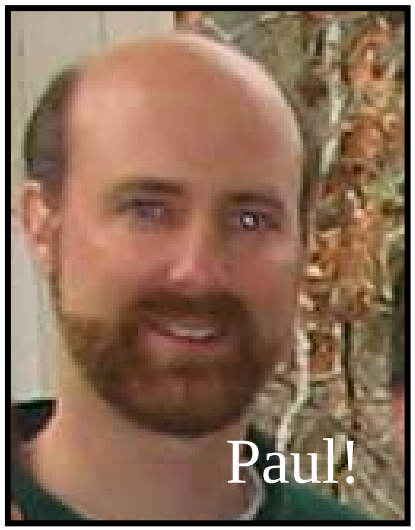
Natural and Accelerated Bioremediation Research Field Research Centers Strategic Plan



Office of Biological and Environmental Research

U.S. Department of Energy

July 2003

Field Research Centers Mission

To serve as premier field research sites at which NABIR and other BER investigators can obtain samples and conduct *in situ* studies that will lead to new insights into the bioremediation of metals and radionuclides and related contaminant fate and transport processes.

S-3 Disposal Ponds During Denitrification

Field Research Center Goals

(1) To operate effectively as major field-scale research facilities for NABIR and other investigators, by offering a multitude of opportunities for testing scientific hypotheses concerning the in situ bioremediation of toxic metals and radionuclides.

(2) To serve as a resource for advancing the scientific understanding of the fundamental mechanisms of microbially-mediated metal and radionuclide immobilization, for advancing subsurface characterization and monitoring technologies, for developing a predictive capability for bioremediation, and for providing an in depth understanding of the fate and transport of contaminants in the subsurface.

An example of my life and Tonia's with Craig Criddle

Field Research Center Goals (continued)

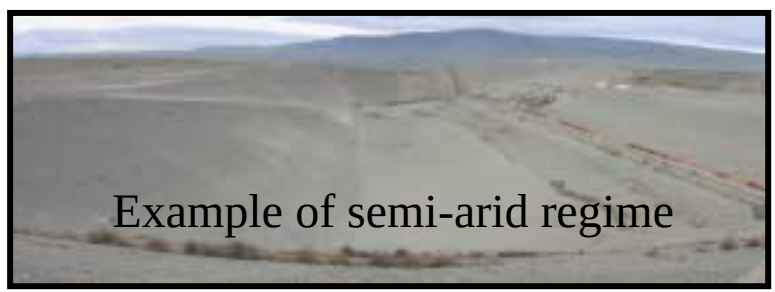
(3) To integrate and coordinate field research within the NABIR Program, to integrate relevant research within other BER programs such as EMSP and Genomes to Life (GTL), and to coordinate FRC research with research being managed by other federal programs and organizations, where appropriate and beneficial.

(4) To provide educational opportunities for students and to provide collective scientific and site characterization data and research findings on a regular basis to the scientific community, regulators, end-users and other stakeholders.

Goal 1: Operating the FRCs Effectively

- Core Operational Activities
  - Role of the NABIR Field Activities Manager.
  - Role of the NABIR Science Advisor.

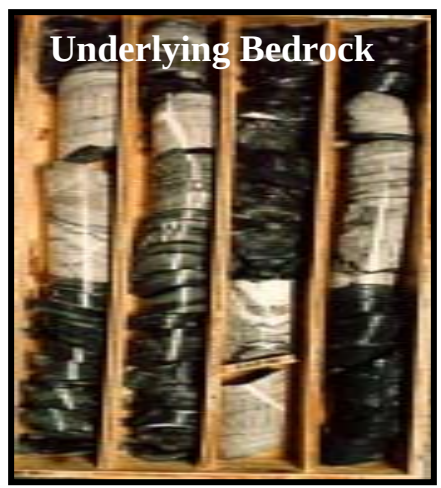
- Discussion of Short-Term Operational Tasks (1-3 years)
  - Identify and characterize existing and new field plots at the Oak Ridge FRC.
  - Identify and establish a new FRC at a DOE site where the subsurface hydrology differs substantially from that at the Oak Ridge FRC, but where the contaminants are similar in type and concentration.
  - Open the Oak Ridge FRC to non-NABIR investigators, especially EMSP and GTL investigators in accordance with the interests of ERSD to make more DOE field sites available for *in situ* research.



Goal 1: Operating the FRCs Effectively (continued)

- Middle-term Operational Tasks (4-6 years)
  - Continue to expand the number and extent of hydrological and geochemical characterization of the field plots available for investigations at the Oak Ridge FRC so that more in situ studies can be initiated.
  - Install boreholes and injection wells at the second FRC for in situ research by NABIR investigators and investigators from other programs.
  - Increase coordination among the FRC staff, PI's and DOE to ensure that operation of the two FRC's for multiple programs is efficient.

FRC media



Goal 1: Operating the FRCs Effectively (continued)

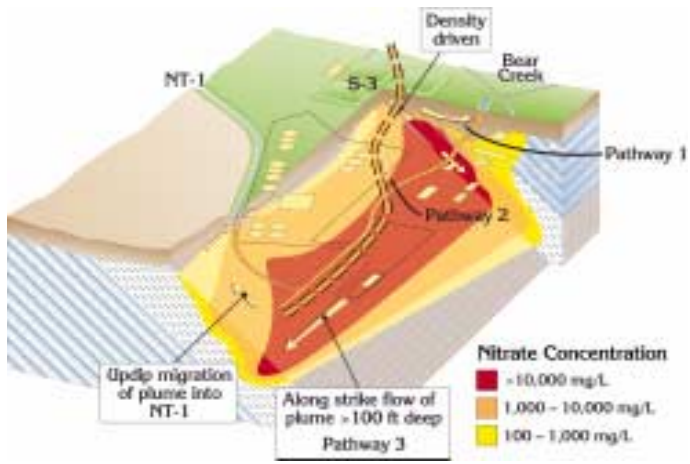
- Long-term Operational Tasks (7-10 years)
  - Continue site operations, characterization, and expansion for any existing and new FRCs.
  - Continue efforts to coordinate between the FRCs.

It may take this long to get that darn U out of the matrix

Pondering structured media with Tim Scheibe

Goal 2: Advancing Scientific Understanding and Analytical and Predictive Capabilities

- Short-Term Scientific Tasks (1-3 years)
  - Achieve U and/or Tc immobilization in the field at the Oak Ridge FRC.
  - Undertake additional site characterization at the Oak Ridge FRC in support of in situ studies.
  - Identify the conditions and processes at the Oak Ridge FRC that may be important for microbial reduction within a plume.
  - Develop a conceptual model of the Oak Ridge FRC.

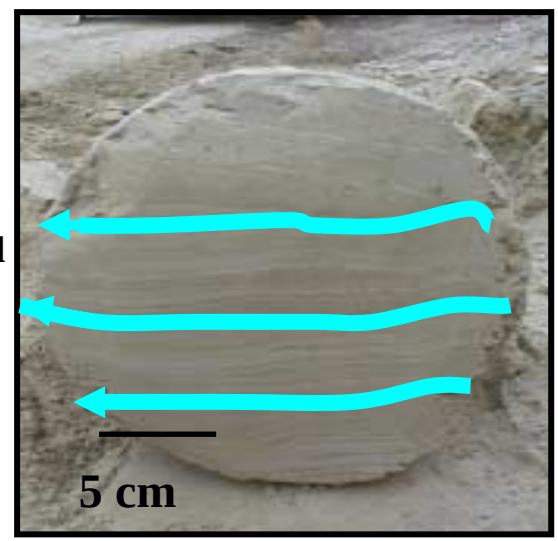


Conceptual model of contaminant transport at the S-3 Ponds Site

Goal 2: Advancing Scientific Understanding and Analytical and Predictive Capabilities (continued)

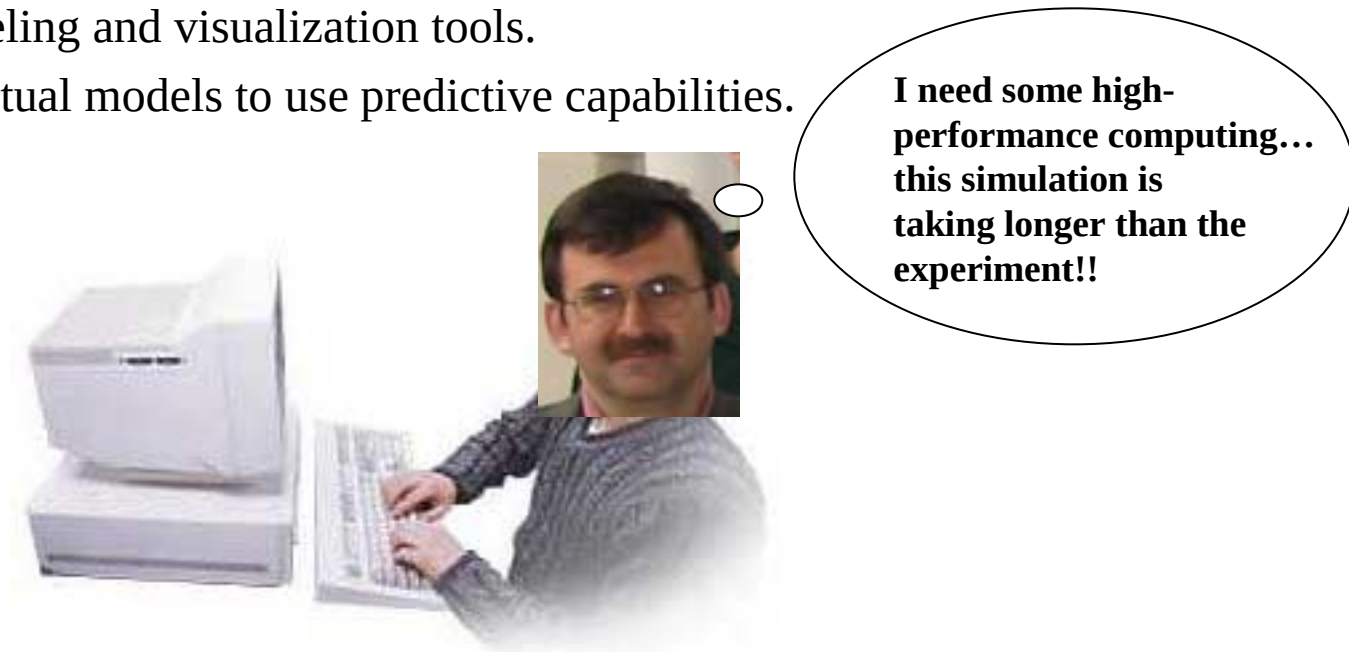
- Middle-Term Scientific Tasks (4-6 years)
  - Improve the understanding of conditions and processes that promote or inhibit in situ bioremediation of metals and radionuclides.
  - Identify and characterize candidate field plots for in situ studies of other redox-sensitive metal contaminants at the Oak Ridge FRC.
  - Revise the Oak Ridge FRC conceptual model.
  - Initiate new in situ research studies and begin to develop conceptual model at second FRC.

Example of conceptualized flow in semi-arid porous media



Goal 2: Advancing Scientific Understanding and Analytical and Predictive Capabilities (continued)

- Long-Term Scientific Tasks (7-10 years)
  - Develop a comprehensive understanding of metal and radionuclide plumes at the Oak Ridge FRC.
  - Continue in situ studies at the second FRC with a focus on increasing length scales of investigation.
  - Enhance modeling and visualization tools.
  - Revise conceptual models to use predictive capabilities.



Numerical flow modeling with Peter Kitanidis

Goal 3: Integrating and Coordinating within NABIR and with Other BER Programs

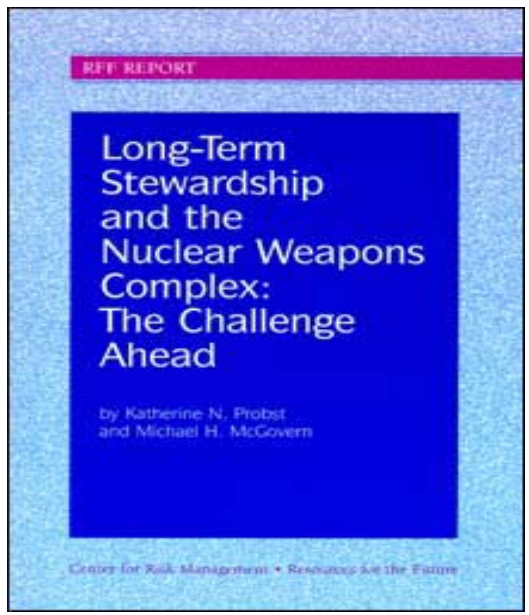
- Short-Term Integration Tasks (1-3 years)
  - **Schedule quarterly conference calls that involve the NABIR Field Activities Manger, the Oak Ridge FRC Manager, the Oak Ridge FRC Science Advisor, and the lead NABIR scientists conducting in situ research at the Oak Ridge FRC.**
  - **Review all work plans for in situ research at the Oak Ridge FRC as well as any field site characterization activities prior to initiation.**
  - **Review and analyze the extent of coordination and integration at the FRC between NABIR and other researchers, and establish working groups to promote integration.**
  - **Integrate the lessons learned from operational planning activities associated with other NABIR field studies, especially results from in situ NABIR research at U Mill Tailing Remedial Action (UMTRA) sites.**
  - **Open the Oak Ridge FRC to BER-funded investigators, especially EMSP and GTL investigators.**
  - **Seek opportunities to coordinate and enhance links with such non-DOE federal programs and agencies as NSF, EPA, USGS, SERDP, and others.**

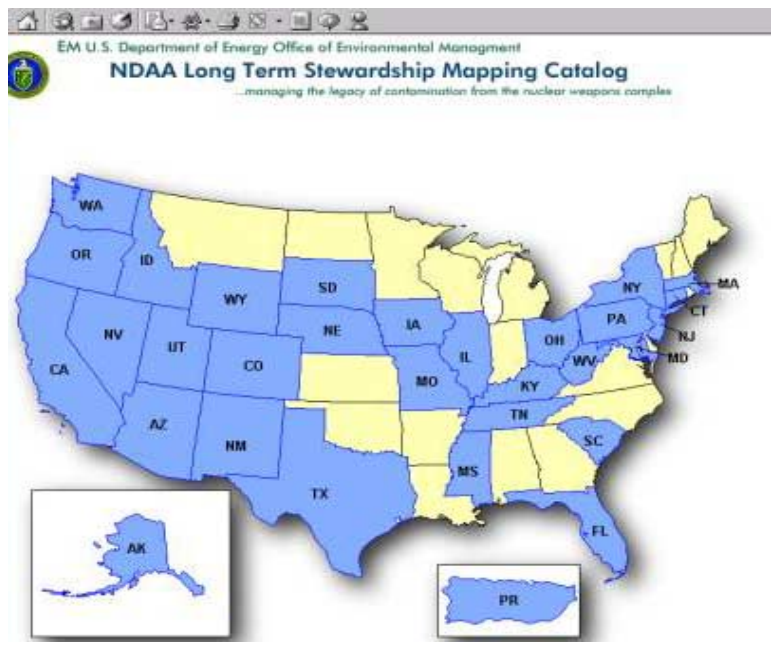
Goal 3: Integrating and Coordinating within NABIR and with Other BER Programs (continued)

- Middle-Term Integration Tasks (4-6 years)
  - Increase coordination and integration among NABIR studies and other BER programs at the Oak Ridge FRC.
  - Set up coordination and integration mechanisms at the second FRC.
  - Continue to seek opportunities to coordinate and enhance links with such non-DOE federal programs and agencies as SERDP, NSF, EPA, and USGS.

Goal 3: Integrating and Coordinating within NABIR and with Other BER Programs (continued)

- Long-Term Integration Tasks (7-10 years)
  - Develop communication linkages between the two FRCs through the establishment of a network system.
  - Promote the integration of data and research results across programs, particularly for issues of importance to Long-Term Stewardship (LTS).
  - Continue to seek opportunities to coordinate and enhance links with such non-DOE federal programs and agencies such as SERDP, EPA, NSF, and USGS.





Goal 4: Educating Students and Providing Scientific Data and Research Findings

- Provide educational opportunities to students throughout the lifetime of the FRCs.
- Communicate on a regular basis with the scientific community, regulators, endusers, other stakeholders, and the media.
- Hold periodic technology transfer meetings with DOE site end users.
- Hold an annual investigators meeting at the FRCs.
- Transfer research findings from NABIR, EMSP, and GTL studies to DOE site endusers and others.

Recent Press Release regarding research at Area 3:

Trapping uranium for cleanup

?

What does nitrate smell like?

Scientist: 'It's highly unusual groundwater: it smells like nitrate and fizzes like Coke.'

By: R. Cathey Daniels | Oak Ridger Staff

cathey.daniels@oakridger.com