use of the Triad Partnering process to streamline decisions using a team approach at monthly meeting of the Tier 1 Team (Beale AFB Restoration Office and AFCEC, multiple regulators, and principle restoration contractors) to reach consensus on investigative and remediation approaches and document content to reduce work plan complexity and expedite field work. The contractor presents summaries of work plans and reports to the Air Force and regulatory agencies in Tier 1 meetings to reduce review times, and conducts document workshops if needed. Further time savings come from combining as many work plans and reports as possible to reduce the workload on the Air Force and regulatory agencies. When possible, the team used existing work plans and Decision Documents. The contractor planned work with Beale AFB and the regulatory agencies to resolve wetlands and vernal pool issues as soon as possible to enable field work to proceed. The Tier 1 Team was open to optimize existing remedies and use Remedial Process Optimization (RPO) wherever possible to reduce the time to achieve RIP or SC. Another key element is working with regulatory agencies to establish remediation goals for active remediation of volatile organic compounds (VOCs) in groundwater. To accelerate the work schedule, work Decision Documents were immediately initiated, since past experience has shown that this is among the most time-consuming activities at Beale AFB. Beale used presumptive remedies and sustainable in situ remedies to the maximum extent practicable. Shut downs of active remedies (e.g., pump and treat, soil vapor extraction, air sparging [AS], and bioventing) at all sites is done as soon as remedy is complete, and including a plan to shut down a pump and treat system at Site OT017 to convert it to passive treatment. Beale worked to reduce groundwater monitoring requirements through renegotiation of Monitoring and Reporting Programs together with geostatistical and monitoring optimization tools to reduce the number of wells being sampled. Successful implementation of the key elements of the strategy and achievement of performance objectives have resulted in early completion of milestones.

## Sustainability

Beale AFB uses innovative and sustainable technologies such as enhanced in situ biodegradation (EISB), emulsified vegetable oil (EVO) injections, enhanced attenuation, and bioreactors to cleanup contaminated ground water. These passive technologies work by feeding bacteria which metabolize and destroy the contaminants. The use of EISB and in situ chemical oxidation (ISCO), are expected to reduce energy usage, decrease cleanup times by over 40 percent or 10 to 30 years, and lower life-cycle costs (LCCs) versus

more traditional remediation technologies. This strategy will facilitate removing existing treatment systems sooner than originally planned. Many of these existing systems (e.g., pump and treat systems, soil vapor extraction systems, sparging systems) are being aggressively optimized and shut down to promote sustainability. Implementation of these sustainable technologies will result in an estimated savings of more than 1 million kilowatt hours of electricity and eliminate more than 700 tons of greenhouse gas emissions between 30 June 2012 and 30 September 2012. Beale AFB has begun tracking energy usage and greenhouse gas emissions as part of the PBR.



Hidden under five flush mount well caps are Emulsified Vegetable Oil injection points forming a biobarrier in a TCE contaminated plume at approximately 150 feet below ground surface. By 2013 the biobarrier has proven to be effective in cutting off the groundwater plume and preventing further migration into the runway security zone. A picket line of biobarrier injection wells can cut a contaminated groundwater plume in half shortening its life.

## Public Involvement

Beale AFB has maintained a long period of public involvement in its environmental programs by supporting an active RAB comprised of 16 members of the local community, and is co-chaired by an elected member and the Base Civil Engineering Squadron Commander. This RAB participates in five meetings and two tours of base environmental cleanup sites and publishes four newsletters each year, which is sent to 300 people. The RAB is informed with presentations on the Air Force's progress at achieving environmental objectives, is allowed to review plans and reports, and provides public comment for Beale AFB decision documents (e.g., Proposed Plans). For community outreach, RAB members regularly man booths at three local events, educating over 150 visitors on restoration efforts and recruiting new RAB members. The California DTSC considers the Beale AFB RAB to be a model program and has filmed a training video featuring the Beale AFB RAB.

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After touring an IRP site, the RAB tour visited the PAVEPAWS radar facility of the Space Warning Squadron. This RAB Tour group photo shows the diverse membership interested in Beale's Environmental Restoration Program. Combining a Mission related visit, with an IRP or MMRP site visit, increases interest greatly among the public RAB members.

### Triad Approach

Beale AFB uses a Triad Partnering approach to coordinate project tasks, achieve consensus on approach prior to submitting work plans for review, and agree on interim steps during investigations (e.g., step-out locations, etc.). This streamlines the document review process by up to 75 percent. Once a year, the Air Force, regulatory agencies, and the Beale AFB restoration contractor participate in team-building activities to strengthen the performance of the Triad team. This unique partnership with team building allows Beale AFB to conduct business in a friendly, non-competitive or adversarial manner, reaching consensus on the approach to be followed at each site and the contents of documents. The Beale AFB Triad team is paramount to much of the success of the program.



Triad Partners during a free annual team building exercise, featuring a tour of Shasta Dam in California. The group consisted of the Beale restoration office, AFCEC, California regulators (DTSC and RWQCB), GEITA Contractors, and the restoration contractor. The Shasta Dam tour occurred after a morning Triad Partnership meeting at the contractor's office in Redding, CA.

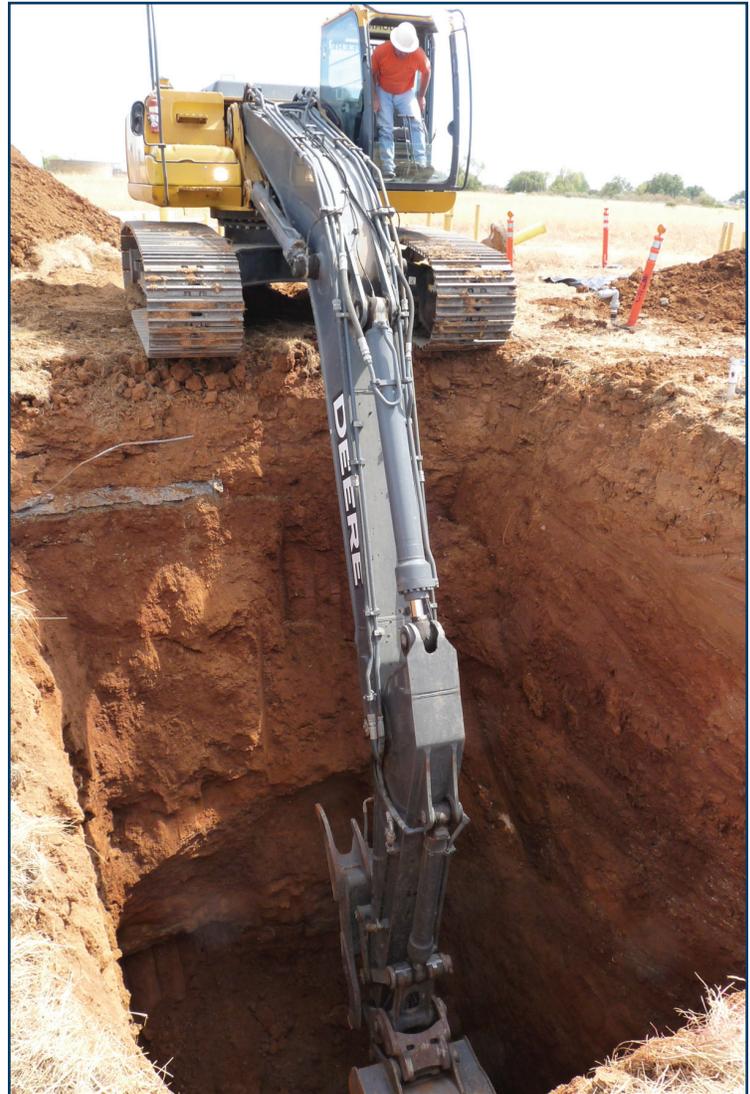
### Summary of Accomplishments

The Beale AFB Environmental Installation Restoration Office, using the Triad Approach within the Tier 1 Team has many accomplishments over the past years. Following is a list of some of these accomplishments.

- By the end of the previous PBR contract in early FY12, Beale AFB had achieved Interim RIP at 20 ERP sites and signed decision documents (e.g., Interim Records of Decision (ROD), Action Memorandums) for each of these sites.
- The follow-on FY12 PBR contract includes a rigorous schedule with performance objectives and contractor payments based on achieving milestones. By the end of FY13, the contract was proceeding ahead of schedule.
- The Triad Partnership (Air Force, regulatory agencies and contractor) reached consensus on a groundwater consolidation and soil de-coupling strategy in 2013. This strategy permits an additional 20 sites to be closed as soil sites within five years. Groundwater contamination beneath the sites was consolidated into a single base-wide site, with a goal of achieving a ROD and RIP by 2017. This agreement results in 28 sites scheduled for SC: four in 2014, 14 in 2015, four in 2016, and six in 2017.
- Innovative in situ cleanup strategies are being employed at most sites, and older, energy-intensive technologies are being phased out. Examples of in situ, innovative remedies being used at Beale AFB include EVO injection; ISCO via injection of permanganate into the groundwater; EISB; bioreactors with solar-powered pumps; cutoff walls with zero-valent iron (ZVI) permeable barriers; AS, and solar-powered passive skimming.
- Four ERP sites that were previously closed to industrial standards were re-opened as directed by AFCEC policy in 2013. Additional funding was obtained so that these sites will be further cleaned and closed for unrestricted use. This will eliminate land use controls and prevent any further Air Force liability for the sites.
- During FY12 and FY13, nearly 100,000 labor hours were performed on the Beale AFB PBR project, with no safety incidents or Occupational Safety and Health Administration recordables.
- Due to potential risk and human health concerns, Beale provided wellhead treatment and bottled water for three off-base residences whose groundwater was contaminated with TCE at concentrations below the drinking water standard. With Air Force approval the base maintained and repaired wellhead treatment systems and trucked in water to feed livestock during the repairs thereby enhancing community relations.

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- Performed ISCO at three sites. This innovative treatment technology remedies groundwater contamination in-place eliminates the need for ongoing equipment operation and maintenance and electrical energy. It also reduced the groundwater contamination plume life by a minimum of 20 years. By the end of FY13, TCE mass reductions of 68 percent at CG041-003, 83 percent at SS023, and 94 percent at CG041-032 were calculated.
- Shut down an innovative EISB system at CG041-031. Performed “polishing” of residual contamination using EVO injections. By the end of FY13, all systems have been shut down at CG041-031 and 93 percent of the TCE mass had been removed from the source area.
- Shut down a biovent system at Site SD032 in FY12 after attaining cleanup goals.
- Installed an innovative bioreactor at Site LF013. This allowed an active SVE system to be decommissioned. In FY13, cleanup goals had been met at all but one well, and the TCE contaminant mass in the source area had been reduced by 89 percent.
- Operation of a groundwater extraction and treatment system at CG041-013, an inactive landfill located along the base boundary, has successfully contained and remediated the groundwater contamination. At the end of FY13, no contamination had migrated off-base at concentrations above drinking water standards. In addition, no contamination had migrated into deeper aquifers beneath the site.
- An AS and SVE system at Site SD008 has been shut down for rebound evaluation, and is being assessed for permanent shut down. The Air Force expects to achieve SC at this site within four years. By the end of FY13, mass reductions were calculated at the SD008 source area to be 100 percent for benzene and gasoline and 92 percent for diesel.
- Obtained regulatory agency approval to permanently shut down the SVE system at Site SD010.
- Obtained regulatory agency approval in FY13 to move forward to SC at Site OT017. A proposed plan to establish SC at the OT017 soil site is currently in review.
- Completed the shut-down analysis and prepared documentation to permanently shut down the SVE system at ST018 during FY13.
- Performed innovative in situ groundwater treatment of TCE at two source areas at CG041-039 using emulsified vegetable oil. By the end of FY13, these treatments had achieved TCE mass reductions of 70 percent and 94 percent at the two source areas.



Bioreactor excavation on ERP Site 13 landfill featured during a RAB tour before being back filled with ordinary garden mulch, gravel, vegetable oil and molasses. The bioreactor was enlarged in 2012 and connected to a well which pumped groundwater to the top of the bioreactor. Pumped groundwater percolates through the mixture and carries organic material into the surrounding groundwater.

- Beale AFB has historically closed out 1,024 underground storage tanks (USTs) at the base. During the achievement period, Beale AFB completed a work plan to characterize the remaining 34 USTs, as a precursor to cleaning these sites (as needed) and closing them.
- Installed a solar-powered bioreactor and SVE system at Site SS035 during the achievement period.
- Injected EVO to form a biobarrier and prevent further migration of TCE in groundwater under the runway security zone at Site CG041-040. The EVO biobarrier was injected at approximate 150 feet below ground surface.

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- Shut down the SVE, biovent, and AS systems at Site TU001 during the achievement period. By the end of FY13, it was calculated that 100 percent of the benzene and gasoline mass had been removed.
- The groundwater monitoring program for all sites is consolidated into two semi-annual reports and is continually optimized by negotiation with the Regional Water Quality Control Board. The consolidated reports, which contain the sampling results of up to 900 wells for FY13, streamlines review. Comments are incorporated into the next report to save editing effort. Adjusted over 50 planned monitoring well locations (10 per year) to preserve base wetlands from construction damage.
- Finished excavating soil containing lead in 2013 at seven MMRP sites for site closure in 2015. The soil was mixed with a lead stabilizer to allow inexpensive disposal at a local landfill instead of a Class I landfill 200 miles away saving over \$200,000. Seven former small arms range MRSs to be closed allowing for unlimited use and a safe wildlife habitat.
- A Base-wide MMRP Phase II CSE has completed all field work resulting in the closure of 70 MMRP sites awaiting a final No Further Action Explosive Safety Submission to the DoD Explosive Safety Board. This freed 9,000 acres for base use, for development, recreation, and wildlife habitat safe to visit and hike.
- Previous advanced closure of MMRP sites in the housing area allowed the current construction of privatized housing.
- Modified remediation plans at 25 IRP sites and 10 MMRP MRSs to protect endangered species.
- Proposed and still planning to apply a unique technology combination to a groundwater site with TCE as a DNAPL. The first technology is to inject the DNAPL area with a mixed iron and oxidizer inside the three acre slurry wall containment. The second action is to replace a section of the slurry wall with a 100 foot long and 35 foot deep zero valiant iron reactive barrier. The third step will remove the currently operating pump and treat system. The new passive experimental approach eliminates operating costs and reduces annual costs and the life cycle cost. This approach replaces perpetual containment with a possibility of a finite life cycle measured in decades.

In summary the highly successful Beale Restoration Program is based on the following aspects:

- A mature Triad Partnering approach to streamline field activity decisions, and developing document content for rapid review.
- A second PBR contract with payment based on accomplishment of specified objectives to achieve accelerated site completion actions. The PBR contract provides incentives for proposing and exceeding minimum performance objectives saving up to 30 percent versus conventional contracting costs.
- The splitting of 20 IRP sites into 20 soil sites and one consolidated groundwater site have allowed the closure of 20 soil sites in less than five years and single base-wide ROD for groundwater remediation.
- A vibrant active RAB with five meetings, two tours, four newsletters, and outreach events each year.
- A rapid transition toward sustainable green remediation based on innovative EISB and ISCO type technologies.
- Building and compounding on previous successful remediation technologies and strategies.



A stabilizer is added to lead contaminated soil at one of seven closed small arms ranges prior to tilling, excavation and truck loading. This prevents lead from leaching from the soil and allowed 638 truckloads to be disposed of at a Class II landfill less the five miles from the base and only 59 truckloads to be disposed of at a Class I landfill 200 miles away. After removal, local backfill soil was trucked in to restore the original land contours.