



Guardian

A PUBLICATION OF THE ENVIRONMENTAL RESTORATION PROGRAM

TRAVIS AIR FORCE BASE, CALIFORNIA

MARCH 2022

First Virtual Restoration Advisory Board Meeting to Be Held in April

The Travis Air Force Base (AFB) Environmental Restoration Program (ERP) Restoration Advisory Board (RAB) will hold its first online interactive virtual meeting on April 21, 2022, at 7:00 p.m. local time.

The last in-person RAB meeting was held in April 2019, so we have a lot to cover. Personnel have changed, the Optimized Remediation Contract and the Per- and Polyfluoroalkyl Substances (PFAS) Contract have been awarded, while ERP work is proceeding as planned.

The virtual meeting will start with general introductions and a review of the meeting agenda.

Our contracting teams will present an overview of their work: Personnel from FPM Remediations, Inc. (FPM), and Jacobs will give highlights of the Optimized Remediation Contract, and Sustainment Restoration Services, LLC, a part of the Oneida ESC Group (Oneida Team), will provide an update on the PFAS Contract. Aqueous Film Forming Foam (AFFF) is the main source of PFAS contamination at Travis AFB. It was used for decades to extinguish training fires and in response to actual aircraft fires.

Representatives from the U.S. Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and the San Francisco Bay Area Regional Water Quality Control Board (Water Board) will provide Travis AFB ERP regulatory updates and other topics of interest. The RAB meeting will conclude with a public question and answer session on any aspect of our ERP.

Travis AFB Virtual RAB Meeting

Thursday, April 21, 2022; 7:00 p.m. local time

Presentations include:

- ERP Program Updates
- Optimized Remediation Contract Overview
- Phase I AFFF Remedial Investigation Overview
- Regulatory Agency Reports

Please RSVP by emailing enviropa@us.af.mil before April 11, 2022.

If you are interested in attending the April 21, 2022, virtual RAB meeting, please email enviropa@us.af.mil before April 11, 2022. Additional details on how to attend the meeting will be provided to you prior to the meeting. *Please note: We will not share your contact information; all Personal Identifiable Information is protected under Federal Privacy Act regulations and will be treated as confidential.*

For more information or to request special accommodations, please contact Travis AFB ERP project staff at (707) 424-7520 or enviropa@us.af.mil.

We look forward to "seeing" you online in April!

Washboard Bioreactor Technology Demonstration

In December 2016, Travis AFB initiated a test of a washboard bioreactor at a groundwater site (Site SD034) contaminated by Stoddard solvent. Stoddard solvent is a petroleum-based mixture, commonly known as mineral spirits, used as a cleaning/degreasing solvent and in paints, lacquers, and varnishes. When Stoddard solvent is released to the environment and infiltrates into the ground, some of it will adhere to the soil particles in the zone above the water table. If enough is released, the Stoddard solvent will reach the groundwater table, where it will float because it is a petroleum-based chemical and less dense than water. Due to wet and dry season groundwater table fluctuations, Stoddard solvent contamination can smear in soil near the water table.

Under natural conditions, commonly occurring microbes break down petroleum-based contaminants including Stoddard solvent unless insufficient oxygen is available and the process stops. The washboard bioreactor functions as an oxygen source and facilitates natural biodegradation.

The washboard bioreactor was constructed by removing site contaminated soil for offsite disposal and backfilling the excavation with gravel as illustrated in **Figures 1, 2, and 3**. Contaminated groundwater is extracted, pumped into the washboard bioreactor, and returned to the groundwater plume with dissolved amendments to support the desired microbial population. Replenishment of amendments allows the desired microbial population to thrive and biodegrade the Stoddard solvent. For this location, Nutrimens brand vitamin amino acid substrate amendments are used. To sustain the oxygen-rich conditions, calcium peroxide is also added to the washboard bioreactor, releasing oxygen as it dissolves. Additional oxygen is added to the system with an in situ Submerged Oxygen Curtain (iSOC). Several iSOCs are installed in wells near the bioreactor to maintain elevated oxygen levels in groundwater and facilitate biodegradation.

To enhance remediation of contamination in the water table smear zone, an additional component using two sets of extraction wells is included in the Travis AFB washboard bioreactor. Oxygen enriched groundwater is extracted from one set of extraction wells, which lowers the nearby water table. Simultaneously, the water table near the bioreactor and the inactive wells rises. After a few days of pumping, the first set of extraction wells are shut down, allowing the water table to recover. The second set of extraction wells are turned on, lowering the water table in the second extraction area. Alternate pumping between the two sets of wells results in an up-and-down movement of the water table around the bioreactor, creating the washboard effect that supports cleaning up the smear zone, as illustrated in **Figures 4 and 5**.

Operation of the washboard bioreactor started in December 2016, with 99 percent reduction of Stoddard solvent groundwater contamination at the site. In addition, the washboard effect flushed out previously undiscovered Stoddard solvent from

beneath a nearby hangar building. Continued operation of the washboard bioreactor will reduce the overall projected cleanup time for this site by decades. Due to demonstrated positive test results, Travis AFB plans to formally incorporate the washboard bioreactor into the groundwater remedy at this site through an amendment to the Groundwater Record of Decision (ROD). Community input on the proposed change to the groundwater remedy will be solicited during the ROD amendment process.



Figure 1: Washboard bioreactor excavation.
Photo Credit: Jacobs



Figure 2: Backfilling the excavation with a mixture of gravel and amendments.
Photo Credit: Jacobs



Figure 3: Post-construction view.
Photo Credit: Jacobs

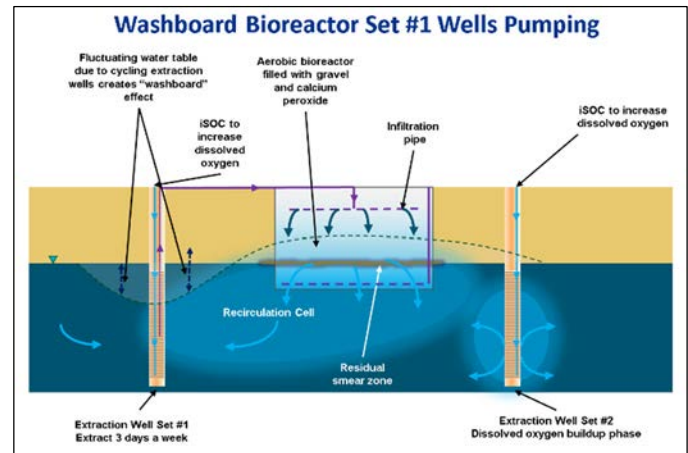


Figure 4: Washboard bioreactor schematic with pumping from Set #1. The groundwater table is lowered near the operational extraction wells (Set #1) and elevated around the bioreactor and Set #2 wells. Oxygen-rich water is distributed through bioreactor to the treatment zone.
Image Credit: Jacobs

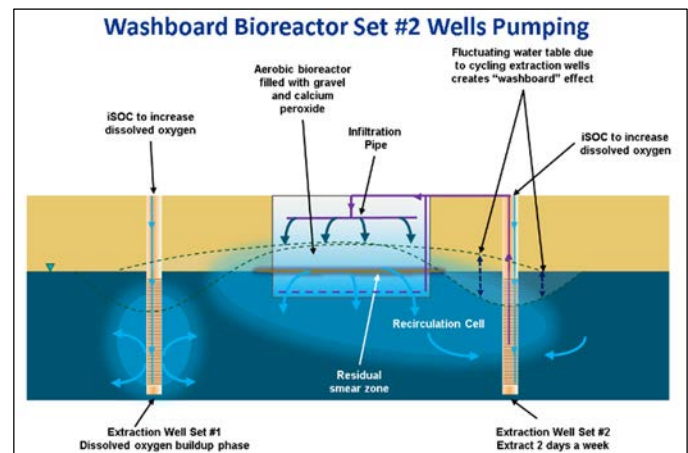


Figure 5: Washboard bioreactor schematic with pumping from Set #2. The groundwater table is lowered near the operational extraction wells (Set #2) and elevated around the bioreactor and Set #1 wells. Oxygen-rich water is distributed through the bioreactor to the treatment zone.
Image Credit: Jacobs

Per- and Polyfluoroalkyl Substances (PFAS) Treatability Study at Travis Air Force Base

In September 2021, the Air Force Civil Engineer Center (AFCEC) awarded a Basic Agency Agreement to AECOM Technical Services, Inc. (AECOM) to perform research addressing PFAS contamination, which presents a legacy groundwater concern at many U.S. Department of Defense sites. PFAS are a class of thousands of different fluorinated organic chemicals, including some found in firefighting foams used at military and municipal airports, including Travis AFB. Many PFAS compounds are very difficult to destroy. Some PFAS pose potential concerns for human health and the environment. The U.S. Department of Defense is actively funding research into how to address PFAS legacy concerns.

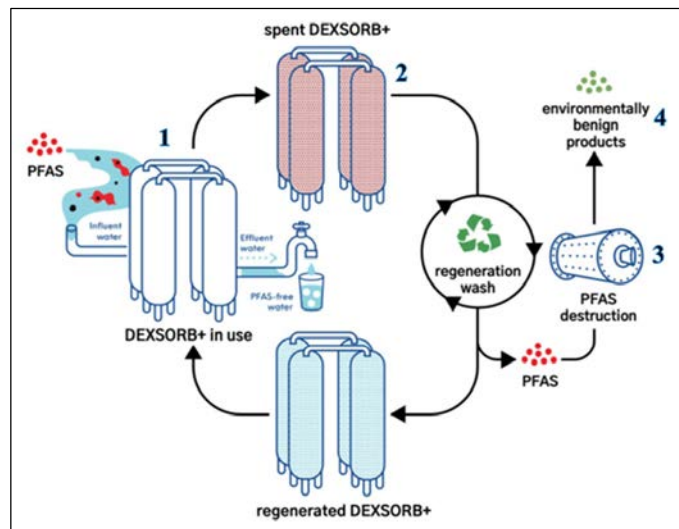
AFCEC selected Travis AFB as the preferred location for AECOM's groundwater treatment demonstration project. Known concentrations of PFAS are present in groundwater treated at the South Base Boundary Groundwater Treatment Plant resulting in generation of PFAS-contaminated granular activated carbon (GAC) that requires management as a hazardous waste

with treatment technologies that are currently impracticable and cost prohibitive.

The purpose of the research to be conducted at Travis AFB is removal and destruction of PFAS from groundwater prior to GAC treatment to prevent production of PFAS-contaminated GAC. Removal is accomplished with DEXSORB®, a renewable product derived from corn starch. Destruction of the removed PFAS occurs as a result of AECOM's DE-FLUORO™ process utilizing chemical reduction and oxidation reactions.

The DEXSORB® system will be installed in April 2022 and operate until September 2022. The DE-FLUORO™ system will be integrated and operated through October 2022.

The overall goal is to demonstrate PFAS can be removed from groundwater and destroyed onsite, resulting in limited to no waste products. Results of the research will provide valuable PFAS removal and destruction data, support accurate PFAS groundwater treatment cost estimates, and improve overall PFAS treatment efficiency as a benefit for Travis AFB, U.S. Air Force, and other stakeholders. Ideally, the demonstration project will result in the first onsite validation of a zero-waste operation.



Schematic of the overall process approach to couple DEXSORB® and DE-FLUORO™ treatment technologies. Numbers indicate the steps of the process.
Image Credit: Cyclopure



Computer-generated model of the DEXSORB® skid system (left) and pilot-scale vessels for the DEXSORB® media (right).
Image Credit: Cyclopure



Trailer of a full-scale DE-FLUORO™ system ready to be deployed for onsite treatment of PFAS.

Photo Credit: AECOM

Phase I AFFF Remedial Investigation Update – Fieldwork Coordination

The Phase I Remedial Investigation for AFFF areas at Travis AFB, initially discussed in the January 2022 *Guardian*, is proceeding. The Project Team includes the Oneida Team, AFCEC, U.S. Army Corps of Engineers, EPA, DTSC, and Water Board representatives. Initial data and current site conditions are under evaluation to prepare for the second field event, planned for May/June 2022. Field activities include installing groundwater monitoring wells and collecting additional soil, groundwater, surface water, and sediment samples to complement existing data. The Project Team, with participation from our regulatory stakeholders, is in the process of identifying optimal sample locations for site characterization.

Once the additional monitoring wells and sample locations are determined, field tasks will be initiated. Proactive coordination with Travis AFB for access to areas near the flightline, buildings, other mission-critical areas, and off-base property parcels is a priority. On a parallel track, the Project Team will collaborate with natural resource specialists and project biologists to assess planned work and to coordinate conservation measures for work in sensitive areas such as California tiger salamander habitat. The Oneida Team will also continue to coordinate equipment and project support services to include drilling rigs, sampling equipment and services, and waste management throughout fieldwork phase.

Updates on the Phase I AFFF Remedial Investigation progress will be presented during RAB meetings and in future *Guardian* newsletters.



California tiger salamander (*Ambystoma californiense*)
Photo Credit: John Cleckler / U.S. Fish and Wildlife Service

Restoration Advisory Board Tours and Meetings

Community members are cordially invited to attend the public RAB meetings and tours. **The next RAB meeting will be an online virtual meeting, scheduled for April 21, 2022,** at 7:00 p.m. If you are interested in attending, please email us at enviropa@us.af.mil **before April 11, 2022,** and let us know. Virtual meeting attendance details will be provided by email for those who RSVP prior to the meeting.

If you are interested in finding out more about the Travis AFB RAB, wish to be included on the email mailing list, or want to inquire about becoming a RAB member, let us know:

enviropa@us.af.mil

(707) 424-7520

For more information about Travis AFB's Environmental Restoration Program, please contact us:

Remedial Program Manager
(707) 424-2812

Public Affairs Officer
(707) 424-5743

Or visit:

<https://www.travis.af.mil/Information/Environment/>