



U. S. Department of Energy Office of Science

## Subsurface Biogeochemical Research

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#### Contractor-Grantee Workshop

April 26 - 28, 2011

JW Marriott

Washington, DC

Time	Title	Room
Monday, April 25, 2011		
5:00 PM – 7:00 PM	Evening Registration	Lobby Level
Tuesday, April 26, 2011		
7:00 AM	Registration	Grand Foyer
WELCOME AND INTRODUCTORY COMMENTS		
8:00 AM	Gary Geernaert, Director, Climate and Environmental Sciences Division	Grand Salons I/II
8:15 AM	SBR Program Update Todd Anderson, DOE Climate and Environmental Sciences Division	Grand Salons I/II
8:45 AM	Changes to the JGI Community Sequencing Program Dan Drell, DOE Biological Systems Science Division	Grand Salons I/II
9:00 AM	Carbon Cycle Research within the Biological Systems Sciences Joe Graber, DOE Biological Systems Science Division	Grand Salons I/II
9:15 AM	Terrestrial Ecosystem Science Mike Kuperberg, DOE Climate and Environmental Sciences Division	Grand Salons I/II
INVITED SPEAKERS		
9:30 AM	Basic Hydrology Challenges in Understanding Hyporheic Exchange at the Stream-Catchment Scale Ken Bencala, U.S. Geological Survey	Grand Salons I/II
10:15AM	BREAK	Grand Foyer
10:45 AM	Modeling Marine Microbial Populations and Biogeochemical Cycles Michael (Mick) Follows, Massachusetts Institute of Technology (MIT)	Grand Salons I/II
11:30 AM	Extrapolating Rates of Critical Zone Processes Across Scales: Successes and Challenges Sue Brantley, Penn State University	Grand Salons I/II
12:15 PM	BUFFET LUNCH (Research Team Meetings)	Capitol Salons DE



Time	Title	Room
<b>BREAKOUT SESSIONS</b>		
<b>2:00 PM</b>	<p><b>Breakout Session A: Contaminant Fate and Transport at the Groundwater-Surface Water Interface</b></p> <p><b>Moderators:</b> Joel E. Kostka, Florida State University and Philippe Van Cappellen, University of Waterloo</p> <p><b>Description of Session:</b> The success of subsurface remediation or monitored natural attenuation strategies, as well as public perception and acceptance of those strategies, will not only depend on what happens in the subsurface but also on whether contaminants are discharged or released to surface waters. Due to the active and complex flow dynamics, the groundwater-surface water interface (GWSWI) exhibits unique geophysical and biogeochemical characteristics, including fluctuating hydraulic gradients, enhanced redox oscillations, and drying-rewetting cycles. The role of this unique and highly dynamic interface on the fate of subsurface contaminants at DOE sites must be further understood in order to develop adequate predictive models that guide remediation and natural attenuation efforts.</p> <p>The GWSWI modulates the release or discharge of nutrients and contaminants to surface waters. Critical hotspots or hot moments in contaminant transformation have been associated with the GWSWI. However, the underlying biogeochemical mechanisms and reaction networks unique to the interface have yet to be completely unraveled. The prediction of discharge and the assessment of risk for contaminant release from the watershed to regional scale are currently limited by our lack of mechanistic understanding of the biogeochemical functioning of the GWSWI. This breakout session will provide a state-of-the-science review of the coupled physical, chemical, and biological processes that control the structure and function of the GWSWI, with a focus on the hyporheic and riparian zones in DOE relevant systems. The goals of the session are to identify key processes that control contaminant transformation, to delineate knowledge gaps, and to highlight research directions that will lead to a more robust predictive understanding of contaminant flux and discharge at the GWSWI. Some of the specific questions that will be addressed during discipline-specific as well as general discussions are listed below.</p> <p><b>A. Groundwater-Surface Water Interactions: Key Questions and Limitations</b></p> <p><b>2:00 PM</b> Roy Haggerty, Oregon State University</p> <p><b>2:30 PM</b> Philippe Van Cappellen, University of Waterloo</p> <p><b>3:00 PM</b> Joel E. Kostka, Florida State University</p> <p><b>B. Groundwater-Surface Water Interactions: Contaminant Transport at DOE Sites</b></p> <p><b>3:30 PM</b> Lee Slater, Rutgers University</p> <p><b>3:50 PM</b> Scott Brooks, Oak Ridge National Laboratory</p> <p><b>4:10 PM</b> General Discussion</p> <p><b>5:00 PM</b> Adjourn</p>	<b>Grand Salons I/II</b>



## BREAKOUT SESSIONS

(Continued)

2:00 PM	<p><b>Breakout Session B: Integrating Microbial Metabolism into Descriptions of Environmental Processes at a Variety of Observational Scales</b></p> <p><b>Moderator:</b> Todd Anderson, Climate and Environmental Sciences Division</p> <p><b>Description of Session:</b> SBR's close association with the Genomic Sciences program, including some overlap of funded scientists and common field sites and materials, provides an opportunity to leverage advances in genome-enabled techniques to advance a more fundamental understanding of the metabolism of microorganisms and detection of the active members of microbial communities in the environment. Historically, research on cellular metabolism has tended to focus on organisms currently in culture, for obvious reasons. In a few cases, detailed metabolic modeling has enabled a translation of metabolic activity investigated in the laboratory to environments where the microorganism under study is found, thereby enabling understanding of that microorganism in its environment. This "bottom-up" approach to understanding microbial communities in the environment, one species at a time, shows some promise for predicting the activity of specific microorganisms in controlled environmental settings, but may be limited in describing the interactions occurring in natural microbial communities. Process-based models of microbial activity, a mainstay of environmental simulations, describe the collective activity of dominant microbial communities, but lack predictive power in explaining environmental impacts on microbial activity. Alternatively, a variety of metagenomic and proteomic techniques take a broader approach to describing the composition and genetic potential of entire microbial communities in the environment. These "top down" techniques have the potential to describe larger scale microbial ecological phenomena, but their broad utility remains constrained. For SBR, it is also unclear how these broader approaches could be integrated with physical/chemical models of environmental processes. This session will highlight approaches to understanding and modeling microbial processes in the environment at a variety of scales. The intent of the session is to engage the audience in a conversation about these approaches and how best to integrate genome-enabled information on microbial activity/ecology into coupled models of environmental processes. A potential outcome of this session would be a series of recommendations that advance a predictive understanding of microbial activity in the environment.</p> <p><b>2:00 PM</b>     <b>Todd Anderson</b>, DOE Climate and Environmental Sciences Division</p> <p><b>2:15 PM</b>     <b>Derek Lovley</b>, University of Massachusetts</p> <p><b>2:45 PM</b>     <b>Eric Roden</b>, University of Wisconsin</p> <p><b>3:15 PM</b>     <b>Lisa Stein</b>, University of Alberta</p> <p><b>3:45 PM</b>     <b>Eoin Brodie</b>, Lawrence Berkeley National Laboratory</p> <p><b>4:15 PM</b>     Open Discussion</p> <p><b>5:00 PM</b>     Adjourn</p>	Capitol Salon F
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**BREAKOUT SESSIONS**

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<p><b>2:00 PM</b></p>	<p><b>Breakout Session C: Pore Scale Processes - Matching Measurements to Models While Upscaling</b>  <b>Moderators:</b> Peter Nico and Jonathon Ajo-Franklin, LBNL  <b>Description of Session:</b> It is taken as a given that precipitation and dissolution processes taking place at the pore scale as a result of remediation or natural perturbations of subsurface systems can have profound impacts on the larger scale behavior of the system. However, both understanding exactly how pore scale processes occur and linking those changes to specific large scale system behavior remains extremely challenging from both an experimental and computational perspective. In this session, we will explore new technological methods and intellectual approaches to image, quantify, and understand pore scale changes while simultaneously evaluating which changes control the evolution of macroscale systems. One of the specific challenges in this process is having both models at the appropriate scale and measurements at a matching scale to inform and validate the models.</p> <p><b>2:00 PM</b>     <b>Li Li</b>, Penn State University, <i>Overview of Modeling Approaches and Challenges to Upscaling</i></p> <p><b>2:20 PM</b>     <b>W. Brent Lindquist</b>, Stony Brook University, <i>Effects of Pore-Structure Change and Multi-scale Heterogeneity on Contaminant Transport and Reaction-Rate Upscaling</i></p> <p><b>2:40 PM</b>     <b>Markus Berli</b>, Desert Research Institute, <i>Tomographic Imaging of Near Root Process</i></p> <p><b>3:00 PM</b>     <b>Bill Moses/Peter Nico</b>, LBNL, <i>Imaging Flow and Heterogeneity Development at Intermediate Scale</i></p> <p><b>3:20 PM</b>     <b>Jon Chorover</b>, University of Arizona, <i>Measuring Field Process Across Scales</i></p> <p><b>3:40 PM</b>     Open Discussion</p> <p><b>5:00 PM</b>     Adjourn</p>	<p>Capitol Salon G</p>
<p><b>5:30 PM</b></p>	<p><b>POSTER SESSION I – Hors d'oeuvres and Refreshments (Cash Bar)</b></p>	<p>Grand Salons III/IV</p>



Time	Title	Room
<b>Wednesday, April 27, 2011</b>		
<b>PLENARY SESSION</b>		
	<b><i>PORE SCALE PROCESSES</i></b>	
8:00 AM	<b>Mechanisms for Stable Isotope Variation during Bioremediation</b> Jenny Druhan, Lawrence Berkeley National Laboratory	Grand Salons I/II
8:30 AM	<b>Current Status of Imaging Microbial Biofilms in Three-Dimensional Opaque Porous Media using X-Ray Microtomography</b> Dorthe Wildenschild, Oregon State University	Grand Salons I/II
9:00 AM	<b>Precipitation Reaction Fronts in Subsurface Environments: Insights from Experiments and Challenges for Modeling and Engineering</b> George Redden, Idaho National Laboratory	Grand Salons I/II
9:30 AM	<b>BREAK</b>	Grand Foyer
10:00 AM	<b>POSTER SESSION II</b>	Grand Salons III/IV
12:30 PM	<b>LUNCH - Box Lunches Provided (Research Team Meetings)</b>	Grand Salons III/IV & Foyer
<b>PLENARY SESSION</b>		
	<b><i>MICROBIOLOGICAL/BIOGEOCHEMICAL PROCESSES</i></b>	
2:00 PM	<b>Biogeochemical Controls on Hg Transformations at a Contaminated Site: The Role of Dissolved Organic Matter and Redox Gradients</b> Carrie Miller, Oak Ridge National Laboratory	Grand Salons I/II
2:30 PM	<b>Microbial Uranium Reduction and Monitoring Tools</b> Frank Loeffler, University of Tennessee	Grand Salons I/II
3:00 PM	<b>Proteogenomic Insights from the Analysis of Biostimulated Microbial Communities</b> Mike Wilkins, Pacific Northwest National Laboratory	Grand Salons I/II
3:30 PM	<b>BREAK</b>	Grand Foyer
	<b><i>MOLECULAR SCALE PROCESSES</i></b>	
4:00 PM	<b>Progress in Understanding Uranium Speciation and Dynamics in Reduced Sediments: Research at Molecular to Centimeter Scales by the SLAC SFA Program</b> John Bargar, SLAC National Accelerator Laboratory	Grand Salons I/II
4:30 PM	<b>Manganese Oxidation in the Subsurface and its Impact on Uranium Immobilization: What Mn Can Do for U</b> Brad Tebo, Oregon Health & Science University	Grand Salons I/II
5:00 PM	<b>Fe<sup>2+</sup> Sorption at the Fe Oxide-Water Interface: A Revised Conceptual Framework</b> Michelle Scherer, University of Iowa	Grand Salons I/II
6:00 PM	<b>POSTER SESSION III – Hors d'oeuvres and Refreshments (Cash Bar)</b>	Grand Salons III/IV





Time	Title	Room
<b>Thursday, April 28, 2011</b>		
<b>PLENARY SESSION</b>		
<b>8:00 AM</b>	<b>Overview/Scope of CESD Programs</b> David Lesmes, Climate and Environmental Sciences Division	Grand Salons I/II
	<i><b>IFRC HIGHLIGHT PRESENTATIONS</b></i>	
<b>8:30 AM</b>	<b>A Geochemical Heterogeneity Model for a Contaminated Vadose Zone-Aquifer System</b> Chris Murray, Pacific Northwest National Laboratory	Grand Salons I/II
<b>9:00 AM</b>	<b>Microbial and Geochemical Dynamics During Bioreduction Stimulated by Emulsified Vegetable Oil</b> Chris Schadt, Oak Ridge National Laboratory	Grand Salons I/II
<b>9:30 AM</b>	<b>Getting a Grip on Subsurface Complexity: Geochemical, Microbiological, and Hydrological Research at the Rifle IFRC</b> Ken Williams, Lawrence Berkeley National Laboratory	Grand Salons I/II
<b>10:00 AM</b>	<b>BREAK</b>	Grand Foyer
<b>10:30 AM</b>	<b>Update on the Status of the ASCEM project (Advanced Simulation Capability for Environmental Management)</b> Ian Gorton, Pacific Northwest National Laboratory	Grand Salons I/II
<b>11:00 AM</b>	<b>Introduction to the Next Generation Ecosystem Experiment (NGEE)</b> Stan Wuschleger, Oak Ridge National Laboratory	Grand Salons I/II
<b>11:30 AM</b>	<b>NGEE Discussion</b>	Grand Salons I/II
<b>12:00 PM</b>	<b>Close-out Final Announcements and Adjourn</b>	Grand Salons I/II