Uranium contamination investigated to guide cleanup

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The U.S. Department of Energy, the Bechtel Hanford-led Environmental Restoration Contractor team and Montana-based MSE Technology Applications have worked together in developing a model to better understand how uranium moves through the soil and groundwater for Hanford cleanup.

A method of predicting the mobility of contaminants is being developed by the U.S. Department of Energy's Bechtel Hanford-led Environmental Restoration Contractor team and a Butte, Mont., firm called MSE Technology Applications. The objective of the project is to better understand how uranium moves through the soil to the groundwater beneath the Hanford Site.

Uranium and other substances were separated from irradiated nuclear fuel during the nearly 50 years of defense production at the Hanford Site. Waste from the processing activities in the 200 West Area, near the center of the site, was discharged using standard practices of the time. Some of the contaminants in the waste have migrated through the surrounding soil and groundwater.

Uranium is one of the elements that has contaminated the groundwater in 200 West. "Understanding how uranium moves through the soil and groundwater is essential to determining effective cleanup technologies, as well as being a key to long-term protection of the Columbia River," said Arlene Tortoso of the DOE Richland Operations Office.

"This modeling effort is essential for knowing the geochemical behavior of uranium under the Hanford Site," added Dib Goswami of the Washington State Department of Ecology. "I expect the results of this effort to help us make better decisions on remedial alternatives at the site." In 1989, DOE, Ecology and the U.S. Environmental Protection Agency signed the Tri-Party Agreement, a legally binding, comprehensive cleanup and compliance agreement for the Hanford Site.

An interim step

A pump-and-treat system is being used as an interim remedial action to remove uranium from the groundwater. The system works by pumping contaminated water to the surface and then through a pipeline to the Effluent Treatment Facility, where contaminants are removed from the water.

"Currently, the pump-and-treat system is not removing enough uranium to meet long-term cleanup goals for the groundwater," Tortoso said. "The results of this work can be used to enhance the effectiveness of this system, or to evaluate other types of technologies for removal of uranium from the soil and groundwater.

MSE Technology Applications, which operates a privatized former DOE laboratory, was chosen to develop the model. The company has 20 years of research and development experience. The Hanford work is funded through DOE's Office of Science and Technology.

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As a first step in the development process, MSE specialists used a mobile unit the company designed to collect gas samples above the water table in Hanford's 200 West Area. "The samples were collected at the same time a groundwater well was being installed, which helped to reduce both the duration and expense of sampling," said Ron Jackson of the Groundwater/Vadose Zone Integration Project.

MSE will conduct a laboratory study using the samples to determine how subsurface conditions control the movement of uranium through the soil to the groundwater. The results of this study will be used to create a computer model that includes variations in soil types as well as different soil and groundwater chemistries.

"We will use the model to predict concentrations of uranium in the groundwater," said Scott Petersen of BHI's Technology Applications Department. "If the results are comparable to uranium concentrations observed in groundwater samples collected for monitoring activities, this will give us confidence that the model simulates actual conditions at the site."

Determining mobility

The new model will be the first to incorporate actual measurements of carbon dioxide taken from deep in the soil near the water table. "It is important to know the concentrations of carbon dioxide in soil above the water table because this gas has a role in the mobility of uranium in the subsurface," said Petersen. "This information, in turn, helps us understand how contaminants reach the groundwater."

Jackson said the carbon dioxide aspect of the model will be beneficial for a variety of uses, both at Hanford and elsewhere. "While most of the model will be specific to Hanford, anyone who wants to evaluate the influence of carbon dioxide in a deep-soil sample could benefit from using these data," Jackson said.

The three-year agreement with MSE is funded through DOE's Subsurface Contaminant Focus Area. It is one of several technology development projects under way to provide new knowledge, data and tools for cleanup and waste management at the Hanford Site.

The project is coordinated through the Groundwater/Vadose Zone Integration Project, which BHI manages for DOE. DOE established the Integration Project in 1997 as its centerpiece for near- and long-term water resources protection in the Hanford Site's cleanup mission. ✦