Bioremediation of the oil/water trench

Summary and Need

The Building 776 Closure Project is one of the most challenging cleanup efforts at the Rocky Flats Environmental Technology Site due to its unique characteristics. Rich in history, the former nuclear building played a major role in manufacturing of plutonium weapons components and waste processing until the 1969 fire. Room 150 in Building 776 contained several compressor and chiller units supporting the facility. These units leaked oil and water into a trench over several years. The oily residues were located in a small trench, 1-foot wide, 1-foot to 4-feet deep, 100 feet long. The trench was not in a radioactivity-controlled area, even though the concrete at the bottom of the trench was suspected to be impacted by plutonium and americium. Removal of the oil by manual methods invoked ALARA concerns. DOE Office of Science and Technology monies were used to support the testing of an off-the-shelf bioremediation product (EcoSolve) used to remove the oily sludges within the trench.

The Technology

A commercially available biodegradation reagent was purchased from EcoSolve. It is comprised of naturally occurring bacteria that was enhanced to metabolize oil products. After placing the product in the target location, a small aquarium pump is used to circulate the water and provide aeration. The recirculated water activates the conversion process, changing the oily water to carbon monoxide and water, resulting in a significant reduction of waste.

The Demonstration

With limited workspace and potential for radiological contamination, Room 150 in Building 776 was the ideal location to test the EcoSolve bioremediation product. The initial performance of the bioremediation product was promising. The observable oil was initially reduced as follows:

- Free floating oil, in its areal extent by approximately 75 percent
- Free floating oil, in its thickness by approximately 25 percent
- Settled oily sludge, in its thickness by approximately 75 percent
- Settled oily sludge, in its visual appearance from black to gray

Biodegradation rates of the free phase oils were from one to five gallons per week over the entire trench. Rates increased as temperature and aeration rose.

Operating compressors within Room 150 use pentaerythritol glycol as a coolant. These systems began to leak glycol while the bioremediation effort was ongoing. As a result, glycol leakage into the trench from these systems progressively increased throughout the life of the project until free floating glycols eventually covered almost 75 percent of the trench's length.

Fresh glycol discharges into the trench eventually overwhelmed the biodegradation rate although evidence of biological activity was observed through the life of the test. Operations were terminated when the source of the glycol was identified. Since the building's demolition schedule did not allow repair or replacement of the compressor but rather temporary operation in a leaking condition, the biodegradation evolution was terminated and oils were allowed to re-accumulate.

The Results and Benefits

It was demonstrated that biodegradation of compressor glycols can be very cost-effectively achieved, minimizing the risk of exposure to radiological contamination.

Key to the success was continuous aeration (providing oxygen to the microbes), which was effected by an off-the-shelf aquarium pump purchased at a local hardware store. The project was not re-initiated because a recent state decision will allow demolition of the entire radiological contaminated building and there is now no need to decontaminate the trench area.

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