

PROGRESS REPORT



NUMERICAL SIMULATION FOR CONTAMINANT FLOW AND TRANSPORT IN SUBSURFACE

— A Study of Soil and Groundwater Contamination at
the Coleville Site



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April 2005

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EXECUTIVE SUMMARY

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CHARPTER ONE – Background

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CHARPTER TWO – Methodology for Subsurface Modeling

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CHARPTER THREE – Modeling Results for PHC Contamination of Soil

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CHARPTER FOUR – Modeling Results for BTEX Contamination of Soil

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CHARPTER FIVE – Modeling Results for BTEX Contamination of Groundwater

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CHARPTER SIX – Conclusions and Recommendations

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EXECUTIVE SUMMARY

The Coleville Site has been seriously contaminated by petroleum hydrocarbons including benzene, toluene, ethyl-benzene, and xylenes (BTEX). Previously, a number of investigation projects have been undertaken. However, insight of the site contamination, pollutant migration, biodegradation reactions, and interactions among different hydrocarbon phases is still unavailable. Many questions remain to be answered, such as:

- (1) What happened underground?
- (2) Are there specific impacts on the community?
- (3) What will happen in the future if we do not take any further remediation action?

Answers to the above questions will help decision makers to get insight into the current site situation. They will then know what they have to spend for, what they do not have to; how much they really have to spend, and how much is still uncertain. These will also be very helpful when they are discussing the problems (and the relevant decisions) with the local authorities.

A good decision will help to reduce a big amount of costs, while a not-so-good one may mean a number of consequences to the present and the future. For a complicated system, such as the site-contamination problem under consideration, this good decision should be based on good and thorough research efforts.

This project is to conduct a thorough study on the site through modeling approaches to answer the above questions. In detail, it consists of the following tasks:

- Modeling for the fate of petroleum contaminants (PHCs) in soil under various scenarios;
- Modeling of BTEX in both soil and groundwater under various scenarios.
- Providing necessary inputs for further environmental impact and risk assessments.
- Provide recommendations for future monitoring and remediation actions.

The element of modeling for the fate of petroleum contaminants transport in subsurface is the most challenging tasks in this study. A large-scale 3-D numerical simulation model is developed for the site to predict the contaminants transport fate in the subsurface.

This report consists of six chapters. Chapter 1 is an introduction of the project and the study site. Chapter 2 details the methodology of petroleum contaminants transport modeling, as well as formulation of the developed numerical models for the Coleville Site. Chapters 3, 4 and 5 present modeling results for predicting concentrations of (1) petroleum hydrocarbons (PHCs) in soil; (2) benzene, toluene, ethyl-benzene, and xylenes (BTEX) in soil; and (3) BTEX in groundwater, in different temporal and spatial units under given scenarios. Chapter 6 lists the summary of this project.

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