How Travis AFB Transformed its Cleanup Program into an Award Winning Green Sustainable Remediation Program

28 June 2018
Program History

• Travis AFB created its Environmental Restoration Program (ERP) in the early 1980’s and was placed on the NPL in 1989.

• Interim RODs in the late 1990’s allowed pump-and-treat operations to begin at several groundwater sites.
Program History

• Several Ground Water Treatment Plants (GWTPs) were built in the late 1990’s and early 2000’s.

• These GWTPs used various treatment technologies such as UV-Oxidation, Air Strippers and Granular Activated Carbon.
Program History

• At the Central GWTP, a Thermal Oxidation Unit that burned natural gas was set up to treat solvents in soil gas.

• These technologies were effective but expensive to maintain and very energy intensive.
Program History

• The ERP staff have always been interested in trying out new ways of cleaning up the environment, for example:

  ❖ Phytoremediation-1999
  ❖ Columnar Wall Jet Gouting-1999
  ❖ Vegetable Oil Injections-2000
  ❖ Solar Pump and Treat-2004
  ❖ Subgrade Biogeochemical Reactors-2008
  ❖ Gravel Chimneys-2015

Travis Air Force Base
Environmental Restoration Program
http://www.travis.af.mil/About-Us/Environment
A New Beginning

• In 2008, I took over as the Project Manager for the Ground Water Treatment Plants.

• It was at this time that the EPA Primer titled “Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites” was published.
A New Beginning

• Everything I read in the primer made sense.
• With this new knowledge, I checked out the O&M of our GWTPs and realized that energy usage was not being tracked or reported.
• I started reading the electrical and gas meters monthly.
A New Beginning

• Using a Dept. of Energy electricity to CO$_2$ equivalency conversion, I began reporting energy usage and CO$_2$ production at the monthly RPM meeting.

• As a result of this reporting, the decision was made by all parties to shut down a GWTP that was creating tons of CO$_2$ annually but only removed $\frac{1}{2}$ lb. of contamination in an entire year!
ASTM Greener Cleanups Documentation

• Travis AFB was the first DoD installation to complete the ASTM Greener Cleanups self-declaration process
  – Develop best management practices
  – Implement greener cleanups project(s)
  – Document results and post to administrative record
Core Elements of Greener Cleanups

• Minimize total energy use and maximize use of renewable energy
• Minimize water use and impacts to water resources
• Reduce, reuse, and recycle material and waste
• Protect land and ecosystems
Putting GSR into Practice

- We hold monthly team meetings to track remediation progress
  - Identify optimization opportunities
  - Foster innovative concepts
  - Develop green and sustainable best management practices
  - Work as a team to turn our ideas into optimization actions or technology demonstrations
Putting GSR into Practice

• When properly implemented, Green and Sustainable Remediation (GSR) goes hand-in-hand with accelerating cleanup timeframes and reducing costs.

• Passive or solar-powered systems, such as subgrade biogeochemical reactors (SBGRs), meet these objectives.
SBGR

Subgrade Biogeochemical Reactor (SBGR) is filled with gravel and in-situ treatment amendments (site-specific and based on contaminant)

- Extraction Well
- Amendment Injection Well (Optional)
- Amendment Recirculation Cell

Excavation/Backfill

Infiltration Pipe Installation
SGBR

Site DP039

Starting TCE = 8,000 µg/L

Site SS016

Starting TCE = 182,000 µg/L

SBGRs replaced dual-phase extraction systems

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SGBR

Graphs show performance from wells within aquifer, between SBGR and extraction well.

<table>
<thead>
<tr>
<th>Site</th>
<th>CVOC Total Molar Concentration Reductions in Groundwater</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Inside SBGR</td>
</tr>
<tr>
<td>DP039 (left)</td>
<td>96-98%</td>
</tr>
<tr>
<td>SS016 (right)</td>
<td>99%</td>
</tr>
</tbody>
</table>

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Site SS014 Technology Demonstration

• Subgrade biogeochemical reactor (SBGR) for remediation of fuel contamination
  – Drywall as a safe and sustainable source of sulfate
Initial Source Area Reductions (12 Months)

- TPH-G: 1,900 ug/L to ND (99%)
- TPH-D: 5,500 to 190 J ug/L (97%)
- Benzene: 74.5 ug/L to ND (99%)
- Electricity and GHG reduction
  - ~9,000 kWh/year
  - ~3 tons CO$_2$/year
Aerobic SBGR Technology Demonstration

- Incorporated several aerobic processes to treat Stoddard solvent hydrocarbon source area and plume
- Adjacent to large hanger with complicated utilities
Aerobic SBGR Technology Demonstration

- Extensive Utilities
- SBGR Trench
- EX Well
- Groundwater Flow

TPH-D = 1,000 μg/L
TPH-D = 100 μg/L

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Initial Source Area Reductions (12 Months)

• TPH-D: 9,600 to 120 J ug/L (99%)
• TPH-O: 2,300 to 65 J ug/L (97%)
• Electricity and GHG reduction
  – ~38,000 kWh/year
  – ~14 tons CO₂/year
Green and Sustainable Results

• Annual electricity reduction of ~790,000 kWh/yr
  – Equivalent to annual consumption of ~120 CA homes
  – Saved over $50,000/year in electrical costs

• Greenhouse gas reduction of ~930 tons per year
  – Equivalent to annual emissions of ~200 cars

• Use of non-refined, recycled, or waste materials
  – Avoid impacts from manufacturing new materials
  – Used fast food fryer oil, recycled drywall, bark mulch, straw, repurposed pump and treat system components

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Solar Pump and Treat

- LF007C solar system reduction ~158,000 kWh/year
  ~59 tons CO$_2$/year
- ST018 solar system reduction ~35,000 kWh/year
  ~13 tons CO$_2$/year
Phytoremediation System

- Phytoremediation of TCE included in Groundwater Record of Decision
- Trees must be maintained, even during periods of drought
- Solar-powered recirculation system supports heath of trees and increases residence time of treatment
Literature Related to Travis AFB Work

- SERDP/ESTCP Environmental Restoration Wiki
  - http://www.environmentalrestoration.wiki (and then click on SBGR) or Google “SBGR ER Wiki”


- “Travis Air Force Base: A Greener Cleanups Case Study” in Remediation Journal
California Air Force Bases. Leading the Way Using GSR!

Dept. of Defense Environmental Restoration Award for Installations

- 2016 Beale AFB, Ca
- 2017 Travis AFB, CA
- 2018 Vandenberg AFB, CA
California Tiger Salamander

Thank you for participating!