



ITRC PROJECT PROPOSAL

Enhanced Attenuation of Metals and Radionuclides in Groundwater

PROPOSAL DATE:

February 10, 2011

Proposal Contacts:

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Call for Proposals Topical Area

CONT **Soil and groundwater contamination:** *In situ passive remediation and stabilization of metals and radionuclides*

Problem Statement (why is this project necessary and relevant to ITRC's purpose & mission?)

This project will address a regulatory barrier and its associated technical issues. DOE and NRC sites, many DoD and Superfund sites, and mining and ore processing sites, are among those contaminated with metals and/or radionuclides. These inorganic contaminants are not subject to degradation reactions like organic contaminants; rather attenuation-based remedies rely on conversion of the metals and radionuclides to more stable and less toxic species. This stabilization can result from natural processes, geochemical gradients or biogeochemical manipulation. Because of their persistence in subsurface media, sites with these contaminants face the challenge of ensuring they do not threaten human health or the environment for very long periods of time.

Monitored Natural Attenuation (MNA) of metals and radionuclides in groundwater involves more complex and interdependent processes than does MNA of organic compounds, however, many of the factors that must be considered by regulators are the same. Most state and federal regulatory programs have incorporated MNA of organic compounds into their policies because practical experience and knowledge of the processes involved have reached a level where the perceived risk is tolerable. Regulatory acceptability of MNA of inorganics lags behind because a similar base of knowledge and practical experience has been lacking. As a result of public perception, risk, and the current regulatory framework, many metals and radionuclides pose a remediation problem even when they are present at extremely low concentrations – levels that are orders of magnitude lower than many of the common toxic organic and inorganic contaminants. “Clean” closure often cannot be achieved when these low-level residual amounts of metals and radionuclides remain at contaminated sites.

A lack of regulatory guidance specifically addressing the use of attenuation-based remedies for metal and radionuclide contamination has contributed to inconsistent approaches and has generally discouraged the consideration of such remedies.

Proposed Scope to Address Problem (what is the approach for this project?)

A new ITRC document, *Attenuation Processes for Metals and Radionuclides* (December 2010), fills a void in regulatory guidance. This technical and regulatory guidance complements EPA's recent 3-volume technical background document on the topic as well as EPA's new policy directive on attenuation of metals and radionuclides in groundwater.

ITRC's new document features a framework for making regulatory decisions. That framework includes a loop for considering enhanced attenuation (EA) in the decision process. EA is the use of low-energy, long-acting (sustainable) technologies when MNA is not sufficiently effective or acceptable. EA can provide an effective and efficient "bridge" from higher-energy remedies to MNA with technologies that either increase the attenuation of the contaminants within the affected aquifer or reduce contaminant loading to the downgradient aquifer. Developing the EA portion of the MNA decision framework will allow these remaining framework steps and options to be presented as companion guidance to the guidance document just published.

The proposed technical and regulatory guidance document will provide a decision framework that can guide decisions at remedial sites. Details of the decision process will help regulators and other decision makers understand if an EA technique or technology is applicable at a site. The guidance document will clearly define the concept of EA for metals and radionuclides and how it differs from EA for organics, and will discuss associated issues: 1) immobilization timeframes versus risk, 2) remobilization potential and geochemical evolution, 3) potential for collateral damage, etc.

The document will point out the major opportunities for attenuation enhancement within a contaminant plume:

- 1) Reduce source loading.
- 2) Increase attenuation capacity, and
- 3) Increase stability.

The guidance document will also discuss EA strategies and may present categories of potential EA technologies that can provide sustainable treatments. There are currently technologies that focus on manipulation of the subsurface biogeochemistry that will result in long-term stabilization of metals and radionuclides, but few have been evaluated for their long-term effectiveness. Therefore, the emphasis will be on providing sufficient information to enable regulators, et al to determine what to look for, what questions to ask and how to evaluate proposals rather than providing technology-specific information.

This scope is within capacity of the current ITRC Attenuation Processes for Metals and Radionuclides (APMR) team, which includes many of the leading researchers and site investigators working on this topic, regulators from 10 states, and representatives from federal agencies (EPA, DOE, DoD).

Targeted Users (who will use products generated by this project?)

As is typical with ITRC documents, the primary targets are state regulators and stakeholders. Because a successful attenuation option is so important to DOE, DoD, NRC, USEPA, tribes, communities, and any commercial facilities that manufactured or handled metals or radioactive contaminants, these products will also target that much broader audience. Participation in the existing APMR team by nearly 20 environmental consultants demonstrates an interest by the environmental industry in applying these technologies to site cleanups. Team members from academia have an interest in educational aspects and research as well.

Summary of Deliverables (primary project products)

- Technology and regulatory guidance document: *Enhanced Attenuation Processes for Metals and Radionuclides in Groundwater*
- Internet-based training: *Enhanced Attenuation Processes for Metals and Radionuclides in Groundwater*

Impact (how will this project result in more effective environmental decision making?)

The proposed technical and regulatory guidance document will provide a decision framework that will help regulators and other decision makers understand if an EA technique or technology is applicable at a groundwater remediation site. The document will be a companion to ITRC's new document, *Attenuation Processes for Metals and Radionuclides*, which features a framework for making regulatory decisions which includes consideration of EA techniques. It will also complement EPA's new policy directive on attenuation of metals and radionuclides in groundwater expected to be released in 2011.

Ultimately this new guidance is expected to encourage the consideration of MNA/EA remedies for metal and radionuclide contamination and to contribute to more consistent application of those remedies.

Project Schedule

Nov-Dec 2011	Team formation (core of the new team is expected to come from the current Attenuation Processes for Metals & Radionuclides Team)
Jan – Mar 2012	Establish project goals (define products and work plan)
Apr 2012 – Oct 2013	Develop guidance document
Oct 2012 – Dec 2013	Develop internet-based training
Dec 2013	Publish Guidance document
Mar 2014	Internet-based training dry run
Jan – Dec 2014	Implementation phase (promote document; offer internet-based training)

Proposed Personnel

Potential Team Membership/Needs

- The proposed Co-Team Leaders are Carl Spreng and Ann Charles. Carl Spreng is a Project Manager at the Colorado Department of Public Health and Environment overseeing environmental restoration at DOE's Rocky Flats site and has been with the Department since 1991. Previously, he worked as an energy exploration geologist involved in searching for such diverse energy sources as oil shale, tar sands, coal, uranium, and oil and gas. Since 1999, Carl has been the co-leader of the ITRC Radionuclides Team and the ITRC Attenuation Processes for Metals and Radionuclides Team. Carl is an instructor on all of the team's Internet-based training courses. Carl has a Bachelor's and Master's degree, both in geology. Ann Charles is a Research Scientist at the New Jersey Department of Environmental Protection overseeing publicly and privately funded investigations and remediations that include metals and radionuclide contaminated sites. She has been with the Department since 1988. Ann has been involved in major regulatory and policy initiatives including the development of soil remediation standards for the State of NJ. She joined the ITRC Radionuclides team in 2004 followed by the ITRC Attenuation Processes for Metals and Radionuclides team. Ann has been a primary trainer for both teams' Internet-based training courses. Ann has a Bachelor of Arts and Masters of Environmental Science. Both Carl and Ann are experienced in working on teams and building consensus to reach scientific and programmatic goals.
- States which provided members on the previous Attenuation Processes for Metals & Radionuclides team include California, Colorado, Florida, Georgia, Kentucky, New Jersey, Oklahoma, South Carolina, Tennessee, Utah, Virginia, and Washington. All states have occurrences of metals or radionuclides contamination; those with large DOE or DOD facilities, or metals mining or processing complexes should be particularly interested.
- Other organizations that have participated as team members for the previous team include: US EPA, NAVFAC Engineering Service Center, US Army Corp of Engineers, US Air Force, US DOE, Desert Research Institute, Georgia Institute of Technology, Montclair State University, University of Central Oklahoma.

- Skill mix of team members should include geochemistry, geology/hydrogeology, engineering, risk assessment, radiation health physics etc.
- Team members should include representation from public and tribal stakeholders, federal agencies with topical guidance or ongoing research, federal agencies with contaminated properties, state regulators, regulated community, etc.).

NOTE: This project will continue to receive budget support from DOE through the Center for Sustainable Groundwater and Soil Solutions at the Savannah River National Laboratory.

Related Work:

ITRC documents:

- *A Decision Framework for Applying Monitored Natural Attenuation Processes to Metals and Radionuclides in Groundwater* (ITRC 2010)
- *Enhanced Attenuation: Chlorinated Organics* (ITRC 2008)
- *Natural Attenuation of Chlorinated Solvents in Groundwater* (ITRC 1999)
- *Use and Measurement of Mass Flux and Mass Discharge* (ITRC 2010)