Helping the NRC look below the surface

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Agricultural Research Service (ARS) scientists are helping U.S. Nuclear Regulatory Commission (NRC) experts model the movement of radioactive materials in the soil. Their findings can be used to fine-tune the risk assessment studies that are an essential component in the development of commercial nuclear facilities.

Soil scientists Yakov Pachepsky, Timothy Gish and Andrey Guber all work in the ARS Animal and Natural Resources Institute in Beltsville, Md. The team set up their study at the Optimizing Production Inputs for Economic and Environmental Enhancement (OPE3) study area in Beltsville, which was established in 1998 to study major environmental and economic issues facing U.S. agriculture. It is equipped with remote sensing gear and other instrumentation for monitoring weather, soil, plants and groundwater.

The researchers studied how contaminants move through the vadose zone, which is the area between the soil surface and the groundwater zone. Over a 2-year period, the team added several nontoxic chemical tracers to irrigation water and used 12 site wells to monitor levels of those tracers at three different depths in the soil. Surface runoff, soil moisture profiles, soil water potential, groundwater levels and weather variables were also monitored.

The researchers compared the field data they collected on water flow and tracer concentrations with results from model simulations. Then they ran a range of chemical transport models that varied in complexity to learn more about conditions that could significantly affect the movement

of water--and contaminants--below the soil surface.

Among other findings, the team concluded that tracer transport in soils and shallow groundwater could be strongly affected by gaps in the vadose zone's restrictive fine-material layers.

This and other findings from this work can be used to estimate pollutant transport scenarios for risk assessment studies of nuclear facilities. The results were published in a report by the NRC in 2009.

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