GlobalResearch
Center for Research on Globalization

Nuclear Energy, Ground Water and "Uranium Bioremediation"

By Global Research News
Global Research, December 08, 2013
sciencedaily.com

Region: USA
Theme: Environment, Science and Medicine

The following 2009 Science Daily article sheds light on an important process which may be of relevance to the debate on the Fukushima disaster. "A team of scientists from Oak Ridge National Laboratory has investigated effectiveness of several electron donors for uranium bioremediation in a study funded by the Department of Energy's Environmental Remediation Sciences Program."

The procedure, however, pertains to uranium rather than to plutonium contamination. It does not focus on the issue of radiation. (GR Editor M. Ch).

* * *

The legacy of nuclear weapons and nuclear energy development has left ground water and sediment at dozens of sites across the United States and many more around the world contaminated with uranium.

The uranium is transported through ground water as uranyl (U^{6+}). In one bioremediation strategy, uranium immobilization in contaminated ground water and sediment may be achieved by the addition of organic molecules known as electron donors to stimulate microbial activity. The microbial community utilizes the electron donors as 'food', consuming all of the available oxygen during aerobic respiration. Once the ground water becomes anaerobic, U^{6+} may be converted to U^{4+} as UO_2, a solid mineral, sequestering the uranium within the sediment. Researchers have been investigating the effectiveness of various electron donors, but have been frustrated by residual U^{6+} which is not converted to insoluble U^{4+}.

A team of scientists from Oak Ridge National Laboratory has investigated effectiveness of several electron donors for uranium bioremediation in a study funded by the Department of Energy's Environmental Remediation Sciences Program. Madden et al. report that the particular electron donor chosen affects not only the rate of uranium removal from solution, but also the extent of U6+ conversion to U4+. Results of the study were published in the January-February issue of the *Journal of Environmental Quality*.

Microcosm experiments containing uranium-contaminated sediment and ground water demonstrated equivalent rapid uranium reduction when amended with ethanol or glucose. In contrast, reduction was delayed by several days when microcosms were amended with methanol. Spectroscopic analyses of uranium oxidation state in stimulated microcosm

sediment slurries demonstrated almost complete uranium reduction when methanol was the donor, as compared with less than half reduced using ethanol or glucose. However, addition of methanol did not always result in uranium reduction. These results suggest that the use of donors such as methanol which are not as readily and rapidly coupled to microbial metal reduction may lead to increased stability of the subsurface towards uranium immobilization.

Research is ongoing at Oak Ridge National Laboratory to investigate the effectiveness of various electron donors for long-term uranium immobilization. Further research is needed to understand the coupling between the microbial community and the biogeochemical processes that occur to immobilize the uranium. While previous research has focused on individual groups of bacteria which most efficiently reduce uranium, these results suggest the need for understanding the microbial community system.

Story Source:

> The above story is based on materials provided by Crop Science Society of America.
>
> Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

1. Madden et al. Donor-dependent Extent of Uranium Reduction for Bioremediation of Contaminated Sediment Microcosms. *Journal of Environmental Quality*, 2009; 38 (1): 53 DOI: 10.2134/jeq2008.0071
