

Case Study: Luke Air Force Base Bioremediation

Bioremediation Transition

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ABSTRACT

The purpose of this report is to provide Luke Air Force Base with documentation on best practices for water remediation. Luke Air Force Base is currently maintaining their own oil and water separation rather than the old pump and treat process. The authors offer documentation of the transition process and a listing of locally based potential converts.

Table of Contents

Background:	3
Brief Review of Bioremediation Technology	3
Historical Luke process.....	3
Methodology	4
Implementation	4
Results/ Evidence	4
Costs	4
Savings	5
Next Steps/Conclusion	5
Works Cited	6

Background:

Waste water is treated through many different methods. Waste water can come from street runoff, vehicle repair, or restaurants. Water that has been contaminated with oil and grease can be treated with oil and water separators. Briefly, oil and water separators are holding tanks where oil rises to the surface, water flows in between, and solids settle at the bottom.

There are different designs of oil and water separators. A standard design is the baffle oil and water separator. This design includes a tank located between drains and sewer pipes. (Fact Sheet, 2010) Oil and water separators can be costly due to their high maintenance. (Oil/ Water Separators, 1999) Oil and water separators are not meant for contaminants other than oils. Some issues with oil and water separators are: other contaminants other than oils run into the holding tanks, sludge tends to build up, and oil from the surface overflows. (Oil/ Water Separators, 1999)

Brief Review of Bioremediation Technology

Bioremediation is the use of microbes, such as bacteria, to clean up contaminated water. (A Citizen's Guide to Bioremediation, 2012) Contaminated water throughout this report refers to water contaminated with substances such as oil. Microbes use contaminants as a source of food and converts them into water and harmless gases. A Citizen's Guide to Bioremediation, 2012) Contaminated water is pumped into tanks and mixed with microbes. Once the water is treated, it can go back into groundwater or sent to a municipal wastewater system. (A Citizen's Guide to Bioremediation, 2012)

Bioremediation has been studied since the late 1940s. (Bioremediation Methods for Oil Spills, n.d.) This process began with the research period where bioremediation was referred to as weathering. (Bioremediation Methods for Oil Spills, n.d.) Weathering is the process of the chemical breakdown of the oil molecules. (Bioremediation Methods for Oil Spills, n.d.) After years of research, bioremediation gained significant attention, but later ran into issues. Some of the issues came from the design flaws within the process. After addressing these issues, bioremediation has become more widely accepted across the world. Some of these cases include: Amoco Cadiz, Exxon Valdez, Mega Borg, etc. (Bioremediation Methods for Oil Spills, n.d.) Bioremediation has also been used in local water treatment, such as in Luke Air Force Base.

Historical Luke process

Luke Air Force Base previously used a traditional method for waste water treatment called pump and treat. Through the pump and treat method, LAFB had a third party company come in pump the contaminated water from their holding tanks and transport the contaminated water to a water treatment facility. The

pump and treat method incurs high operating costs when pumping and transporting contaminated water, maintaining infrastructure (holding tanks and pipes), and various overhead needed. These cost will later be discuss in detail.

Methodology

This report will provide documentation on best practices/ methods used by Luke Air Force Base. Methods documented are based on research and documentation provided by Luke Air Force Base.

Implementation

Since the transition of water treatment methods at Luke Air Force Base, they have saved financially and have implemented a more efficient method on base. As mentioned before Luke Air Force Base has transitioned from a Pump and Treat method to bioremediation. Their waste water treatment implementation will now be described.

LAFB has 5 gallon buckets of bacteria located at drains. These buckets are at drains located at restaurants. The bacteria not only expedites oil and water separation but also helps maintain the drains and pipes. This helps reduce the cost of maintenance. There are two types of bacteria, one is used to break down grease and the second one is used to break down oil.

Waste water travels from the drains to a waste water holding tank. Waste water is held at the holdings for roughly five weeks. Five weeks is how long it takes for the bacteria to clear out the contaminated water. Like mentioned before, there are two types of bacteria for different types of contaminants, meaning that there is separate water holding tanks as well. LAFB has a smaller tank connected to where planes are maintenance.

Once waste water is treated by bacteria, it goes to LAFB water management facility. Once at the water management facility, it is further treated to be redistributed back to LAFB. LAFB method of bioremediation is a closed circle cycle, making it efficient and sustainable. Pumping and transporting of water and maintenance has been reduces significantly in a matter of a year. Cost and savings will be described next.

Results/ Evidence

Costs

Pump and Treat facilities were contacted for pricing. One of the facilities charges 10 to 25 cents per gallon if you are a client on a regular basis. If an emergency pumping is needed, then an additional 75 dollar per hour is charged. A second facility charges a rate based on the contaminants of the water. For example, they

charge 65 cents per gallons for pumping water from a car wash facility. An auto shop facility, which has oils and other high pH level contaminants have a charge of 85 cents to a dollar per gallon. It is more costly to pump and maintenance waste water tanks from auto shops than car wash facilities due to the contaminants and build up to causes to the tanks.

Luke Air Force Base has roughly 35 buildings that needed pumping. For the whole course of 2012, there were 175,926 gallons pumped. The cost of pumping and tank maintenance was \$66,208.80. Man hours needed to maintain the infrastructure were 97.5, which is an additional \$3,866.85. The total cost of pumping and treating LAFB traditional pump and treat infrastructure was \$70,075.65.

Savings

As discussed, bioremediation is demonstrably efficient and supported by the cost savings. Gallons pumped in 2014 were reduced from 175,926 to 7,440 gallons. Associated man hours were reduced from 97.5 to 2.5 hours. The total cost to pump in 2014 was reduced to \$3,859.15. This is a total savings of 94% from 2013 to 2014. Calculations of total emission reduction from pumping trucks were outside the scope of this project and have not been analyzed or described.

Next Steps/Conclusion

Jeff and Luke Air Force Base have made a strong case for transitioning away from traditional pump and treat methods toward using bioremediation for the treatment of commercial wastewater. The first year documented a dramatic shift in maintenance requirements and produced a substantial cost savings. As supportive data continues to accumulate, they will be well positioned to capitalize on opportunities for converting local commercial users.

As part of the deliverables for this project, a contact list has been provided to Jeff and Luke Air Force Base. A dozen locations have been identified within five miles of the base that contain dense concentrations of potential bioremediation users. Contact information for nearly 70 businesses were collected and consolidated for LAFB use. The list could be used in conjunction with the infographic also developed for this project.

As bioremediation use spreads to businesses surrounding LAFB, a follow up study could be conducted to assess the emission reductions realized from diminished transport from pump and treat facilities.

Works Cited

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