FY 2017 Secretary of Defense

Environmental Awards

Environmental Restoration – Installation
Travis Air Force Base

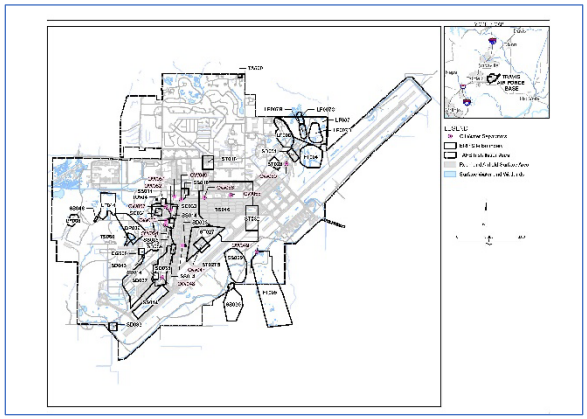
Introduction

Travis Air Force Base (AFB) is a 6,696-acre military installation located in Solano County, California, midway between San Francisco and Sacramento. The Base is composed of three primary mobility organizations as well as 50 partner organizations. The host wing, the 60th Air Mobility Wing, works seamlessly with the 349th Air Mobility Wing, the Air Force's largest associate reserve wing, and the 621st Contingency Response Wing, America's only contingency response wing ready to deploy within 12 hours to support contingencies or humanitarian operations around the globe. The 60th Air Mobility Wing's mission is to rapidly project American power anytime and anywhere in support of national objectives. The 60th Air Mobility Wing and the 349th Air Mobility Wing jointly operate a versatile all-jet fleet of 18 C-5M Super Galaxy and 13 C-17 Globemaster III cargo aircraft and 27 KC-10 Extender refueling aircraft. The 60th Air Mobility Wing's major warfighting platforms include the aerial port and the David Grant Medical Center. The 60th Air Mobility Wing maintains a workforce of approximately 6,854 active-duty military and 3,083 civilians, including personnel from the Department of Defense (DoD), Department of Homeland Security, and Department of Veterans Affairs. The 349th Air Mobility Wing workforce is comprised of more than 2,938 active-duty and traditional reservists. The 621st Contingency Response Wing is composed of 640 active-duty members. The total annual economic impact of Travis AFB is approximately $1.5 billion in Solano County. Travis AFB also owns a 25-acre former NIKE missile facility, known as the Potrero Hills Annex, located approximately five miles south of Travis AFB.

Background

The Travis AFB Environmental Restoration Program (ERP) encompasses one Military Munitions Response Program (MMRP) site and 63 ERP sites, consisting of 21 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, 16 Petroleum

only Contamination (POCO) sites, three inactive sites at the Potrero Hills Annex, and 23 closed sites.



Cleanup Sites: Travis AFB has one MMRP site and 63 ERP sites. Most sites are associated with former aircraft and vehicle maintenance, underground fuel hydrant systems, landfills, and fire training areas.

Chemicals of Concern for ERP sites range from petroleum and chlorinated hydrocarbons to metals. Most of the petroleum releases resulted from leaking underground storage tanks or past breaks in fuel hydrant pipelines. Sites with only petroleum contamination are managed under the POCO program and receive regulatory oversight exclusively from the San Francisco Bay Regional Water Quality Control Board (RWQCB). The chlorinated hydrocarbon and metals contamination resulted from legacy waste management practices associated with aircraft and vehicle maintenance, repair activities, and on-base fire training that occurred from the 1940s to the mid-1970s. ERP sites with CERCLA contamination and the MMRP site receive regulatory oversight from the United States Environmental Protection Agency (EPA) Region 9, the California Department of Toxic Substances Control, and the RWQCB.

Current ERP staffing at Travis AFB consists of three permanent civilians and one full-time support contractor. ERP and MMRP site remediation and monitoring are conducted under a $37.5 million Performance Based Remediation contract that is serviced by the United States Army Corps of Engineers, Omaha District.

The Travis AFB ERP promotes a robust and effective community involvement program that ensures all ERP activities are transparent and interested community members have the opportunity to provide feedback on proposed actions. The recently reinvigorated Travis Restoration Advisory Board (RAB) consists of 17 base, regulator, and community representatives. The RAB meets twice a year, once for a face-to-face meeting, and once for a base tour, which bolstered both leadership and public interest. RAB members actively review draft documents along with regulatory agencies, including a Community Involvement Plan that will guide future activities. Travis AFB provides access to the latest environmental news and documents by publishing a quarterly restoration newsletter, maintaining a public website, and monitoring daily and responding promptly to inquiries sent to an environmental public affairs email account. Trained ERP staff internally produce the newsletter and update the website via the Air Force Public Information Management System without contractor support.

RAB Technology Display: A field technician describes the procedures for injecting vegetable oil into tight clay soil. This presentation was given to RAB members during a recent base tour to help Board members to understand the overall Travis ERP groundwater cleanup strategy to convey to their constituents.

Travis AFB fosters a strong and productive working relationship with the three regulatory agencies that has promoted the implementation of 19 groundwater remedies as described in a July 2014 base-wide Record of Decision. The remedies are presented below.

- No Further Action for Building 905 (Site SS041)
- Monitored Natural Attenuation for nine ERP sites: Fire Training Area #3 (Site FT004); Landfill #1 (Site LF006); Landfill #2 (Site LF007 – Subareas B and D); Landfill #3 (Site LF008); TF33 Test Stand (Site ST027 Subarea B); Facility 1205 (Site SD031); Storm Sewer II, South Gate Area, Facilities 810 and1917, and West Branch of Union Creek (Site SD033); Facilities 818 and 819 (Site SS035); and Building 916 (SD043)
- Groundwater Extraction and Treatment for four ERP sites: Fire Training Area #4 (Site FT005); Landfill #2 (Site LF007 – Subarea C); Monitoring Well 329 Area (Site SS029); and Monitoring Well 269 Area (Site SS030)
- Bioreactor and Groundwater Extraction and Treatment for the Oil Spill Area (Site SS016)
- Emulsified Vegetable Oil Injection and Enhanced Attenuation for three ERP Sites: Solvent Spill Area (Site SS015); Facilities 872/873/876 (Site SD036); and Sanitary Sewer System, Facilities 837/838, 919, 977, 981, Ragsdale/V Street Area, and Area G Ramp (Site SD037)
- Bioreactor, Phytoremediation, Emulsified Vegetable Oil Injection, and Enhanced Attenuation for Building 755 (Site DP039)
- Passive Skimming and Enhanced Attenuation for Facility 811 (Site SD034)

Travis AFB works with the RWQCB to clean up POCO sites. They implemented Monitored Natural Attenuation at TF33 Test Stand (Site ST027, Subarea A), used sustainable technology to treat contaminated groundwater at the North and South Gas Stations (Site ST018), and conducted a technology demonstration to accelerate fuel cleanup at the Jet Fuel Spill Area (Site SS014).

Summary of Accomplishments

The Travis AFB ERP is focused on using technological advances and innovative technologies to accelerate site closures, reduce cleanup costs, and ensure the protection of human health and the environment. Travis AFB personnel presented several technology success stories at the May 2016 *Battelle International Symposium on Chlorinated and Recalcitrant Compounds Remediation* to showcase how innovative technologies can expedite the cleanup and closure of contaminated sites and allow for unrestricted land use.

Green and Sustainable Remediation

Green technologies (those that reduce greenhouse gas emissions and other negative effects during remediation) have become the backbone of the Travis AFB ERP. The base built demonstration prototypes, which started as innovative technologies that were promising but unproven, to demonstrate their effectiveness under site-specific conditions. These technologies rely on naturally-occurring bacteria to break down chlorinated solvents into harmless compounds.

During the accomplishment period, the base optimized the original demonstration infrastructure to develop fully functional and effective groundwater remedies that apply green principles. For example, the Site DP039 subgrade biogeochemical reactor (SBGR) is only the second such reactor built in the United States. A SBGR is an underground structure, composed of gravel and mulch, which cleans contaminated groundwater that percolates through it. Powered only by a solar panel array, the reactor was augmented with recirculation infrastructure to complete the cleanup of the second worst chlorinated solvent source area on-base and to significantly extend the treatment

zone. A second Travis solar-powered SBGR at Site SS016 is located above the worst chlorinated solvent source area on-base and adjacent to a high-security aircraft parking ramp. The optimized SS016 remedy was constructed to accelerate source area cleanup and prevent contaminant migration, thereby avoiding any cleanup efforts beneath the parking ramp that would have a detrimental effect on the base mission. Analytical data demonstrates that the SS016 SBGR removes over 99 percent of the contaminant mass from influent groundwater, reducing the estimated time to closure from 169 years to 45 years.

Another green technology that received regulatory approval is phytoremediation, which uses water-loving trees to stabilize plumes and break down contaminant mass. The phytoremediation component of the Site DP039 groundwater remedy also started as a technology demonstration and was optimized with a solar-powered recirculation system to increase the amount of contaminated water available for treatment and to protect the trees during current and future drought conditions.

A key technology for cleaning up highly concentrated chlorinated solvent plumes involves the injection of emulsified vegetable oil (EVO), a food-grade hydrogen donor, to stimulate bacterial activity needed for contaminant breakdown. The emulsion allows the oil to flow readily into tight contaminated clay-rich subsurface soil. This green technology was tested and proven to be effective at Sites SS015, SD036, and SD037; the test areas in these three sites were expanded into full-scale remedial actions, which have reduced their estimated times to closure by 61 (67 to 6), 26 (63 to 37), and 25 (53 to 28) years, respectively. A variation of this technology is the placement of EVO injection points in a row to form a permeable reactive barrier; this approach is now a part of Sites DP039 and SS016 groundwater remedies. The combined DP039 SBGR (mentioned above), phytoremediation, and EVO technology treatment train has reduced the estimated time to closure by approximately 25 (53 to 28) years.

Sustainability (the minimizing of environmental and energy footprints during a project life) has also been built into the Travis ERP. Three ERP sites (LF007 Subarea C, SS016, and DP039) and one POCO site (ST018) use solar panel arrays to power extraction pumps and recirculate treated water. By removing this electrical demand from the Travis power grid, the Travis ERP reduces annual energy consumption by 675,480 kilowatt hours at an annual cost savings of $37,000 and avoids the annual generation of 1,773,000 pounds of carbon dioxide equivalents (CO_2e). The Travis ERP was one of the first programs to report monthly electrical usage and greenhouse gas generation during regulator meetings and teleconferences.

The incorporation of green and sustainable remediation principles into the Travis ERP also resulted in the shutdown of two conventional groundwater extraction and treatment plants, the mothballing of a natural gas-powered thermal oxidation unit, the decommissioning of a large network of dual-phase and eductor pumps, and the replacement of an ultraviolet oxidation system with an activated carbon system. Compared to historic program expenditures, these actions have reduced annual system operation and maintenance costs by over $200,000 and greenhouse gas generation by approximately 1,800,000 pounds of CO_2e.

In compliance with the 2014 American Society for Testing and Materials (ASTM) *Standard Guide for Greener Cleanups*, the Travis ERP is the first DoD program, and the first private or federal program in EPA Region 9, to self-certify conformance with the ASTM Greener Cleanup Standard. This self-certification demonstrates that the best management practices (BMPs) in the Travis AFB ERP reduce the environmental

footprint associated with site restoration. EPA Region 9 uses Travis AFB successes in its training materials to explain how facilities within or outside of DoD can utilize similar approaches to clean up contamination effectively. These BMPs are promoted through Travis ERP newsletters, Air Force public affairs articles, and EPA's TechDirect web articles.

Tools for Accelerated Cleanup

The successful application of green and sustainable remediation to speed up groundwater cleanup and reduce the Travis AFB carbon footprint was made possible through the use of Performance Based Contracts (PBCs). The statement of objectives for the current $37.5 million PBC was crafted with green and sustainable remediation principles in mind. To enforce the application of these principles and ensure that contract objectives are met, the Travis ERP staff meets with contractor representatives monthly.

Partnerships

Travis ERP staff conducts monthly meetings and teleconferences with regulatory agency representatives to promote effective two-way communication and foster positive working relationships. These meetings also provide a forum for introducing new ideas and receiving valuable feedback to guide the ERP forward. Almost all Travis green and sustainable remediation proposals receive tentative approvals before the start of remedial design. This approach helps to obtain regulatory acceptance of the overall concept, avoid potential roadblocks, and streamline design and work plan approvals. An example of positive regulator relations is the informative presentation that the RWQCB representative voluntarily gave to the Travis Regional Armed Forces Committee, a community outreach group, to promote ERP accomplishments. The Travis ERP is proud of its productive relationship with the three regulatory agencies and its outstanding reputation with high-level regulatory managers. This was confirmed at the recent Air Force Western Regional Environmental Restoration Summit in San Francisco when EPA Region 9 management commented the Travis ERP is the "Best Performance Based Remediation Team in Region 9!"

Strict California environmental regulations and guidance pose project challenges. Some state maximum contaminant levels are more difficult to achieve than federal levels, and water quality protection policies and requirements have to be considered in the design and implementation of all cleanup actions. To overcome these challenges, ERP staff conducts planning discussions with the three regulatory agencies to finalize remedial designs and remedial action work plans that meet stringent standards.

Activities at ERP sites on the active flight line require coordination with Airfield Operations to meet Federal Aviation Administration requirements and avoid adverse impacts to the base flying mission. ERP staff participates in weekly Airfield Construction Working Group meetings to ensure construction activities can be successfully carried out.

Recently, the Travis ERP faced a new challenge involving the 2010 discovery of the California Tiger Salamander, a federally listed endangered species, on base and in nearby breeding pools. Coordination with the United States Fish and Wildlife Service (USFWS) and the application of negotiated conservation measures to protect this species have significantly impacted the pace of field work. For example, it took time for contractor biologists to identify and receive USFWS approval to use salamander exclusion fencing at project sites. The presence of wetlands and/or vernal pools have also limited the locations where monitoring and injection wells and other restoration infrastructure can be placed. Subsequent coordination of site plans and field construction procedures with base and

Installation Support Team biologists minimized the impact of ERP field work on protected habitat, reducing mitigation costs by approximately $100,000.

Innovative Technology Demonstration, Validation, and Implementation

Bioaugmentation Demonstration: A field technician explains the procedures for injecting a bacterial culture into a plume of solvent-contaminated groundwater without introducing oxygen into the injection point. The Travis ERP will use the results of this technology demonstration at two sites (one shown in background) to guide future groundwater remediation optimizations.

Now that selected groundwater remedies have been implemented and are undergoing performance monitoring, the next ERP phase will identify the best ways to expand the treatment areas of these remedies and reduce the amount of construction needed to reach the Response Complete goal. To obtain the data needed to guide future Air Force and regulator-approved optimizations, the Travis ERP is testing innovative SBGR designs (gravel chimneys and infiltration trenches) to promote EVO recirculation in three chlorinated solvent demonstrations and the use of bioaugmentation, the addition of bacterial cultures to speed up the rate of contaminant degradation, at two sites in a fourth demonstration.

To accelerate the cleanup of fuel-soaked subsurface soil and dissolved petroleum contaminants using sulfate-reduction biological treatment, Travis AFB built the first ever subgrade sulfate reactor at Site SS014 as a POCO technology demonstration with scrap drywall destined for a local landfill. A second demonstration at Site SD034 is testing mechanical and chemical oxygen generators to biologically break down non-chlorinated solvents in soil and groundwater beneath an active aircraft maintenance hangar. These regulator-approved projects offer the potential to significantly reduce both the cost and time to complete future POCO remedial actions. Although it is too early to evaluate the performance of the Site SD034 demonstration, the initial estimated reduction in time to closure resulting from the Site SS014 demonstration is approximately 10 (27 to 17) years.

Bioreactor Construction: Travis AFB built the first ever subgrade biogeochemical sulfate reactor that relies on sulfate reduction to biologically treat petroleum contamination in soil and groundwater. Scrap drywall from home construction projects that would have been landfilled was collected and used as a source of sulfate in reactor construction.

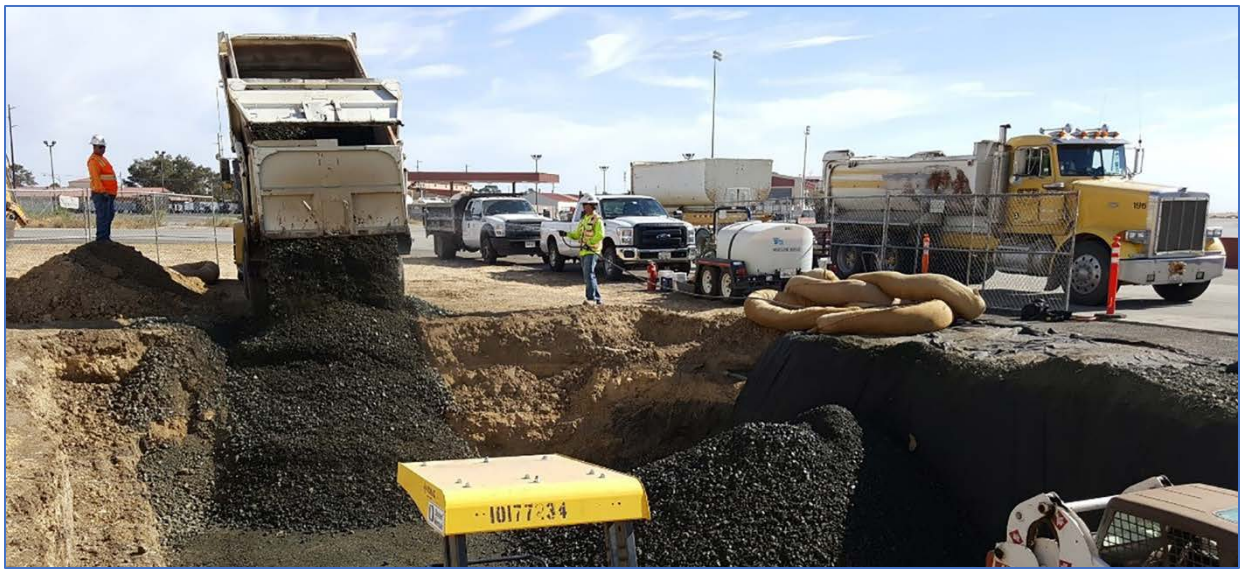
Site Closure

Travis AFB has made great strides in completing remedial actions and closing sites. The ERP provided documentation needed by the RWQCB to close Site TU507, and completed a site investigation that resulted in the closure of Site CG508. At the recommendation of the RWQCB, two POCO sites (Facilities 363 and 1201 – Site ST028 and Monitoring Well 246 – Site ST032) were evaluated under the RWQCB

Underground Storage Tank Low Threat Closure Policy and received RWQCB approval to reach closure status.

The highlight of the 2016 summer construction season was the achievement of Response Complete status for 11 compliance restoration program oil/water separator sites. Besides decommissioning idle infrastructure, this fieldwork also removed two airfield obstructions that posed potential aircraft safety issues. Completion reports and supporting documents are underway to close one quarter of the Travis AFB ERP in 2017. Additionally, clean stockpiled soil from the previously mentioned technology demonstration project was used as fill to restore the oil/water separator sites, which saved approximately $20,000.

Oil/Water Separator Decommissioning: Heavy equipment operators tear down the walls of an unused oil/water separator. The concrete rubble was transported off-base for recycling, and restoration of the site reduced mitigation costs by creating additional California Tiger Salamander habitat acreage.



Oil/Water Separator Site Restoration: Heavy equipment operators backfill an excavation void adjacent to the flight line from the decommissioning of an unused oil/water separator. The fill material provides sufficient compaction to avoid subsidence and allows the footprint to be used for future military construction projects.