



U.S. Department of Energy

Office of Science

Oak Ridge Field Research Center

Environmental Remediation and Stewardship Research



Oak Ridge Integrated Field-Scale Research Challenge ERKP686

Research Outcomes, Data Management, Site Contributions, and Opportunities

ERSD Annual PI Meeting
Lansdowne, Virginia
April 16-19, 2007





Research Outcomes & Site Contributions

Multi-scale predictive monitoring and modeling tools that can be used at sites throughout the DOE complex to inform and improve the technical basis for decision making, and to assess which sites are amenable to natural attenuation and which would benefit from source zone remedial intervention.

Recommendations and strategies, conveyed via technical reports and stakeholder workshops, that will assist local decision makers with scientifically informed choices on ground water remediation actions relevant to ORR EM groundwater problems between 2012 -2015.

Integration of research findings and lessons learned across all ERSD IFC sites through the sharing of knowledge regarding the influence of coupled processes on natural and engineered processes in contaminated subsurface environments.

Scientific publications that convey our improved multi-scale conceptual and predictive understanding of manipulated and natural contaminant attenuation rates and mechanisms and the long-term effectiveness of remedial activities relevant to *in situ* remediation and stewardship at DOE sites.





Characterization and other data of wide appeal will be loaded into a central database

- **Data will be searchable and accessible via a Web interface.**
- **Both list and map-based queries will be available.**

Data resulting from investigator experiments will be documented using a Web-based metadata entry tool

- **Controlled vocabulary and indexing terms will ensure consistency in the data descriptions.**
- **The metadata will contain hyperlinks to the associated data.**
 - **Initially the metadata and associated data will have access limited to project personnel.**
 - **However, all data and documentation will eventually be searchable and accessible by anyone from the ORFRC website.**
- **Each investigator will create their own data sets in consultation with IFRC-ORFRC data manager.**
- **All data will be stored on ORNL file server.**



Schedule (see Integration Plan)

Task	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A. GEOPHYSICAL DEFINITION OF SUBSURFACE HETEROGENEITY WITHIN PATHWAYS																				
A.1 Link geophysics response to media	Install borings/arrays				Assessments															
A.2 Define heterogeneity and pathways	Install arrays				Assessments															
B. QUANTIFYING RATES AND MECHANISMS OF NATURAL ATTENUATION																				
B.1 Shale and carbonate pathways																				
B.1.1 Coring and well installation	Share borings from Task A				Install additional borings															
B.1.2 Rates and mechanisms - nitrate	Assessments with Task A and existing wells								Assessments with new well transects and consideration of geophysical data											
B.1.3 Rates and mechanisms - U and Tc	Assessments with Task A and existing wells								Assessments with new well transects and consideration of geophysical data											
B.2 pH adjustment experiments																				
B.2.1 Batch and field column studies	Batch and field columns																			
B.2.2 Controlled field plot studies					Develop field plot				Manipulations				Recovery							
B.2.3 Microbial assessments					Premanipulation				Manipulation and post manipulation phases											
B.3 Recharge studies																				
B.3.1 Hydrobiogeochemical studies									Perched zone continuous tracer injection											
B.3.2 Geophysics studies					Install arrays—monitor recharge events—assess data															
B.3.2 Recharge reduction test																	Drainage ditch diversion			
C. ENHANCED CONTAMINANT STABILITY STRATEGIES (SOURCE CONTROL)																				
C.1 Field plot expansion																				
C.1.1 Expand field plots - install wells	Coring and install wells																			
C.1.2 Field plot biostimulation					Biostimulation of plots as needed				Remobilization studies											
C.2 Microbial reduction assessments									Gravel pathway years 2-4/Saprolite pathway years 4-5											
C.3 Ca-oleate slow release assessment									Gravel pathway oleate additions											
C.4 Metal sequestration by organic-P									Gravel pathway years 2-4/Saprolite pathway years 4-5											
C.5 Microbiology of reduced zones					Premanipulation				Manipulation and post manipulation phases											
C.6 Geophysical Studies					Premanipulation				Manipulation and post manipulation phases											
D. MULTIPROCESS AND MULTISCALE MODELLING																				
D.1 Multiscale flow and transport model																				
D.1.1 Site-wide modeling	Expand existing model and incorporate reactive transport								Iterative feedback from data collected during implementation of Tasks A, B, and C											
D.1.2 Local scale modeling	Localized models for Plots 1, 2, and 3, recharge and transition zones, and batch and column test																			
D.1.3 Upscaling and model accuracy	Iterative feedback from data collected during implementation of Tasks A, B, and C																			
D.2 Advanced pattern recognition	Summarize data, classify results based on sites and manipulations, develop predictive capability																			
E. PROJECT MANAGEMENT																				
E.1. Prepare Implementation Plan																				
E.2. Modify ORFRC Management Documents																				
E.3. Subcontracting																				
E.4. Prepare Detailed Task Implementation Plans																				



Opportunities for collaboration

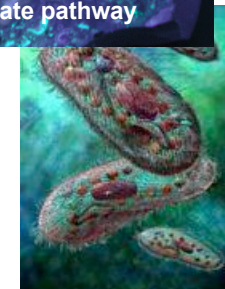
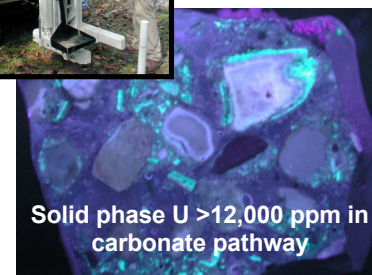
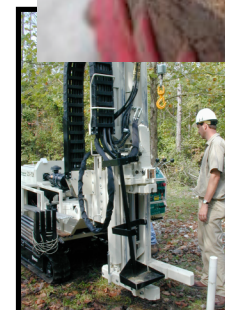
Collaborative research can begin immediately, if resources are available, since the ORFRC is well characterized; the site infrastructure has been established, and all the management plans and agreements with regulators and site contractors are in-place.

At least six large areas with spatially and temporally diverse hydrological, geochemical, and microbial processes are available. The field manager and project personnel are highly experienced to guide and execute collaborative research.

Educational opportunities to students throughout the lifetime of the ORFRC are available and have proven invaluable from past endeavors.

Groundwater and sediment samples from highly diverse hydrological, geochemical, and microbial regimes, and humic reference samples, can be provided to ERSD researchers upon request. Collection of over 25,000 groundwater and core samples.

Several thousand genetic sequences from groundwaters and sediments have been retrieved by ERSD investigators, compiled, and annotated by our group into the only sequence database of its kind for DOE sites. The genetic database is highly annotated and available to ERSD researchers as an Excel spreadsheet.





A publicly accessible ORFRC website and listserver (<http://www.esd.ornl.gov/nabirfrc/>) is available for the distribution of information and data to the broader scientific community, EM, regulators and the public. Project characterization data and research findings are periodically transferred to the Oak Ridge Environmental Information System for use by environmental decision makers.

Over 70 peer-reviewed publications have resulted from ORFRC site characterization and research with numerous others pending. Site-wide conceptual and numerical models have been developed, previous research activities documented and, research capabilities have been described and documented at <http://www.esd.ornl.gov/nabirfrc/>.

