

**STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION**

STAFF REPORT FOR REGULAR MEETING OF MAY 4-5, 2011
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ITEM NUMBER: 19

SUBJECT: Department of Defense Program Cleanup Sites in the Central Coast Region

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SUMMARY

The Central Coast Water Board is reimbursed for its regulatory oversight at Department of Defense (DoD) facilities in our region. This Staff Report summarizes DoD facility cleanup progress during the last two calendar years and changes in the DoD program. *Note new information since the December 2009 Status Report is provided in italics.*

DISCUSSION

Congress established the Environmental Restoration Program by the Superfund Amendments and Reauthorization Act of 1986 to address historic activities at federal facilities that that could pose a threat to human health or the environment. The DoD program follows the investigation, cleanup, and closure process laid out by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The USEPA is the lead regulatory agency at all California DoD facilities on the National Priorities List (i.e., federal "Superfund Sites") with support from regional water boards statewide and the Department of Toxic Substances Control (DTSC). The Former Fort Ord Army Base is the only DoD Superfund site in the Central Coast Region.

A 1997 agreement between the State Water Quality Control Board and DTSC designated the respective roles of the two agencies at the various DoD facilities. At DoD facilities in our region, the Central Coast Water Board either shares the lead regulatory role with DTSC (e.g., Vandenberg Air Force Base) or is the sole lead (e.g., Camp Roberts National Guard Base). The Central Coast Water Board's primary oversight responsibilities include: (1) reviewing and commenting on technical reports and studies designed to develop remedial alternatives; (2) achieving public outreach and education through public meetings; and (3) providing oversight of leaking underground storage tank (UST) cases. The Central Coast Water Board's authority for cleanup of polluted DoD sites include: California Water Code, Division 7, Section 1300, Section 13304, and Section 13172, and California Health and Safety Code, Chapter 6.7.

Program Overview

DoD program staff include two full-time and *two* partial-time project managers, an approximately 1/2-time senior (shared with the *National Pollution Discharge Elimination System* program), and two student interns. DoD program resources for fiscal year 2010/2011 are similar to prior years' at 4.6

personnel years and approximately \$473,000. *At the end of January 2011 with 58 percent of the year completed, 48 percent of these budgeted resources had been expended.*

Most of the DoD program budget for the Central Coast Region covers oversight at Vandenberg Air Force Base (VAFB), Fort Ord, Fort Hunter Liggett Army Base, Camp Roberts National Guard Base, Lompoc Branch U.S. Disciplinary Barracks Federal Correction Facility (Lompoc Barracks), and Monterey Peninsula Airport (a former U.S. Navy Air Base).

There are numerous other military-related sites in the Central Coast Region that the military classifies as Formerly Used Defense Sites. Formerly Used Defense Sites are sites that were previously owned, operated, or leased by DoD, such as the Monterey Peninsula Airport. In most cases, there is little site information and DoD ranks them as low priority for funding purposes.

As noted in the Executive Officer's Report for the December 9, 2010 Board Meeting, a three day a month furlough directive led to about a 13.9% reduction in staff resources in our office over the last several years, resulting in decreased staff time spent on all military base cleanup projects. Furloughs have slowed down the rate at which both Water Board and DTSC staff can review and respond to technical documents. Thus schedules associated with these environmental outcomes have been and continue to be negatively impacted.

Water Board staff continue to prioritize our sites based on: a) risk to human health and the environment (e.g., indoor air exposure, discharges to surface water or groundwater); b) project complexity (e.g., site conditions or waste types); and c) federal contract availability (e.g., short-term or long-term contracts). To leverage our work and continue to work on highest priority projects, DoD staff reviewed their prioritized list of sites in November 2010 and confirmed they are continuing to work on the highest priority sites despite the reduction in resources due to the furloughs.

VANDENBERG AIR FORCE BASE

Lead Staff: Don Eley, Carol Kolb, and Donette Dunaway

VAFB, located on the north coast of Santa Barbara County, is the third largest Air Force installation in the nation, occupying almost 100,000 acres and 35 miles of California coast line. Installation Restoration Program sites at VAFB include: closed landfills, space launch complexes, missile silos, fuel and chemical spill areas, and UST areas. Typical chemicals of concern include: jet fuels, rocket fuels, petroleum hydrocarbons, solvents, polychlorinated biphenyls (PCBs), pesticides, perchlorate, metals, and unexploded ordnance.

In 2009, the Air Force's Installation Restoration Program set a goal to have a "Remedy in Place by 2012" (RIP) for a majority of its cleanup sites. *Although the Air Force plans to no longer use RIP as a primary goal, the Air Force has used significant staff resources to achieve this goal, including utilizing a performance-based contract with a primary environmental contractor at many of VAFB sites. In December 2010, the Air Force sent out a directive memo to VAFB staff committing to "Accelerated Site Completion," which allows for VAFB's single contractor to perform fence-to-fence investigation and design/construction activities. The Air Force's goal with this type of contract mechanism is to promote flexibility for industry innovation, dynamic decision-making, and efficiency.*

Prior to full-scale implementation "remedy" or cleanup technology at a particular cleanup site, the CERCLA process requires the Air Force to prepare a technical report, called a Record of Decision/Remedial Action Plan, which must be agreed upon by the regulatory agencies. The agencies will approve the document if the selected remedy protects human health and the environment, and is in compliance with applicable or relevant and appropriate requirements (e.g., California Water Code, Water Quality Control Plan, etc.). The Record of Decision is a public document describing the site history, site characteristics, community participation, contaminated

media, types of wastes present, remedy selected to cleanup the waste, as well as cleanup objectives for the individual wastes present.

As many of the remedial pilot studies involve in-situ or in-place injections of various materials, the Air Force applied for enrollment under the General Waiver Enrollments for Specific Types of Discharges; Resolution No. R3-2008-0010 (General Waiver), which was adopted by the Central Coast Water Board on May 9, 2008. The Air Force has provided sufficient information to demonstrate compliance with the appropriate General Waiver conditions for these sites and injectate materials. The waste discharge types, which are consistent with those listed in Section D of the General Waiver, are listed as injectate materials in the table below. The wastes targeted for treatment are also listed, as are the dates of the associated General Waiver enrollment letters *since the last DoD staff report*:

<u>Site Name</u>	<u>Site Waste(s) Targeted for Treatment</u>	<u>Injectate Material</u>	<u>Date of Letter</u>
Site 3	Trichloroethene (TCE)	Ozone (chemical oxidant).	October 19, 2010
Site 13	TCE	Emulsified soybean oil (carbon substrate).	February 24, 2011
Site 15	TCE	Sodium lactate solution (microbial substrate; e.g., Wilclear™); Shaw SDC-9™; (dechlorinating microbe culture with dehalococcoides sp. bacteria); sodium lactate amended with nutrients (microbial substrate with WilclearPlus™, or functional equivalent); hydrogen gas (microbial substrate); lithium bromide (tracer); molasses (microbial substrate); fluroscein dye (tracer); sodium bicarbonate (buffering agent); sodium carbonate (buffering agent); and sodium hydroxide (buffering agent). LactOil (microbial substrate)	August 9, 2010 April 2011 (pending)
Site 19	Tetrachloroethene (PCE) and TCE	Emulsified soybean oil; SDC-9™; and lithium bromide (LiBr; tracer).	January 13, 2010
Site 24	TCE, PCE and 1,4-dioxane	Sodium lactate solution (e.g., Wilclear™); sodium lactate amended with nutrients (microbial substrate with WilclearPlus™, or functional equivalent); Accelerite™ (metabolic supplement for enhancing kinetics and efficiency of biological systems); SDC-9™; Modified Fenton's Reagent (chemical oxidant); lithium bromide; fluroscein dye; sodium carbonate; sodium hydroxide; sodium bicarbonate; and molasses.	June 10, 2010
Site 35 (32 Cluster)	TCE	Emulsified soybean oil; SDC-9™; and fluroscein dye.	May 28, 2009
Site 50	TCE	Emulsified soybean oil and sodium hydroxide.	March 1, 2011

<u>Site Name</u>	<u>Site Waste(s) Targeted for Treatment</u>	<u>Injectate Material</u>	<u>Date of Letter</u>
Site 60	Methyl tertiary-butyl ether (MTBE)	Modified Fenton's Reagent.	March 16, 2011
Site 142	PCE, TCE and their breakdown products	SDC-9 TM ; emulsified soybean oil and lactate	Dec. 20, 2010

VAFB Site Progress/Success Stories/Challenges:

Approximately 20 VAFB sites have active Water Board staff involvement; some of those sites with significant progress since the last status report are presented in detail below.

Site 1, Base Exchange Service Station (Donette Dunaway): Site 1 was a gasoline service station on VAFB for privately owned vehicles. The station was operated from 1967 through 2006. The fueling station was demolished in March 2007, and USTs were removed. Soil and groundwater beneath the site were degraded by total petroleum hydrocarbons (TPH) as gasoline (including benzene, toluene, ethylbenzene, and xylenes [BTEX]) and MTBE), as well as other volatile organic compounds (VOCs). Some soil was excavated during the replacement of the USTs in 1985; however BTEX, MTBE and VOCs remained in soil and groundwater. During 2010, approximately 12,000 tons of soil were removed to a depth of 12 to 15 feet, where groundwater was encountered. Excavation confirmation soil samples indicate that most of the known impacted soil was removed during the 2010 excavation activity. However, confirmation sampling revealed that a few pockets of pollutants remain in areas where deeper or more extensive excavation was hindered due to site conditions. Oxygen release compound (ORC®) was applied to the floor of the excavation. ORC® is a patented chemical which, when applied to groundwater, supplied dissolved oxygen to indigenous bacteria in order to promote aerobic biodegradation of groundwater contaminants. The excavation was backfilled with clean gravel mixed with additional ORC®. Monitoring wells will be installed in and around the backfilled area. The Air Force will monitor the groundwater for remaining pollutants, and may re-inject ORC®, if necessary. The Air Force is intending to meet clean closure requirements for this site in 2011-2012.

Site 3, Old Railroad Pumping Station & 9300 Block Buildings (Don Eley): Site 3 consists of the old railroad pumping station and the 9300 block buildings in the cantonment area at VAFB. The Site includes fuel USTs and aboveground storage tanks (AGTs), numerous industrial buildings (e.g., printed circuit board manufacturing, painting and photographic processing operations, etc.), and the 9300 Block wastewater line. Trichloroethene, PCE, TCE-breakdown products, methylene chloride, benzene, and polynuclear aromatic hydrocarbons currently exist above California Department of Public Health groundwater Maximum Contaminant Levels (MCLs) in Site 3 wells.

From first quarter 2010 through first quarter 2011, the Air Force performed soil, groundwater, soil gas and indoor air investigations at Site 3. This included additional lateral and vertical assessment of TCE-degraded soil and TCE-degraded groundwater resulting from historical discharges to wastewater lines.

Site 3 remediation activities conducted by the Air Force include the fuel transfer station TPH-degraded soil excavation conducted from September 2009 to May 2010, and an ozone injection pilot test conducted in October 2010 for treating TCE-degraded groundwater. The Air Force anticipates submitting a Site 3 Feasibility Study by the third quarter of 2011, which will be followed by a Site 3 Record of Decision/Remedial Action Plan submittal in the first quarter of 2012.

Site 5 Cluster (Sites 5, 6 and 7), Space Launch Complex-3 East and Space Launch Complex-3 West (Don Eley): Sites 5 and 6 were originally developed in 1959 by the US Navy, with the first missile launch occurring in 1961 from Site 5. The Air Force acquired these facilities in 1966 and continued their launch operations. Site 6 was decommissioned in 2000, and Site 5 continues to launch rockets. Historic launch activities resulted in TCE waste release to soil and groundwater, and sandblast grit release to the land surface with elevated metals concentrations and PCBs.

Site assessment work, conducted in third quarter 2009 through third quarter 2010 by the Air Force, identified TCE waste in soil gas below Site 6's historical deluge-water management infrastructure, and detected TCE in Bear Creek Canyon (Site 7) surface water at concentrations ranging from 0.16 to 4.5 micrograms per liter ($\mu\text{g/L}$). These detections are just below TCE's 5 $\mu\text{g/L}$ MCL for drinking water and about one order of magnitude below aquatic habitat standards.

In addition to TCE wastes in the subsurface, the Air Force has identified several historical sandblast grit disposal areas. The Air Force performed PCB-degraded sandblast grit/ soil excavation between November 2010 and February 2011 at Site 5, which removed approximately 3,000 tons of degraded soil. Similarly, the Air Force is in the work-plan development phase for excavating similarly degraded sandblast grit/ soil from Site 6.

The Air Force conducted a successful soil vapor extraction (SVE) pilot study at Site 6 in June 2010. Results from this study will support remedy selection in the Site 5 Cluster Feasibility Study scheduled for submission by the Air Force in the second quarter of 2011. In addition, the Air Force has incorporated soil gas, groundwater and surface water results from the site assessment work into an updated conceptual site model and an updated groundwater numerical fate and transport model, which also supports the pending Feasibility Study. Groundwater/surface water quality monitoring by the Air Force continues on a regular basis via the Base-wide Groundwater Monitoring Program.

Site 8 Cluster (Sites 8, 9 and 10), Space Launch Complex-4 East and Space Launch Complex-4 West (Don Eley): These two adjacent launch complexes were active from 1964 until they were decommissioned in 2006. Launch activities resulted in TCE and perchlorate groundwater plumes extending over 3,000 feet to the bluffs above the Pacific Ocean. In November 2003, the Air Force began operation of a dual-phase (groundwater and soil vapor) extraction system at the Site 9 groundwater "hot spot." This system successfully removed wastes through 2007, and was turned off due to a diminished mass removal rate.

The Air Force subsequently installed in-situ bioremediation (ISB) pilot studies at both Site 8 and Site 9. These bioremediation pilot systems have locally reduced TCE concentrations to below its 5 $\mu\text{g/L}$ MCL, and perchlorate concentrations to below the laboratory detection limit (typically 1 $\mu\text{g/L}$). Due to the ISB pilot study systems' successes, the Air Force expanded both source area treatment systems, and installed two new ISB barriers, one in the downgradient third of the Site 9 plume, and one in the middle of the Site 8 plume, which were both completed in September 2009.

The Air Force will submit a final-draft feasibility study in second quarter 2011, which at the request of the DTSC and Water Board staff will include adding an ISB barrier in the downgradient third of the Site 8 plume. The Air Force anticipates submitting a Record of Decision/Remedial Action Plan for the Site 8 Cluster in the fourth quarter 2011.

Site 13 Cluster (Sites 13 and 14), (Donette Dunaway): Site 13 Cluster consists of Sites 13 and 14. Site 13 includes the Advanced Ballistic Reentry System A (ABRES-A) Launch Complex and the adjacent canyon. Site 14 consists of ABRES-A Lake which received washdown water and natural runoff waters from the launch complex, Missile Silo 395-B, and surrounding lands. The key contaminants of concern are TCE, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-DCE, vinyl chloride, and 1,1-DCE.

In 2005, the Air Force completed a biobarrier, which consisted of emulsified soybean oil (ESO) injections into 18 wells. In 2007 the biobarrier was expanded, and BAC-9 microbial cultures were injected. The biobarriers have successfully created a reductive dechlorination zone.

To expedite groundwater treatment, two permeable reactive barriers were installed in January 2009, located upgradient from the original biobarrier. The permeable reactive barriers utilize a carbon and iron mixture. Additionally, the Air Force installed a SVE system to address TCE-degraded soil. The SVE system was initiated in 2006 and was operated until 2009, at which time the system was temporarily suspended. The SVE system was restarted (March 2010) in the two SVE wells with the highest TCE concentrations.

The Air Force continues to monitor and maintain the biobarrier, the permeable reactive barriers and SVE system. Most of the wells downgradient of the biobarrier show relatively favorable reducing conditions, which is necessary for dechlorination. The Air Force intends to continue maintenance of the biobarrier, passive reactive barriers, and SVE system.

Site 15, ABRES-B Launch Complex (Don Eley): Site 15 is a former launch complex located approximately 1.5 miles from the Pacific Ocean. The complex was built in 1959 and was used for missile launches through 1967. Large quantities of the solvent TCE were used to clean the missiles prior to launch. An unknown amount of TCE migrated into the shallow aquifer underlying sand dunes. At least two plumes (Channel A plume and Channel B plume) extend from the launch pad channels to San Antonio Creek, over 3,000 feet south of the launch complex. Surface water samples show that TCE and its break down products are present at low concentrations in a 3,000 foot reach of San Antonio Creek where the plumes discharge to surface water. To date, most of the detected VOC concentrations are below MCLs and aquatic habitat screening values; however, vinyl chloride has been detected at concentrations above its MCL in San Antonio Creek.

In October 2009 the Air Force installed an in-situ permeable reactive barrier treatability study designed to treat degraded groundwater at two distal plume locations. The Air Force built two 50-foot long permeable reactive barrier walls, composed of overlapping columns installed with a large-diameter auger drilling rig. Carbon infused with nano-sized iron (a reducing compound) is the reactive material in the columns that comprise the barriers. Results from the in-situ permeable reactive barrier treatability study, *through September 2010, are inconclusive.*

More recently, in March 2011 the Air Force completed infrastructure installation for an ISB substrate recirculation treatment system treatability study in the source area of the primary TCE plume (Channel A plume). ISB substrate injection treatability study testing at the Channel B source area is planned for later in 2011. Together, results from these treatability studies will support the Air Force's Site 15 Feasibility Study development and subsequent Site 15 Record of Decision/Remedial Action Plan development.

Site 19, National Aeronautics and Space Administration (NASA) Building (Donette Dunaway): Site 19 is currently an active NASA facility with multiple operations including satellite communications control, hardware assembly, and telemetry. The Air Force used TCE in the past as a degreasing agent for parts cleaning, and likely discharged TCE to the ground surface, resulting in a TCE-degraded groundwater plume approximately 240 feet in length, 110 feet in width, and 29 feet in depth. *TCE investigations were initiated in 1999. More recently, in 2008, PCE, was detected in two of the 22 Site 19 monitoring wells. In relation to the TCE plume, the PCE appears spatially limited on the site (two well locations).*

The Air Force initiated an enhanced ISB study in 2006, which included new well installations, and injecting hydrogen releasing compound substrate, and injecting dechlorinating microbes. The initial

injections effectively treated the lower sandy zone, but had limited effect on the waste concentrations in the upper clay zone. *In December 2009, the Air Force conducted in-situ bioremediation treatments at two source areas for PCE and TCE treatment. The ISB treatments included injecting dechlorinating microbial culture and a carbon source (emulsified soybean oil), which created condition favorable to ongoing reductive dechlorination.* The Air Force has committed to having RIP by 2012 for Site 19.

Site 20, UST Area 1, Landfill and Drum Disposal Site Areas 2 & 3 (Donette Dunaway): Site 20 is located in the main cantonment area and is composed of an UST Area (Area 1), Landfill 1 (Area 2), and Drum Disposal site (Area 3). At Area 1, the Air Force used a dual-phase (soil vapor and groundwater) extraction system and in-situ chemical oxidation to remove diesel fuel and gasoline wastes from soil and groundwater at the site. The Air Force continues to monitor groundwater quality until groundwater cleanup objectives are reached. *Remediation and closure decisions for Area 1 will utilize petroleum UST-site closure protocols.*

Areas 2 and 3 - Area 2 (Landfill 1) served as the main landfill for VAFB between 1942 and 1957. Waste disposed in Landfill 1 included municipal trash, incinerator ash, scrap metal, pesticides, waste oil, lubricants, and potentially unexploded ordnance. *Area 3 was identified as a potential historical drum and unexploded ordnance disposal site. However, extensive Area 3 site assessment did not substantiate the drum disposal hypothesis. Approximately 200 pounds of inert unexploded ordnance were found and removed from the primary ravine in Area 2. No items containing explosive residue or filler, or fused ordnance were encountered. The Air Force did not detect PCBs, explosives, or semi-volatile organic compounds in any samples in the primary ravine soil samples. The clean samples indicate that pollutants are not being eroded from, or leaving the site.*

The Air Force submitted a feasibility study to identify and evaluate remedial technologies for Areas 2 and 3. The Air Force and state agencies including Water Board staff, concluded that the best alternative is to initiate institutional controls that include access and land use restrictions, groundwater monitoring, and an on-going five-year site review cycle. This decision considered long-term effectiveness, reduction of toxicity, mobility and/or volume of contaminants, implementability, cost, and overall protection of human health and the environment.

Site 24, Area between New Mexico Avenue, Iceland Avenue, and Utah Avenue (Don Eley): Previous Site 24 operations and historical infrastructure include vehicle maintenance/fueling/washing, military tank maintenance/fueling, pesticide mixing/washrack at the Entomology Building, historical laundry facility in Building 11193, and the sewer line associated with Building 11193. The Air Force has identified TPH waste, organochlorine pesticide wastes, and VOC wastes, including PCE, TCE, and 1,4-dioxane, at Site 24.

The Air Force has previously performed remediation efforts related to TPH (e.g., excavation and chemical oxidation), organochlorine pesticides (e.g., excavation), TCE (e.g., ISB) and PCE (e.g. chemical oxidation). In April and May 2009, the Air Force performed chemical oxidation by injecting sodium permanganate and potassium permanganate for treatment of PCE in shallow soils and groundwater north of Building 11193.

In the third quarter of 2010, the Air Force initiated additional Site 24 treatability studies. Activities conducted through February 2011 included additional groundwater and soil assessment for refining treatment system configuration, ISB injections (143 locations) in shallow, middle and deep aquifers primarily for TCE and PCE treatment, and Modified Fenton's Reagent injections (25 locations) in the three aquifers primarily for 1,4-dioxane treatment. Investigating soil gas and potential indoor vapor intrusion associated with Building 11193 is the Air Force's most significant pending assessment work at Site 24.

Treatability study effectiveness monitoring by the Air Force is on-going. Results from the treatability studies and results from the Building 11193 soil gas and indoor air investigation will support the Air Force's Site 24 Feasibility Study development and the subsequent Site 24 Record of Decision/Remedial Action Plan development.

Site 25 Cluster (Sites 25, 26, 39 and 49), (Donette Dunaway): *Site 25 Cluster consists of four former sites: 25, 26, 39 and 40. Sites 39 and 40 are located in Space Launch Complex - 1, a launch facility that has not been used for launch operations since the late 1960s to early 1970s. Sites 25 and 26 are located in Space Launch Complex-2, and are the only active launch facilities within the Site 25 Cluster. Due to ground surface and bedrock undulation, groundwater above bedrock ranges from seven to about 90 feet below ground surface. The regional groundwater flow direction, and site location, indicates the potential for groundwater discharge into the Pacific Ocean.*

Primary chemicals of concern in soil are PCBs and heavy metals, in association with historical sandblast grit disposal. VOCs are the primary chemicals of concern in groundwater. TCE is the predominant VOC and has been detected at concentrations up to 130 µg/L. The estimated residual TCE mass in the groundwater is less than 10 pounds. Baseline human health risk assessment and ecological risk assessment results indicate that the surface soil and groundwater are the primary media of concern. The primary potential threat to humans from this site is via hypothetical ingestion of TCE-degraded groundwater. PCBs and lead in degraded soil pose potential ecological risks.

The Air Force issued a Focused Feasibility Study which concluded that the best approach to meeting cleanup objectives is to remove the lead-source (sandblast grit) and initiate in-situ bioaugmentation and in-situ chemical oxidation at the toe of the VOC plume. This combination of treatments will provide overall protection of environmental and human receptors and will destroy and/or remove contaminants from groundwater so that they cannot reach the Pacific Ocean. In May 2010, Water Board staff approved of the proposed actions, and anticipates the plan will be initiated in spring 2011.

Site 27, Exploded Missile Silo (Donette Dunaway): *Site 27 originally was a Titan 1 missile site, in which the first missile exploded within its silo in 1960. The explosion destroyed the silo and the adjacent equipment terminal. No missile launches took place at the site, and the site has not been used for any purpose since the 1960 explosion. The Air Force has detected the following constituents of concern in groundwater near the exploded missile silo: TCE, 1,1,2,2-tetrachloroethane (TeCA), and trichloro-fluoromethane (TCFM). As of winter 2008, concentrations of TCE and TCFM were below their MCLs. TeCA has not been detected at concentrations above its MCL since 2004.*

The Air Force conducted a Feasibility Study and chose land use controls with no active remediation or monitoring as the selected Record of Decision/Remedial Action Plan. In the Feasibility Study, the Air Force concluded that active remedial action is not warranted to protect site workers and ecological receptors, and adverse effects of habitat destruction resulting from active remedial action would likely outweigh the benefit of hazard removal. Despite the fact that constituents of concern were below MCLs since 2008, a "No Action" alternative was not acceptable because: 1) The Human Health Risk Assessment did not evaluate soil exposure pathways for residential receptors and 2) the Air Force did not evaluate the potential vapor intrusion by collecting soil gas samples. Site conditions will reduce the toxicity, mobility, and volume of the few remaining waste constituents over time. The Air Force submitted, and DTSC and Water Board staff approved, a Record of Decision/Remedial Action Plan, dated May 2010, which was signed by Central Coast Water Board Executive Officer Briggs on April 30, 2010.

Site 32 Cluster (Site 32 and 35), Atlas F Missile Silos (Don Eley): *Site 32 Cluster is composed of Sites 32 and 35, which are missile silo complexes that were historically used for launching Atlas F*

missiles. The Air Force launched two Atlas F missiles from the Site 32 facility in the 1960s. However, this silo facility served primarily as a training facility for active launch operations from Site 35. The Air Force launched seven Atlas F missiles from the Site 35 facility in the 1960s. The Air Force used dry pad technology for launches at both facilities, which typically generated some TCE waste. More recently, the Air Force used Site 32 as a radar facility until 1999. Site 35 is currently used for equipment storage and office space.

The Air Force has identified VOC wastes, most notably TCE, associated with the Site 35 facility. Site characterization performed in 2007 through *May 2010* identified a subsurface paleochannel that conveys VOC-degraded groundwater at approximately 4,000 feet downgradient to the southwest. In December 2008, the Air Force began injecting carbon substrate and dechlorinating microbes into a *treatability study distal-plume bio-treatment barrier*. *In February 2010, the Air Force completed substrate and microbe injections to form a second treatability study bio-treatment barrier closer to the identified source release area. The Air Force continues to monitor these treatability studies, and will perform additional substrate, buffer media, and microbial injections as needed to treat the VOC-degraded groundwater plume.*

In addition to treating the groundwater plume, the Air Force has excavated and removed TCE-degraded soil from Site 32 Cluster. In April 2010 the Air Force excavated approximately 472 cubic yards from the Site 35 source area. In December 2010 the Air Force excavated approximately 200 cubic yards of shallow soil degraded by PCBs. Results from these soil removal actions, and from the plume treatability studies described above, will support the Air Force's Site 32 Cluster Feasibility Study development and the subsequent Site 32 Cluster Record of Decision/Remedial Action Plan development.

Site 33, Missile Silo 576-E (Donette Dunaway): Site 33 is an active Taurus missile launch facility historically used for launching Atlas F missiles. The Air Force excavated and removed burned metal debris and approximately 40 tons of metal wastes in soil, and removed a diesel UST and an emergency rocket propellant fuel dump tank, as part of the silo's decommissioning process in 1993 and 1994. The Air Force identified VOC wastes, most notably TCE, in groundwater at Site 33. The lateral extent and amount of TCE groundwater waste are limited and have decreased over time.

In October 2008, Water Board staff recommended closure of Site 33 with land use controls. After Water Board approval at the October 17, 2008 Board Meeting, the Executive Officer issued a letter approving closure with land use controls (i.e., no installation of water supply wells), and directing the Air Force to properly destroy existing Site 33 monitoring wells. Subsequent to this action, DTSC concluded that a Record of Decision/Remedial Action Plan was more appropriate regulatory mechanism to address residual TCE at the Site because it requires the Air Force to review site conditions every five years. *The Air Force subsequently submitted, and DTSC and Water Board staff approved, a Record of Decision/Remedial Action Plan, dated May 2010 and signed by Central Coast Water Board Executive Officer Briggs on April 30, 2010.*

Site 50, Area located between 6th and 8th Streets, and Iceland and Nevada Avenues (Don Eley): Previous Site 50 operations include missile engine assembling and cleaning, metal plating, and hazardous materials storage. The main contaminant in soil and groundwater at Site 50 is TCE and its breakdown products. The Air Force has performed TCE groundwater plume treatability studies at Areas 1 and 2 of Site 50. The studies performed from 2007 to date include in-situ chemical oxidation (Modified Fenton's Reagent injections) at Area 1, which was expanded November 2008 through January 2009, and ISB (carbon substrate, buffering media, and dechlorinating microbe injections) at Area 2, which was expanded in June 2009. Both remediation study methods have lowered TCE waste concentrations in groundwater. *However, the Air Force has shown, for Site 50-specific conditions, that the ISB remediation approach is more effective than the chemical injection*

approach. As a result, the Air Force has developed a treatability study work plan for treating the balance of the most highly TCE-degraded groundwater at Site 50 via ISB.

In addition to the groundwater plume treatability studies, the Air Force has excavated soil most highly degraded with TCE at Site 50. Between July and September 2010 the Air Force excavated approximately 500 tons of degraded soil from the Site 50 Area 1, and approximately 1,650 tons of degraded soil from two excavation pits in the Site 50 Area 3. Results from these soil removal actions and from the plume treatability studies described above will support the Air Force's Site 50 Feasibility Study development and the subsequent Site 50 Record of Decision/Remedial Action Plan development.

Site 60, Former General Service Administration Service Station (Don Eley): Site 60 is a former gasoline service station south of Monroe Street, near the south-base VAFB gate, where fuel-related waste constituents were historically released. The Air Force has removed service station infrastructure, and has excavated degraded soil from the source area. MTBE and its degradation daughter product tertiary-butyl alcohol (TBA) are the primary wastes currently degrading Site 60 groundwater.

Past remedial actions have resulted in decreased waste constituent concentrations in the shallow aquifer zone plume. Benzene and TPH concentrations detected in monitoring wells demonstrate a decrease to below regulatory criteria. MTBE concentrations have declined in most of the shallow aquifer monitoring wells to below 5 µg/L, the MCL for MTBE. Some monitoring wells still exhibit MTBE above its MCL, at detections typically less than 20 µg/L; however, they generally show a decreasing concentration trend through time. TBA concentrations have declined in most shallow aquifer monitoring wells to less than the 12 µg/L California Department of Public Health drinking water action level.

In June 2010, the Air Force performed in-situ chemical oxidation injections, using Modified Fenton's Reagent, for the purpose of treating MTBE and TBA in the middle aquifer zone. Historical MTBE and TBA concentrations in middle aquifer zone are documented as high as 530 and 510 µg/L, respectively (in 2005 and 2004). Following the June 2010 injections, MTBE was most recently detected in the middle aquifer zone at 85 µg/L and TBA was not detected (third quarter of 2010). If MTBE concentrations in groundwater will continue to drop, and TBA concentrations will remain less than 12 µg/L, the site could be closed in the near future.

Area of Concern (AOC) 59 (formerly called Site 142) (Donette Dunaway): AOC 59 was used to store and mix pesticides from 1959 to 1964. Pesticide-degraded wastewater was disposed of down a sink, which connected to a sewage lagoon. The site also included a 1,000-gallon diesel UST and an auto service washrack. Runoff from the washrack was directed into the adjacent agricultural field. Site investigations initiated in 1998 identified PCE, TCE, and their breakdown products as the primary chemicals of concern at AOC 59.

In May 2010, the Air Force initiated a phytoremediation pilot study by planting 0.8-hectares with densely spaced poplar trees. The trees (still on-site) were found to significantly influence groundwater (and consequently groundwater-carried PCE) movement by pulling groundwater toward the grove of tree. The trees may inhibit PCE migration during high-transpiration periods (diurnally and seasonally). However, groundwater PCE concentrations within the poplar grove area have not diminished significantly over the years.

The Air Force is conducting in-situ bioremediation treatment by injecting LACTOILTM and a dechlorinating microbial culture SDC-9TM in the highest PCE groundwater concentration areas at the site. Post-injection groundwater samples will be compared to baseline sampling data to determine treatment effectiveness. The Air Force will present sampling data, analytical results,

interpretation of findings, conclusions, and recommendations in semiannual Remedial Action Optimization Reports and Status Reports, submitted in April and October of each year.

Areas of Interest (AOI) and AOC Program (Carol Kolb): The Air Force is proactively investigating multiple areas that could be associated with waste releases. The Air Force, DTSC, and Water Board staff defines an AOI as any area that could cause environmental concern, but does not pose a serious immediate threat to human health and the environment. If a preliminary assessment (review of historical information/site visit) confirms the potential threat, the Air Force and the agencies will classify the AOIs an AOC and the Air Force will undertake site investigations to determine appropriate subsequent actions. *There are 666 AOIs, and 166 AOCs at VAFB. Approximately 714 of the 832 AOI/AOC sites have been closed. Most of the remaining 118 AOI/AOC sites have already undergone some level of investigation and are in various stages of evaluation or further site assessment. Water Board and DTSC staff, and Air Force's staff and their contractors attribute the continued successful cleanup and closure work on a strong commitment by all parties to work collaboratively and openly.*

UST Program (Carol Kolb): The Central Coast Water Board is the lead agency for UST cleanup sites. *There are 918 UST sites on VAFB. To date, a total of 805 UST sites have been closed or met the Water Board's No Further Action criteria. The remaining sites are undergoing investigations or are awaiting assessment in the future.* Also included in this program are approximately seven miles of solvent and petroleum/oil/lubricant transmission lines are scheduled to be investigated and remediated within the next five years.

FORT ORD

Lead Staff: Grant Himebaugh

Fort Ord encompasses 28,000 acres between the cities of Seaside and Marina. USEPA declared the base a federal Superfund site in February 1990 based on impacts to the City of Marina's municipal water supply from facility-related groundwater wastes. The Army officially closed the base in September 1994 and most of the facility has since been transferred to civilian use. Since the facility's closure, the Army's base closure team has identified over 40 environmental waste sites, most of which have been remediated. The primary water quality concerns involve landfill gas, one carbon tetrachloride groundwater waste plume, and three TCE groundwater waste plumes.

Fort Ord Progress/Success Stories/Challenges

On this federal Superfund site, Water Board staff work with USEPA and DTSC to oversee cleanup activities. The Army is remediating several large-scale groundwater waste plumes. Landfill gas and underlying groundwater is being remediated with a gas removal system. *During 2010, the Army removed 39.5 pounds of groundwater wastes from the three active groundwater remediation systems. This is a 9% decrease from the previous year. This drop in mass removal occurred mainly at Sites 2-12, and is due to a decrease in what had been accelerated mass removal from the operation of a new air stripper system.*

All biodegradation treatment areas for the Army's carbon tetrachloride groundwater cleanup are operating. To date, groundwater concentrations are decreasing and the Army will continue to monitor groundwater conditions as the bacterial food source, sodium lactate, migrates through the degraded aquifer.

The USEPA has awarded a community Technical Assistance Grant (TAG) to Marina in Motion, which is based in the City of Marina. Marina in Motion has contracted with two technical contractors and began project reviews in February 2011. TAGs are awarded to qualified local groups to assist

them in evaluating and communicating the technical aspects of USEPA Superfund cleanups to the local community.

Operable Unit 1, Off-site: To complete off-site assessment and prevent Operable Unit 1 TCE groundwater plume migration, the Army hired a separate contractor for the investigation and cleanup. The Army completed off-site plume characterization and construction of the groundwater treatment system in 2008. This new off-site system has been successful in reducing contaminant levels below remediation goals. *The Army has completed a chemical concentration rebound evaluation for the off-site area. The Army halted groundwater extraction and continues long-term monitoring at a few select wells.*

Operable Unit 1, On-site: *The Army's contractor has reconfigured parts of the groundwater extraction system, which resulted in increased removal efficiency in the plume interior. Mass removal for 2010 was 0.51 pounds of wastes, versus the previous year's figure of 0.91 pounds. This reduction in mass removal is a reflection of the minimal waste concentrations available for removal. Water Board staff believes there is a significant possibility that Operable Unit 1 can cease groundwater extraction and begin a final concentration rebound study in the next two to three years.*

Operable Unit 2: *Operable Unit 2 mass removal for 2010 was 29 pounds of contaminants, versus the previous year's figure of 30 pounds. The Army's biggest challenge has been to control the highly diffuse leading edge of the groundwater waste plume. The Army gains plume control in the winter when regional groundwater use declines. The Army loses hydraulic control in summer when nearby agricultural pumping helps pull the waste plume away from the Army's extraction wells. In September 2009, the first detection of TCE contaminants were found in Marina Coast Water District (MCWD) supply well Number 31. To date, low levels of TCE contaminants, always below MCLs and seasonally non-detectable, are now found in all three of the former Fort Ord – now MCWD wells. An October 2009 meeting with MCWD staff revealed that due to sea water intrusion issues alone, these three supply wells are planned for abandonment in favor of installing deeper municipal wells in the next several years. Despite the wastes reaching the supply wells being well under the MCL for TCE (5 ug/L), the Army and regulators continue to work together to understand this unwanted TCE migration, and minimize its extent.*

Sites 2/12: *The Sites 2-12 mass removal for 2010 was 10 pounds of contaminants, versus the previous year's figure of 12.5 pounds. The Army has operated the new air stripper treatment system modification for over three years. The Army uses the air stripper to treat vinyl chloride after extracted groundwater exits the granular carbon treatment units. The Army's modification, compared to the prior treatment (using carbon alone), creates greater treatment efficiency. This efficiency is now on the decline as waste removal reaches asymptotic levels. However, like Operable Unit 1, Sites 2/12 waste mass has been greatly reduced, and site remedy completion will begin to reach a predictable time range.*

Carbon Tetrachloride Plume: The Army and regulatory agencies signed a Record of Decision for the carbon tetrachloride plume, which contains the agreed-upon final remedy for this waste. The Army completed operational aspects of a pilot project study in 2008. The Army has kept regulatory staff regularly informed of study results. *The Army has completed construction of the final remedy for the upper A-Aquifer. This remedy consists of an in-situ biodegradation system, which is located largely in the Preston and Abrams Park areas within the City of Marina. Expansion of the Operable Unit 2 groundwater extraction system to aid in removing carbon tetrachloride contaminants is currently underway. The accompanying groundwater monitoring system has also been expanded.*

Prior to aquifer substrate injections in 2009 and 2010, Water Board staff enroll the Army in the General Waiver of Waste Discharge Requirements for Specific Types of Discharges (Resolution No. R3-2008-0010; General Waiver). The waiver was provided for the injection of sodium lactate into

the uppermost or unconfined A-Aquifer. The sodium lactate was injected as a microbial food source to enhance in-situ biodegradation of carbon tetrachloride contaminants.

MONTEREY PENINSULA AIRPORT

Lead Staff: Grant Himebaugh

Monterey Peninsula Airport is a Formerly Used Defense Site comprising 455 acres three miles southeast of downtown Monterey. Formerly leased by the Navy from the Monterey Peninsula Airport District in 1942, today the Airport serves the local area with commercial and private air service. Known cleanup sites include two former 50,000-gallon concrete USTs with an associated petroleum waste groundwater plume and a TCE waste groundwater plume. A former fire fighting training facility and several other potentially polluted sites have been ruled out as waste sources.

In May 2003, The Army Corps of Engineers (Army Corps) initiated a treatability study to remediate TCE in groundwater at the Casanova Oak Knoll Park. The Army Corps began operation of another cleanup system at the Airport's TCE waste source area in fall 2003. Regulatory and community feedback for both of these facilities has been positive.

The Army Corps is in the process of engineering groundwater remedy enhancements. Water Board staff anticipates receiving these enhancement proposals in 2011 or 2012.

FORT HUNTER LIGGETT

Lead Staff: Grant Himebaugh

Fort Hunter Liggett is an Army training facility consisting of approximately 165,000 acres in southern Monterey County, with current and historic Army uses of this facility including field exercises and weapons and equipment testing. Most of the land is undeveloped. Environmental Restoration Program sites include a closed landfill, former USTs, spill areas, unexploded ordnance areas, hazardous waste accumulation sites, and former fire fighting training areas. The primary chemicals of concern include chlorinated solvents, petroleum, oils, lubricants, heavy metals, chlorinated pesticides, and PCBs. To date, the Army has completed actions at 32 of the 35 sites at Fort Hunter Liggett. The Army's three remaining sites needing action are the facility landfill and two groundwater waste plumes associated with former petroleum storage facilities. In 2008, the Army had significant installation funding challenges for site cleanup activities. In 2009, the Army received additional funding and Water Board staff began working closely with the Army Corps to expedite further assessment and cleanup of two large petroleum groundwater cleanup sites: Buildings 258 and 194.

Building 258: This extensive gasoline plume is roughly one-half mile long and contains thousands of gallons of gasoline product. In 2007, the Army constructed a SVE system to remove the gasoline from soil and groundwater and expanded the system in November 2009. Since beginning operation, the Army has removed nearly 80,000 pounds of gasoline wastes or the equivalent of approximately 12,900 gallons of gasoline. No current drinking water resources are impacted and no environmental receptor pathways have been identified. It's uncertain what caused this major fuel release, although some of the Army's leak detection coincided with the 1989 Loma Prieta earthquake. The Army completed a major effort to characterize the lateral extent of groundwater impacts in March 2011. Further characterization will be conducted this year to concentrate on the vertical limits of petroleum migration. Water Board staff met with the Army in March this year to discuss overall project status and additional cleanup strategies. The Army is currently evaluating strategies to assist or expand the SVE system.

Building 194: This groundwater waste plume consists primarily of petroleum products. Degraded groundwater was treated with hydrogen peroxide injection in the late 1990s, although waste concentrations have persisted. The Army responded with additional groundwater characterization efforts, and has submitted (March 2011) a work plan for injection of a more effective chemical oxidizing agent, RegenOx™. Water Board staff is working to expedite review of this proposal to reduce waste mass in shallow aquifers while groundwater elevations are at unusually high levels due to this winter's heavy rain. As of this writing, Water Board staff anticipates acceptance of the Army's injection proposal and the Executive Officer will enroll the Army under the General Wavier in 2011.

CAMP ROBERTS

Lead Staff: Grant Himebaugh

Camp Roberts is a California Army National Guard installation located approximately 10 miles north of Paso Robles. The 42,000-acre facility spans northern San Luis Obispo County and southern Monterey County. The Army built the installation in 1941, and used it as a staging/training area until 1971, when it was transferred to the National Guard. The National Guard and Army currently use Camp Roberts for training. The installation contains two developed areas, the Main and East Garrisons. The remaining lands are used for training and firing ranges. Because the Army's funding has been limited, the environmental restoration process has been conducted for only limited groups of sites. The Central Coast Water Board is the sole regulatory lead agency at this installation.

In the fall of 2005, the Army awarded a "paid for performance" environmental investigation contract. The Army's contractor presented its scope of work and schedule for a Remedial Investigation/Feasibility Study and for closure of two former landfills. The Army has completed final covers for all landfill cells, except where endangered species issues have prevented some of the work. The Army completed a remedial investigation report for six suspected or known waste sites in 2007. Water Board staff approved the report, which resulted in soil cleanup activities at the FMC Corporation Yard and Site 936 groundwater cleanup. In summer 2008, the National Guard performed a second slurry injection of oxygen release compound at Site 936. These treatments have reduced groundwater waste concentrations, although additional treatment will be necessary to reach groundwater cleanup goals.

Beginning in late 2005, the Army reported perchlorate detections in the current landfill monitoring program. Perchlorate monitoring detections are in the 2 µg/L to 5 µg/L range; for reference, the MCL for perchlorate is 6 µg/L. The Army analyzed the facility's water supply and found no detectable concentrations of perchlorate. *The Army continues its landfill groundwater monitoring program to ensure water quality standards are not exceeded.*

Water Board staff approved an Installation Action Plan in March 2011. This plan outlines the installation's total multi-year cleanup program. Of particular interest are plans for environmental assessment for a fire fighting training area, three pesticide buildings, and some vehicle washracks.

LOMPOC BRANCH U.S. DISCIPLINARY BARRACKS

Lead Staff: Donette Dunaway

The Lompoc Branch U.S. Disciplinary Barracks Federal Correction Facility is located approximately two miles northwest of the City of Lompoc in Santa Barbara County. The property was purchased by the War Department in 1941 and operated as part of Camp Cooke until 1946, when it was converted to an Army military detention center. In 1959, the U.S. Bureau of Prisons took over management of the facility, which is currently operated as high, medium, and low security prisons.

The property consists of approximately 2,900 acres and includes a sign factory, electron cable manufacturing plant, furniture factory, print shop, cattle ranch, dairy, butchering plant, sewage treatment plant, and farm.

This facility was selected for closure as part of the 1995 DoD's Base Realignment and Closure and ownership was transferred to the current operator, Bureau of Prisons, in 2003. In June 1997, the Army completed an Environmental Baseline Survey Report, which delineated potential or known areas of concern. The Central Coast Water Board is the lead agency for this site and the County of Santa Barbara is also overseeing environmental issues at a closed landfill and at the Wood Dump/Landfill. Ongoing cleanup sites include the Wood Dump/Landfill and the Washrack Site. Chemicals of concern include chlorinated solvents, petroleum, oils, lubricants, and metals at the Washrack Site.

Wood Dump: At a former landfill, the Wood Dump, a cover, erosion controls and runoff conveyances have been functioning well over the last three years, and monitoring data indicate little to relatively minor waste impact to groundwater. In a July 16, 2009 submittal, the Army requested ceasing almost all site monitoring, including well abandonment. *Staff's review of the December 9, 2005 Final Post Site Mitigation Maintenance and Monitoring Plan and the October 4, 2010 Change Memorandum found that these documents incorporate all of the monitoring and reporting requirements that are included in Monitoring and Reporting Program (MRP) Order No. R3-2010-0028. On December 30, 2010, Central Coast Water Board staff concurred with the Army's request to rescind MRP No. R3-2010-0028, provided the Army conducts the monitoring and reporting as described in the Final Post Site Mitigation Maintenance and Monitoring Plan as modified by the October 4, 2010 Change Memorandum.*

Washrack Site: During historical operations, petroleum fuel compounds and solvents were discharged to soil and groundwater. In 2002, the Army performed enhanced reductive dechlorination by carbon injection. From September 2005 to December 2008, the Army expanded its injection program, resulting in significant reduction in waste concentrations in shallow groundwater. *The Army's most recent Washrack groundwater monitoring data submitted (September 2010) indicate solvents remain in groundwater above their respective MCLs. During the April 2009 monitoring event, PCE was present in groundwater up to 41 µg/L. Daughter products of PCE are also detectable above MCL. However, groundwater contaminant concentration trends are that PCE is decreasing, while daughter products (particularly (cis-1,2-DCE) are increasing, which indicates that reductive dechlorination is occurring.*

FORMERLY USED DEFENSE SITES PROGRAM

Lead Staff: Grant Himebaugh

In 2010, Water Board staff coordinated with the National Park Service and the Army Corps of Engineers to close six former USTs and two associated electrical transformer sites on Santa Rosa Island. Three of the UST sites were closed with Water Board concurrence with staff recommendations. The remaining five sites were closed at the staff level.

In 2011, Water Board staff coordinated with The Land Conservancy and the U.S. Navy to close a former UST site on Santa Cruz Island. Historic and current monitoring well data indicated no groundwater impacts from a 1994 fuel release to soil. With the soil cleanup completed to acceptable levels, and no impact or threat to groundwater, a staff closure was performed for this site.

Although the Santa Cruz Island UST site is situated in a remote and highly controlled environment on Santa Cruz Island, the Central Coast Water Board staff is noticing the presence of residual hydrocarbons in soil. Residual soil contamination may exist in concentrations that could conceivably

pose an unacceptable risk under certain site development activities such as site grading and excavation. The Central Coast Water Board, Santa Barbara County Fire Department, Fire Protection Division (FPD), and the appropriate local planning and building departments must be notified prior to any changes in land use, grading activities, or excavation. This notification must include a statement that residual soil contamination underlies the property. The levels of residual contamination and any associated risks are expected to reduce with time. Additionally, Santa Barbara County may require a health risk assessment be conducted should this site be developed.

The Army Corps' Formerly Used Defense Site Program Manager recently left Sacramento to work in Afghanistan. Although the program manager has been a key contributor to program success, and plans to be overseas for at least a year, Water Board staff plan to continue forward with this program during his absence.

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