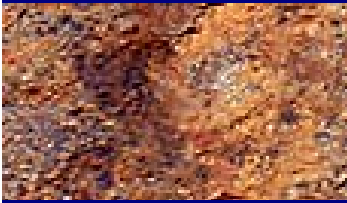


The benefit/cost analysis  
was performed in 1999



JTRP/INDOT RESEARCH PROGRAM

# Research Pays Off

## Bioremediation Treatability Studies for Soils Containing Herbicides, Chemicals, and Petroleum Products

Organic chemicals have long been used and stored at INDOT facilities. Because of spills and leakage, soil contamination may exist. To lessen the potential environmental problems arising from soil contamination due to hazardous pollutants, it is of importance to investigate cost-effective methods to remedy those contaminated soils and underground water.

Traditional site remediation and disposal methods simply transfer contaminated soils to a specific area such as a landfill, and are often prohibitively expensive. The method of bioremediation, however, can potentially be an effective, low cost and terminal solution for remediation of sites contaminated with organic pollutants, especially petroleum products. Instead of removing contaminated soils, bioremediation utilizes bio-

degradation processes to destroy contaminants, and transforms pollutants into harmless products such as CO<sub>2</sub> and H<sub>2</sub>O.

This study was initiated in 1994, and completed in 1996. The primary emphasis was to determine the feasibility of bioremediation as a treatment option for contaminated soils at INDOT facilities. Soil samples were taken from typical contaminated sites and laboratory tests were performed to characterize the type and level of contamination and the presence of indigenous pollutant degrading microorganisms. Also, in-situ tests were conducted to investigate in-situ bioremediation and determine the extent to which oxygen and nutrients additions are required to promote biodegradation.

### Research Findings and Implementation

Based on this study, it was found that bioremediation is a potentially suitable method for the remediation of petroleum contaminated soils at INDOT facilities. All soils tested had large populations of heterotrophic bacteria, a commonly used predictor of biodegradation potential. Benzoate was used as a substrate to estimate biodegradation potential as well. All INDOT soils were also found to contain large populations of benzoate degraders. This would suggest that microorganisms in these soils could

also degrade toluene.

The bioremediation method has been implemented for several field projects to degrade organic contaminants in soil and groundwater. The effectiveness of bioremediation under different site conditions is being studied. A guidance manual is being developed for INDOT to serve as "standard specifications" for the design, implementation, and monitoring of bioremediation projects.

## Benefits

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The benefits generated by this study are three-fold. First, it provides a final solution to remediate contaminated soils by degrading pollutants to harmless compounds, and can reduce the pollutant concentrations to an acceptable level. Secondly, bioremediation results in less exposure of INDOT workers and the local com-

munity to pollutants. Finally, bioremediation can reduce disturbance to the site and is less costly than traditional methods.

*Cost of  
Research  
\$40,000*

## Estimated Economic Value Over 20 Years At 5% Discount Rate

<b>Number of Facilities with leaks</b>	<b>Savings per Cubic Yard of Contaminated Soil</b>	<b>Annual Savings</b>	<b>Discounted Savings (20 years)</b>	<b>Benefit/Cost Ratio</b>
3500	\$30	\$10,500	\$130,853	33

Note: Assume that the average contaminated soil is 10 cubic yard per facility.

## Contacts

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