National study explores the reaction and transport of tungsten in drinking water

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A Kansas State University scientist is digging deep to solidify information about potential tungsten contamination in the nation's groundwater and aquifers.

Tungsten is a naturally occurring metallic element that in its alloy or solid form is primarily used for incandescent lightbulb filaments and X-ray tubes.

In an effort to limit toxins in the environment, tungsten is replacing lead in fishing weights and in ammunition for hunting and recreational shooting. The military is substituting tungsten in its high kinetic energy penetrators and small arms ammunition, as well as other ammunitions.

"Tungsten originally was thought to be nontoxic, as it was believed to be an inert metal of low environmental mobility," said Saugata Datta, assistant professor of geology at K-State. "But tungsten is a contaminant in groundwater and a growing concern."

Scientists and health officials began connecting tungsten to clusters of childhood leukemia cases in the Western U.S. after finding high concentrations of the element in residents' bodies. People examined lived in towns near tungsten-bearing ore deposits and even hard metal processing plants. Drinking water in these areas has an elevated concentration of tungsten.

"Animal model studies have shown tungsten can be toxic and even carcinogenic," Datta said. "Because of this, we need to understand tungsten's biogeochemistry in the environment, about which very little is known."

To find out how tungsten reacts and relates to groundwater and the surrounding environment -- referred to as biogeochemistry -- Datta recently began collaborating with Karen Johannesson, professor of earth and environmental sciences at Tulane University.

Their research is being funded by a three-year grant issued by the Hydrology Division of the National Science Foundation in fall 2010.

The project investigates the biogeochemistry of tungsten reaction and transport in the environment. More specifically it's an evaluation of how tungsten concentrations change along groundwater flow paths and modify the groundwater makeup.

When tungsten is exposed to oxygen -- a process called oxidation -- it often seeps into the ground and even into groundwater-bearing aquifers. During this process the tungsten can also mix with organic matter present in natural soils. In the presence of sulfur rich solutions, it forms thiotungstate complexes, which are also toxic.

To gather information the researchers are looking at pristine aquifers, like the Ogallala, as well as affected aquifers. Data from these findings can be used to create a conceptual model for this project and future studies, Datta said.

"Looking at emerging contaminants is one of the biggest things for an environmental geoscientist, and health is a big issue connected to any elemental or environmental study we do," Datta said.

"We are trying to approach this project from the standpoint of understanding this element and its behaviors in the environment before taking our findings to the general public so the situation can be addressed," he said.

Datta's previous work studied arsenic levels in the groundwater in West Bengal, India, and Bangladesh. Along with a K-State graduate student, he looked at why naturally occurring arsenic -- another toxin in nature -- got into groundwater from river-borne sediments, and finding well locations for cleaner water.

Provided by Kansas State University

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