Environmental Remediation Science Program

U.S. Department of Energy
Office of Science
Office of Biological & Environmental Research
ERSP PI Meeting
April 20, 2009
Purpose

The ERSP is a very diverse and multidisciplinary program and relies on integrative science to accomplish its goals.

The Annual PI Meeting serves three important purposes:

- Provide opportunities for scientific interaction and discussion among the ERSP scientists; a critical element for the program.
- Provide the ERSP program staff an opportunity to assess progress on each project and discuss research direction with the PIs.
- Showcase the ERSP to interested parties within DOE and within other Federal Agencies.
Office of Biological & Environmental Research

Biological Systems Science Division
- Genomics: GTL
- Bioenergy Research Centers
- Joint Genome Institute
- Low Dose Radiation
- Radiochemistry, Imaging & Instrumentation
- Structural Biology

Climate & Environmental Sciences Division
- Climate Change Research
- ARM Climate Research Facility
- Environmental Remediation Science Program (ERSP)
- Environmental Molecular Sciences Lab (EMSL)
Research Program Focus

Subsurface Contamination
- vadose zone and saturated zone contamination
- technically challenging problems with no clear solutions

Current Contaminants of Concern
U, Tc, Pu, $^{90}$Sr, $^{137}$Cs, $^{237}$Np, Hg, Cr
“To advance our understanding of fundamental physical, chemical and biological processes that control contaminant behavior in the environment in ways that help solve DOE’s intractable problems in environmental remediation and stewardship”

1. Understand and Predict Contaminant Fate and Transport
   Develop an improved understanding of the processes governing the fate and transport of contaminants to predict and control the long-term performance of environmental remediation and facilitate stewardship of DOE sites

2. Subsurface Remediation and Long-Term Stewardship
   Explore new options and concepts for remediation and long-term stewardship of subsurface systems

3. Measurement and Monitoring
   Provide the scientific foundation for new measurement and monitoring tools leading to a better understanding and management of remediation strategies and long-term site stewardship.
To provide sufficient scientific understanding such that DOE sites would be able to incorporate coupled physical, chemical and biological processes into decision making for environmental remediation and long-term stewardship
Subsurface Research Across Scales

Integrative, multidisciplinary approaches to understanding multi-scale processes controlling contaminant mobility in the environment

- Characterization & Monitoring
- Microbiology, Geochemistry, Hydrology
- Modeling & High performance computing
- Field Research
- Molecular science, EMSL, Light sources

Field Scale
> 10^3 m

Mesoscale
10^{1.5}-10^3 m

Pore scale
10^{-3}-10^{1.5} m

Microscopic
10^{-7}-10^{-3} m

Molecular/nano
10^{-10}-10^{-8} m
## Budget News

### FY 2008 Appropriation  | FY 2009 Appropriation
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Research |  |  
Biological Systems | 167 | 173  
Bioenergy Research Centers | 75 | 75  
Climate Change Research | 98 | 132  
Environmental Remediation Science | 47 | 49  
Total, Research | 387 | 429  
Facilities |  |  
Scientific User Facility Operations |  |  
* Environ. Molecular Sciences Lab (EMSL) | 43 | 49  
Production Genomic Facility (JGI) | 60 | 65  
* Atmospheric Radiation Measurement (ARM) | 35 | 40  
Total, Facilities | 138 | 154  
Other (e.g. SBIR) | 19 | 17  
Total, BER | 544 | 600  

*ARRA funds ("Stimulus")
**Notice 08-09 (major delays)**

- 105 proposals submitted and reviewed
- 21 proposals funded
- The last notifications of award made just this past March(!)
- Award processing is ongoing
- Abstracts to be posted on the ERSP website

**Notice 09-07 (closed April 9)**

- Pre-apps reviewed = 147
- Proposals submitted = still downloading
- Review Panel scheduled for August
- Award in early FY2010 (pending budget passage)
Current ERSP National Laboratory Programs SFA programs

- Pacific Northwest National Laboratory (review in 2011)
- Lawrence Berkeley National Laboratory (review in 2010)
- Oak Ridge National Laboratory (review in June)
- Argonne National Laboratory (review in June)
- Idaho National Laboratory (review in 2010)
- SLAC National Accelerator Laboratory (review in 2012)

Re-competition of an National Laboratory SFA Program in Transuranics Transport Processes

- Five proposals submitted (LANL PNNL, LLNL, INL, ORNL)
- Review begins Thursday PM

2010 Darcy Lecturer
**Tim Scheibe** (PNNL)

2008 AAAS Fellows
**J. Zhou** (Univ. Oklahoma)
**M. Celia** (Princeton Univ.)

**Phylochip** wins R&D 100 Award
(Andersen, DeSantis, Brodie, Piceno from LBNL)

Special Issue of *Geobiology*
Dedicated to **Terry Beveridge**

**Geological Society of America**
Hydrogeology Division

2010 Birdsell-Dreiss Lecturer
**Susan Hubbard** (LBNL)

New Associate Editor
**Michelle Scherer**
Univ. of Iowa

**PFLOTRAN on “Jaguar”**
**Peter Lichtner**, LANL

“Project of the year”
**Baohua Gu**, ORNL

Outstanding Student Paper
**Ilenia Battiato**, UCSD
Publications

As a program we continue to publish in a wide variety of peer-reviewed Journals addressing key issues in:

- Environmental Science
- Geochemistry
- Microbiology and Microbial Ecology
- Hydrology and Water Science

.....and many other related areas.

- 124 publications in 2008
- 16 and counting in 2009

Total publications for NABIR/ERSP coming close to 1000!
Combined U(VI) desorption and tracer studies simulate U transport in Hanford sediments.

Laboratory derived kinetics studies of U(VI) desorption from individual mineral fractions can be coupled with tracer studies from field experiments to upscale U(VI) desorption processes and describe U(VI) transport at the field scale.

This approach will be tested in the field at the Hanford 300 Area as part of the ERSP-funded Hanford IFRC project.

Coupling a constraint-based *in silico* model of *Geobacter sulfurreducens* to the reactive transport model HYDROGEOCHEM to describe *in situ* uranium bioremediation

- Mechanistic understanding and prediction of changes in cell growth yield as a function of changes in donor/acceptor availability and nutrient forms (ex. NH$_4$ or N$_2$)
- Expandable to eventually include gene regulatory mechanisms to further describe a and communities
- Approach field tested at the Rifle IFRC site

Treatment of Nitric Acid-, U(VI)-, and Tc(VII)-Contaminated Groundwater in Intermediate-Scale Physical Models of an In Situ Biobarrier

- Stimulated removal of nitrate, U and Tc from acidic ground water in *ex situ* column experiments
- U removal across steep pH gradient dominated by sorption to limestone as a U-phosphate species at the column inlets
- Tc and nitrate removal more dependent on stimulated microbial activity
- Results demonstrate an integrated description of processes hindering contaminant transport from acidic source areas such as the S3 ponds at the Oak Ridge IFRC

Meeting Agenda
(Monday-PM Plenary)

3:35 PM ERSP Strategic Planning Process - David Lesmes, ERSP Program Manager

INTEGRATED FIELD-SCALE SUBSURFACE RESEARCH CHALLENGE (IFRC) PRESENTATIONS - OAK RIDGE

4:00 PM Overview of the Oak Ridge Integrated Field Research Challenge Project and Introduction of Year 3 Research Activities - Philip Jardine, ORNL

4:20 PM Geophysical Quantification of Plume-Scale Flow Architecture and Recharge Processes - Susan Hubbard, LBNL

4:45 PM Bioreduction of Uranium with Slow Release Substrate - Dave Watson, ORNL

5:10 PM Microbial Community Response Parallels Uranium Immobilization and Remobilization during In Situ Field Manipulation - Joel Kostka, FSU

5:35 PM Sequestering Uranium and Technetium through Coprecipitation with Aluminum in ORIFRC Acidic Sediments - Baohua Gu, ORNL

6:00 PM DINNER Dining Room
7:00 PM POSTER SESION I Potomac Room
Thank you

Todd Anderson – Program Manager
  Field Biology/ Microbiology
Paul Bayer – Program Manager
  Environmental Science/EMSL Management
David Lesmes – Program Manager
  Geophysics/Hydrogeology
Roland Hirsch – Program Manager*
  Chemistry, Synchrotron science
Arthur Katz – Program Manager*
  Biomolecular science

Kim Laing – Program Support Specialist
Leslie Runion – Program Secretary

Poster sessions in the Potomac Room