

Transport Behavior of Mercury (II) in Oak Ridge Reservation Soil

The Applied Research Center at Florida International University (ARC-FIU) is assisting the U.S. Department of Energy's (DOE) Oak Ridge Reservation (ORR) in developing solutions to mercury contamination in soil, sediment and water, including the incorporation of emerging technologies for the efficient management of mercury-contaminated materials. This task focused on laboratory tests to determine mercury transport parameters and adsorption/desorption (K_d) coefficients in ORR soil to support complex watershed model development via the use of experimentally determined input values.



Figure 1. Flow-through columns.

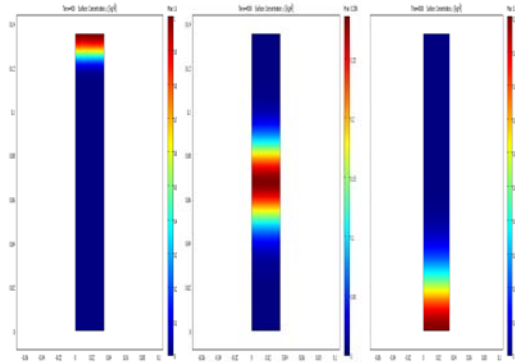


Figure 2. Comsol simulations for tracer test.

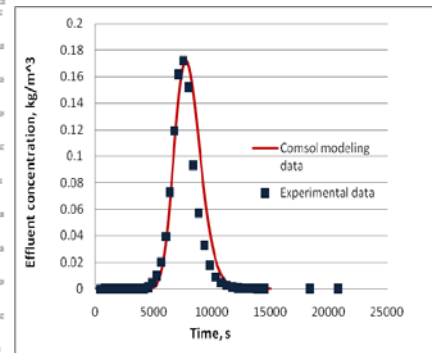


Figure 3. Tracer test results.

Project Objectives

- Conduct characterization of soil to be used in the batch and soil experiments.
- Determine mercury sorption/desorption parameters in batch tests. Evaluate the effect of temperature on Hg (II) adsorption.
- Determine axial dispersion parameters from soil column tracer tests. Determine Peclet's number and qualify the dispersion (large, intermediate, low).
- Conduct column flow-through experiments to determine the dispersion and retardation factors.
- Conduct flow-through sorption experiments to determine the sorption capacity of the soil and the retardation coefficient.
- Determine mercury leachability to assess possible impact on aquifer by using extraction fluids with pH 2.9 and 4.9 used in EPA method 1311 Toxicity Characteristic Leaching Procedures (TCLP).
- Conduct modeling of contaminant transport under constant flow conditions using Comsol multiphysics software supported by measurements obtained from the experimental study.

Project Benefits

- Simulation of Hg movement by advection, diffusion, dispersion and retardation by sorption. Better understanding of the transport factors affecting mercury mobility for more accurate estimates of fate and transport in the ORR hydrologic system.
- Use of actual mercury contaminated material from ORR, thus providing site-specific input values which enhance the model's accuracy and applicability.

Project Accomplishments

- Determined mercury transport parameters to better understand factors affecting mercury mobility in ORR contaminated soil.
- Simulated contaminant transport under constant flow conditions using measurements obtained in batch and column experiments.

