New clean-up project builds upon success gained in field

December 14 2006

A new five-year project headed by Oak Ridge National Laboratory is expected to lead to a more in-depth understanding of natural and other approaches to clean up contaminated sites around the nation.

The Department of Energy-funded $3 million per year task will build upon accomplishments since April 2000 at the Environmental Remediation Science Program Field Research Center, a 243-acre contaminated area in Bear Creek Valley next to the Oak Ridge Y-12 National Security Complex. This and many other sites in the United States are contaminated with legacy wastes that include radionuclides, organics and nitrate.

"Our goal is to more accurately determine the long-term fate of contaminants from waste sites around the country," said David Watson, manager of DOE's Field Research Center and a member of the Environmental Sciences Division. "Through this effort we will bring to bear experts from multiple universities and national laboratories to help solve a problem of great national significance."

Researchers from ORNL and elsewhere plan to develop numerical models that will allow them to predict the rate at which contaminant concentrations decrease through a combination of active remediation techniques and natural mechanisms such as dilution. Bioremediation, one of the remediation methods being tested, involves stimulating bacterial growth in the subsurface to clean up contaminants and may provide a more economical and effective approach than more conventional

methods.

Researchers will make chemical additions and pH adjustments to help develop new methods to stabilize contaminants in the subsurface. New state-of-the-art analysis techniques are being developed to monitor changes in microbial populations and geochemical properties. Changes in the subsurface are being monitored using geophysical methods that send electric, acoustic and other signals into the ground.

Nationwide, this DOE effort is expected to have a huge impact as subsurface contamination exists at more than 7,000 sites and involves an estimated 1.7 trillion gallons of contaminated water, which is equal to about four times the daily water consumption in the United States. In all, there are about 40 million cubic meters of contaminated soil, or enough dirt to fill approximately 17 professional sports stadiums.

The Y-12 site contains uranium, technetium, nitrate and other contaminants from the weapons manufacturing era from 1951 to 1983. These liquid wastes were disposed of in four ponds during that era. The pond area, which is 400-by-400 feet and 17 feet deep, was neutralized in 1984 and capped by an asphalt parking lot in 1988. As a result of these waste disposal activities, a large plume of contaminated groundwater extends several miles away from the ponds.

The area is constantly monitored using a variety of state-of-the-art techniques, including hydraulic testing, tracer tests and sampling.

"At no other field research facility is the investigation of the subsurface fate and transport of contaminants performed on such a large scale using a real-world contaminated site," Watson said.

Key conclusions from research projects at the site include:

microorganisms found in subsurface environments can transform radionuclides such as uranium, technetium and other contaminants like nitrate into chemical forms that are less mobile in groundwater;

- the introduction of naturally occurring humic substances – organic matter found in soil – can accelerate the chemical reduction and immobilization of these contaminants; and,
    - co-contaminants in the subsurface and elevated concentrations of other chemicals can inhibit the chemical reduction process and can reoxidize uranium, making it more mobile.

Watson and colleagues are confident that this new project will lead to new methods of site remediation and a fundamental scientific understanding of the long-term fate, transport and attenuation of contaminants in the environment as a function of space and time.

Source: Oak Ridge National Laboratory