



# Guardian

America's ~~First~~ Choice for Environmental Restoration

A Publication of the Environmental Restoration Program

Travis Air Force Base, California

October 2017

*Award-Winning*

## INSIDE

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### Editor's Corner

*Nine months have past since Travis AFB won the General Thomas D. White Award for Environmental Restoration, the highest honor that the Air Force can bestow on a restoration program (the General's photo is shown above). As enjoyable as it is to reflect on the many accomplishments that helped us to win this prestigious award, we cannot help but notice the dust collecting on the trophy or the deflated balloons on the floor.*

*So, the party is almost over, and it is time to refocus on our basic mission, the cleanup of contaminated soil and groundwater. This quarter, we describe a new way to clean up fuel contaminants that is different from the one shown in the January 2017 Guardian.*



Photo by Roberto Vanegas (CH2M)

**Pouring in the Peroxide:** Heavy equipment operators place a mixture of gravel and calcium peroxide into a trench, forming a subsurface biogeochemical reactor (SBGR). The calcium peroxide will release oxygen that promotes the microbial breakdown of petroleum in the soil and groundwater.

## The Washboard Test

An Innovative Approach to Speed up Petroleum Cleanup

**By Glenn Anderson**  
Travis Environmental Project Manager

Before the days of electric clothes washers, a common tool to scrub clothes by hand until they were clean was the washboard. It consisted of a four-sided wooden frame with a series of wooden or metal ridges in the center to rub the clothes on.

Washboards are still used in some parts of the world. The clothes are soaked in a tub or sink with soapy water to start the cleaning process. Then, they are rubbed up and down

the ridges to force the soapy solution through the cloth to remove the dirt. Clothes are then rinsed and hung up to dry.

Repetitive motion of the clothes over the same surface is what makes the washboard so effective, and environmental scientists have found innovative ways to apply the repetition concept to groundwater cleanup actions. Over the last five years, Travis AFB has tested this concept by setting up groundwater recirculation systems across solvent plumes. The idea of recirculation is to repetitively move the chemicals that break down solvents

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Visit our Environmental Program web site at <http://www.travis.af.mil/About-Us/Environment>



Travis Air Force Base, California

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# One Score and 14 Years Ago

Recently, I participated in a unique and exceptionally rewarding training opportunity. Offered by the Lincoln Leadership Institute at Gettysburg Pennsylvania, this three-day event presented lessons in leadership from the bloodiest battle of the American Civil War.

Learning about this interesting turning point in the history of this war and our country was a fascinating experience. Rather than sitting in a classroom all day and taking tests, I and about 80 students walked the hallowed grounds of the Gettysburg National Military Park and heard about the decisions made during that three-day battle from military historians, retired generals, a retired Navy command master chief, and leadership professionals.

Most people remember the basics of this battle: the Army of the Potomac under Major General George Meade defeated attacks by the Army of Northern Virginia under General Robert E. Lee, which stopped the Confederate advance on the North. However, there are countless stories of heroism, sacrifice, and decision-making under harsh conditions that provide teachable moments for future leaders.

There is not enough space in this Viewpoint to summarize all of the great stories from this brutal battle, but I walked away with three useable lessons learned that can be applied to our 34-year-old restoration program:

1) Good decisions still need good people to carry them out. Historians have pointed toward the performance of several of Lee's generals in the field to explain the Confederate loss. As a program manager, I rely on my project managers as well as contractor support staff and field technicians to carry out cleanup decisions. The best cleanup strategy is worthless if the field crew cannot install a well properly. Fortunately,



## VIEWPOINT

Lonnie A. Duke  
 Travis AFB Restoration  
 Program Manager

Travis AFB has a great team of experienced environmental professionals that makes the most of our available resources to get the job done right the first time.

2) Bad or the lack of information leads to bad decisions. The Civil War was fought at a time when the cavalry was the eyes of the army. Without valuable information brought back on horseback, the army was blind and vulnerable. At one point, General Lee's cavalry general, J.E.B. Stuart, took his three best brigades on a path away from the army, depriving Lee of intelligence and resulting in premature engagements with Union forces. In my world, all decisions are based on limited data, so we follow strict procedures to ensure the availability of the high quality data needed to make the best decisions possible.

3) Finally, winning a war takes a long time to achieve. The Battle of Gettysburg lasted only three days in a war that lasted 4 years, 3 weeks and 6 days. Similarly, even though we have achieved great results with our new cleanup technologies and proper funds and manpower management, it will be a long time before the base can claim victory over the remaining soil and groundwater contamination.

It is one thing to read about a battle; it is a much more enlightening experience to see what the troops in the field saw and understand the decisions that their leaders made. This was one of the best training courses of my career, and I hope to apply the course material to our restoration program and any future leadership opportunities that

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## Dashboard

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through the same contaminated area to promote chemical distribution which improves cleanup efficiency.

So far, the early results of these recirculation tests have been promising, but it still takes time for a drop of water to be injected into the subsurface, flow across a plume, be extracted out of the subsurface, and return through a pipe to its original starting point. An improved method of distributing the chemicals that clean up contamination could offer significant advantages over a recirculation method.

The environmental scientists at Travis AFB may have found that improved method that relies on the washboard approach. Known as an “aerobic washboard bioreactor”, this approach builds on bioreactor (also known as sub-grade biogeochemical reactor or SBGR) technology to create a large active treatment zone. The January 2009 edition of the Guardian described the construction of

the first Travis bioreactor and the way that it works. In summary, it creates the groundwater conditions that allow microbes to break down contaminants into harmless compounds. It looks like an underground percolator with a gravel mixture instead of coffee grounds.

Travis AFB is testing the washboard bioreactor approach at a groundwater site that is contaminated with Stoddard solvent. Stoddard solvent is a petroleum-based mixture of single-chain hydrocarbons; it is commonly known as mineral spirits and is used as a cleaning/degreasing solvent and a solvent in paints, lacquers, and varnishes.

Households use Stoddard solvent to clean used paint brushes, as a starter fluid for charcoal grills, and to clean auto parts and tools. Because it is petroleum-based, it floats on the surface of the water table and sticks to soil particles in a zone where the water table rises during the rainy winter season and falls during the dry summer season.

Under natural conditions, microbes find it easy to break down Stoddard solvent until they run out of oxygen, then the breakdown process stops. To be an effective cleanup technology, the washboard

can enter the water and be used by the microbes. The combination of chemically and physically generated oxygen sources keeps the solvent breakdown process at a high level.

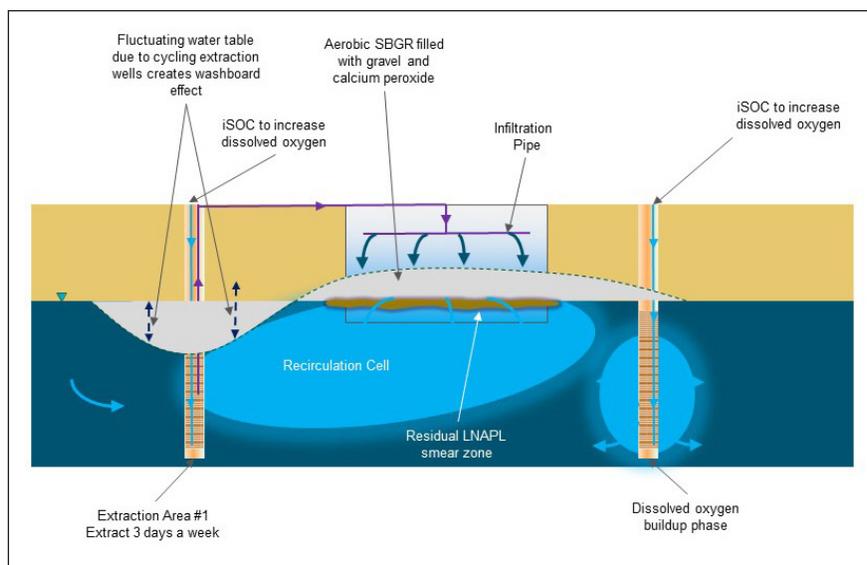
“It is too early to tell if this innovative approach to petroleum cleanup is working as designed,” said Mr. Lonnie Duke, Travis AFB Restoration Program Manager. “If this bioreactor can work at this challenging site, it will work almost anywhere on the base.”

By now, a reader may wonder where the washboard concept fits into this technology. When the system is started, oxygen-rich groundwater is extracted from one set of wells (Set #1). This lowers the top of the water table around those wells. This water is pumped into the bioreactor, which raises the water table around it and the inactive wells (Set #2). Then, the Set #1 wells are shut off (raising the water table) and the Set #2 wells are

turned on (lowering the water table). The constant flow of oxygen-rich water into the bioreactor forces water out into the subsurface and increases the treatment zone. The alternating pumping from the two sets of wells creates an up-and-down movement of the water table, or a “washboard” effect, that helps to clean up contaminated soil above the water table.

“We will run this bioreactor for the next two to three years,” said Mr. Duke. “At the end of the test, we will compare its performance to its cost and see if this washboard approach to cleanup is worth keeping.”

isOC to increase dissolved oxygen



**Scrubber Schematic:** Oxygen is delivered to contaminated groundwater through the SBGR and extraction wells. By alternating the extraction of groundwater between wells, the oxygen-rich water is moved from side to side, creating a washboard effect.

bioreactor provides a steady flow of oxygen into the treatment zone to keep the breakdown process going.

How does the washboard bioreactor work? During the bioreactor construction, a harmless chemical that generates a lot of oxygen (calcium peroxide) is mixed in with the gravel. This gives the microbes a quick oxygen boost. Then, the bioreactor is surrounded by a network of extraction wells with each well containing an oxygen delivery device known as an in situ Submerged Oxygen Curtain (iSOC). The iSOC releases oxygen in the form of tiny bubbles; the smaller the bubble, the greater the amount of oxygen that



# Gettysburg

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may present themselves. Also, this course introduced me to base civil engineers, fire chiefs, and many other Air Force personnel in leadership positions. You never know when one of these folks may help us one day in carrying out the Air Force mission. All in all, this was a great opportunity and I'm glad I was able to participate.

To learn more about the Lincoln Leadership program, go to <https://www.gettysburgleadership.com/>.

## Quick Note: Travis AFB Restoration Advisory Board Base Tour

October 19, 2017



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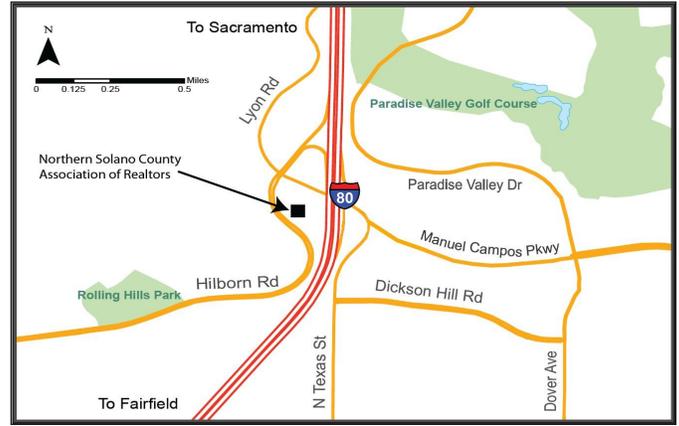


*If you have any questions or would like more information about the RAB tour, please contact Lonnie Duke, (707) 424-7520.*

## Travis AFB Restoration Advisory Board Meeting

April 19, 2018  
7 p.m.

Northern Solano County  
Association of Realtors  
3690 Hilborn Road  
Fairfield, CA



### LOCATION OF INFORMATION REPOSITORIES

**Vacaville Public Library**  
1020 Ulatis Drive  
Vacaville, CA 95688

(707) 449-6290

**Monday-Thursday:** 10 a.m. - 9 p.m.  
**Friday-Saturday:** 10 a.m. - 5 p.m.  
**Sunday:** 1 p.m. - 5 p.m.

**Fairfield-Suisun Com. Library**  
1150 Kentucky Street  
Fairfield, CA 94533

(707) 421-6500

**Monday-Thursday:** 10 a.m. - 9 p.m.  
**Friday-Saturday:** 10 a.m. - 5 p.m.  
**Sunday:** 1 p.m. - 5 p.m.

**Mitchell Memorial Library**  
510 Travis Boulevard  
Travis AFB, CA 94535

(707) 424-3279

**Monday-Thursday:** 10 a.m. - 9 p.m.  
**Friday:** Closed  
**Saturday:** 12 p.m. - 6 p.m.  
**Sunday:** 12 p.m. - 6 p.m.



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