DOE NEWS

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Helping Mother Earth Restore Monument Valley

Scientists investigate alternative remedies to clean up contaminated ground water

Caring for Mother Earth and helping maintain and restore the health of desert land are part of the Navajo way of life. Putting this into practice, Navajo Nation officials and scientists from the U.S. Department of Energy (DOE) Office of Legacy Management (LM) and S.M. Stoller Corporation, the contractor for LM, together with University of Arizona researchers and Diné College students, are exploring natural remedies for ground water contamination at the LM site near Monument Valley, Arizona.

DOE completed removal of radioactive mill tailings from Monument Valley, a former uranium ore processing site, in 1994. Nitrate and ammonium, used during the milling process, remain in a shallow ground water plume spreading from a millsite soil source. Nature can transform ammonium to nitrate; drinking water containing high levels of nitrate can make people and animals sick. A conventional cleanup strategy might involve drilling wells and pumping ground water to an aboveground treatment facility. DOE is investigating alternative remedies that would be more sustainable and require less intervention. These studies are jointly funded by DOE and the University of Arizona, Tucson. In addition, DOE is providing funds to Diné College, Tsaile, Arizona, for intern students to participate in the research.

Pilot studies involving plants and soil microbes that will help remove nitrate from the ground water are under way at Monument Valley. Plants are withdrawing nitrate from both the soil source and the plume and converting nitrate into healthy plant tissue. Two native, desert

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phreatophytes—plants that send roots into ground water—are doing most of the work: díwózhii_beii and díwózhiishzhiin in Navajo, fourwing saltbush and black greasewood in English. When healthy, these plants can send roots more than 40 feet into ground water, and, like so many straws, suck about 380,000 gallons of plume water and 100 pounds of nitrate (as nitrogen) per acre in a year, a process scientists call phytoremediation. In addition, as the ground water flow approaches the far end of the contaminated plume, soil microbes will have converted nearly half of the nitrate to harmless nitrogen gas, a process called microbial denitrification.

So far it looks like the simplest of enhancements— growing and protecting more plants—will help Mother Earth the most. An irrigated field of fourwing saltbush planted at the plume's source is removing nitrate and ammonium from the soil, thereby preventing deep seepage of nitrate into ground water because of high rates of water uptake by plants. When the plants are irrigated, the added organic matter from the plant roots feeds the soil microbes, enhancing denitrification. Transplanting and fencing saltbush and greasewood over the contaminated plume will slow or stop it from spreading further, allowing natural microbial denitrification to do its job there as well.

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