

Program Announcement To DOE National Laboratories LAB 08-30

Environmental Remediation Science Program

The Office of Science (SC), U.S. Department of Energy (DOE), hereby announces interest in receiving proposals from DOE National Laboratories for research on the fate and transport of transuranic contaminants (e.g., Plutonium, Neptunium, Americium) in the environment under the Environmental Remediation Sciences Scientific Focus Area (SFA) within the Office of Biological and Environmental Research (BER). This SFA research program will be part of the Environmental Remediation Sciences Program (ERSP) within the Climate and Environmental Sciences Division (CESD). The focus of the ERSP is on developing a fundamental scientific basis for understanding the fate and transport of contaminants in the subsurface. This task is guided by the **BER long term performance measure** to *"provide sufficient scientific understanding such that DOE sites would be able to incorporate physical, chemical and biological processes into decision making for environmental remediation and long-term stewardship."* To meet this measure, BER funds basic research to investigate the key processes affecting the mobility of subsurface contaminants found at DOE sites. The goal of this solicitation is to support innovative, fundamental research investigating the coupled physical, chemical, and biological processes affecting the subsurface transport of **transuranic contaminants** at DOE sites. Proposals should identify key knowledge gaps and propose hypothesis-driven research to better understand the significant physical, chemical, and biological processes influencing the form and mobility of transuranic contaminants in the subsurface. Research projects should aim to provide the scientific basis for the long term stewardship of contaminated sites across the DOE complex and when possible the development of new remediation concepts or strategies. **Proposals should address the applicability of the proposed research to understanding DOE relevant, field-scale, contaminant transport processes.** The environment of interest is the terrestrial subsurface including the vadose zone, the saturated zone and key groundwater-surface water interfaces. The contaminants of interest are all transuranic elements including Pu, Np and Am.

It is anticipated that up to **\$1,200,000/year will be available to establish an SFA research program at a DOE National Laboratory** starting in mid-Fiscal Year 2009, contingent on the availability of appropriated funds. Collaborations with other National Laboratory, university and/or private sector investigators are encouraged as needed and are to be funded as subcontracts through the lead National Laboratory. Researchers will be required to submit a brief (eight pages) Program Plan outlining the proposed SFA research program. Upon acceptance of a Program Plan by BER, the National Laboratory submitting it will then be invited to prepare and submit a detailed SFA Science Plan for external peer review. The narrative of the five-year SFA Science Plan is limited to 40 pages. Additional details regarding Program Plan and Science Plan preparations can be found below.

Science Needs and Relevance to DOE Mission

Transuranic contaminants exist in many different chemical forms, with a wide variety of co-contaminants, across the DOE complex. Furthermore, site specific factors such as the hydrogeologic setting can have a significant impact on the physical, chemical and biological processes that control the mobility and transport of transuranic contaminants in subsurface environments. For example, colloid-facilitated transport of Pu has been identified as a critical issue at several sites in the western U.S. (e.g., Kersting et al, 1999; Clark et al, 2006; Department of Energy, 2007). Microbial processes are another potentially important factor controlling the redox chemistry of transuranic species in the subsurface. The ERSP seeks to fund an SFA research program that identifies key science challenges that can be addressed through fundamental research and that will have an impact on understanding the mobility and transport of transuranic contaminants at relevant DOE sites. While the SFA is not required to include a field component, a laboratory-based program should be tied to DOE-relevant field situations.

To summarize, researchers will need to identify critical gaps in scientific knowledge that limit our ability to understand, predict and control the mobility of transuranic contaminants in relevant subsurface environments. A key consideration in the evaluation of the SFA Science Plans will be the applicability of the proposed research to the BER long-term performance measure. **SFA Science Plans submitted in response to this Notice must explicitly state in the Executive Summary how the proposed research will support the accomplishment of the BER Long Term Performance Measure "to provide sufficient scientific understanding such that DOE sites would be able to incorporate physical, chemical and biological processes into decision making for environmental remediation and long-term stewardship."** The SFA Science Plan should leverage the capabilities of the laboratory staff, facilities (including relevant DOE user facilities) and field sites (if applicable). For National Laboratories that have previously established SFA research programs, BER Program Managers will evaluate how the proposed research on the fate and transport of transuranic contaminants complements the existing ERSP research program.

SCIENTIFIC FOCUS AREA (SFA) PROGRAM PLANS

Due Date: October 16, 2008, 4:30 pm, Eastern Time.

Researchers are **required** to submit an SFA Program Plan (see below), referencing Program Solicitation LAB 08-30 for receipt by DOE by 4:30 p.m., Eastern Time October 16, 2008. The SFA Program Plan should be sent as a single PDF file attachment via email to: Kim.Laing@science.doe.gov. **The subject line of the email must state: "SFA Program Plan LAB 08-30"**. A reply will be sent within two business days acknowledging receipt of the SFA Program Plan.

SFA Program Plans

The purpose of an SFA Program Plan is to outline a five year vision for a BER SFA program at a National Laboratory. A Program Plan should outline the SFA being addressed, the overall research objective(s), the approach to accomplishing the research objectives, the key personnel involved, and an organizational and management structure for the proposed SFA program at a National Laboratory. The Program Plan should be a broad but concise view of the proposed

research program and may not be more than eight pages in length. Program Plans are a high-level overview of a larger, more detailed Science Plan (see below) that may be submitted subsequently.

If a Laboratory's Program Plan is judged by ERSP program managers to be responsive to the solicitation and aligned with ERSP's strategic goals (http://www.science.doe.gov/ober/ERSD_top.html), then the National Laboratory will be invited to submit a longer and more detailed Science Plan that will describe the research proposed to be performed over the next five years. These Science Plans will be reviewed by an external panel of experts.

Program Plans should include the following elements:

1. Title, National Laboratory, Laboratory Research Manager and Technical Co-Manager (if applicable).
2. Overall research objectives and hypotheses.
3. Overall approach to accomplishing the research objectives and investigating the hypotheses, including proposed program milestones over the next five years.
4. Key lead personnel involved in the SFA program.
5. Organizational structure for the SFA program.
6. Proposed management plan to ensure program integration and coordination.

Program Plans are essentially white papers describing the overall elements of a proposed SFA research program. Additional information on SFA Program Plan development can be found at <http://www.sc.doe.gov/ober/labreview.html> in the document entitled "Managing BER Scientific Focus Area (SFA) Programs At the DOE National Laboratories"

SCIENTIFIC FOCUS AREA (SFA) SCIENCE PLANS

Due Date: January 30, 2009, 4:30 pm, Eastern Time.

The SFA Science Plans (see below) should be sent individually as a single PDF file attachment via email to: Kim.Laing@science.doe.gov for receipt by DOE by 4:30 p.m., Eastern Time January 30, 2009. **The subject line of the email must state: "SFA Science Plan LAB 08-30"**. A reply will be sent within two business days acknowledging receipt of the SFA Program Plan.

SFA Science Plans

The purpose of an SFA Science Plan is to provide a five-year vision of the National Laboratory's strategic direction for its research program. **The SFA process requires each Laboratory to**

take advantage of the Laboratory's unique expertise and capabilities in ways that advance fundamental science and address the BER/ERSP long-term performance measure.

The Science Plan should:

- describe the SFA program research objectives, and indicate clearly how these objectives are designed to meet ERSP long-term performance measure,
- define and describe the ERSP mission-relevant problem(s) that is (are) being addressed under the research objectives and identify critical knowledge gaps,
- propose specific, formal hypotheses (science questions) and approaches to resolve the knowledge gaps identified above,
- describe datasets, as appropriate, to be utilized to test hypotheses,
- emphasize, build on, and extend the Laboratory's distinguishing capabilities relevant to the SFA,
- emphasize and encourage interdisciplinary science, and
- achieve synergy through collaboration (e.g., involve specialized expertise from universities, institutes, industry, and other National Laboratories; and employ unique DOE facilities and capabilities).

Additionally, each SFA Science Plan should have clear long-term objective(s) with demonstrable annual milestones for the program over a five-year period. Progress toward the objective(s) should be tracked by the annual milestones. Key lead personnel will be required to attend the annual ERSP PI meeting.

Additional information on SFA Science Plan development can be found at <http://www.sc.doe.gov/ober/labreview.html> in the document entitled "Managing BER Scientific Focus Area (SFA) Programs At the DOE National Laboratories"

Review of Science Plans

Science Plans prepared by National Laboratories that are submitted to BER will be reviewed by an external panel of experts. The criteria used by panelists to evaluate submitted Science Plans can be found at <http://www.sc.doe.gov/ober/labreview.html> in the document entitled "Managing BER Scientific Focus Area (SFA) Programs At the DOE National Laboratories"

SFA Reporting and Review

Once a National Laboratory's Science Plan has been accepted and implemented, the National Laboratory will begin a process of routine annual reporting, as well as triennial review by BER. The processes for the annual reporting and triennial reviews of SFA programs at the National

Laboratories can be found at <http://www.sc.doe.gov/ober/labreview.html> in the document entitled "Managing BER Scientific Focus Area (SFA) Programs At the DOE National Laboratories"

FOR FURTHER INFORMATION CONTACT:

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ADDITIONAL INFORMATION:

BER funds basic research on subsurface contaminant transport and remediation, ranging from molecular to field-scale processes, via a unique set of National Laboratory and university-led research programs, field research sites, and user facilities. An overview of these current programs can be found at the ERSP website: <http://www.lbl.gov/ERSP/index.html>. The ERSP intends to support in FY 2009 the following Environmental Remediation Sciences SFA research programs at the following National Laboratories:

- 1. *Role of Microenvironments and Transition Zones in Subsurface Reactive Contaminant Transport***, Pacific Northwest National Laboratory (PNNL)
- 2. *Sustainable Systems SFA***, Lawrence Berkeley National Laboratory (LBNL)
- 3. *Geochemical and Molecular Mechanisms Controlling Contaminant Transformation in the Environment***, Oak Ridge National Laboratory (ORNL)
- 4. *Subsurface Immobilization of Metal Contaminants by Amendment-Driven Mineral Precipitation***, Idaho National Laboratory (INL)
- 5. *Argonne Subsurface Science SFA***, Argonne National Laboratory (ANL)
- 6. *SSRL Environmental Remediation Science Program***, Stanford Linear Accelerator Center (SLAC)

These research programs primarily focus on the fate and transport of non-transuranic contaminants in subsurface environments. The PNNL and SLAC SFA research programs currently have minor research efforts focused on Pu transport in the environment.

In FY 2007, ERSP initiated three large multidisciplinary Integrated Field-Scale Subsurface Research Challenge (IFC) sites at the following locations: Oak Ridge, TN (<http://www.esd.ornl.gov/orifrc/index.html>); Old Rifle, CO (<http://ifcrifle.pnl.gov/>); and Hanford, WA (<http://ifchanford.pnl.gov/>). At the IFC research sites scientists can conduct field-scale research and obtain DOE-relevant samples of soils, sediments, and ground waters for laboratory research. These sites are an important component of ERSP-funded research enabling the testing of laboratory-derived hypotheses under natural conditions at the field scale. However, the research at these sites is primarily focused on the fate and transport of uranium and non-transuranic co-contaminants.

Programmatic resources also include the Environmental Molecular Science Laboratory (EMSL) at the Pacific Northwest National Laboratory (<http://www.emsl.pnl.gov/emslweb>). EMSL is sponsored by BER as a DOE Scientific User Facility for molecular-level environmental science research using EMSL's integrated experimental and high performance computing capabilities.

Experimental capabilities are available in kinetics and reactions (<http://www.emsl.pnl.gov/capabilities/kinetics/>), microscopy (<http://www.emsl.pnl.gov/capabilities/microscopy/>), spectroscopy and diffraction (<http://www.emsl.pnl.gov/capabilities/spectroscopy/>), and subsurface flow and transport (<http://www.emsl.pnl.gov/capabilities/subsurface/>); however, experiments with samples containing transuranics must be volumetrically controlled or sealed source samples. Supercomputing capabilities (<http://www.emsl.pnl.gov/capabilities/computing/>) include a 2,310 node Linux cluster system. The EMSL's supercomputer is available for computational research in the physical, chemical and biological sciences, including geochemistry, groundwater flow and transport simulations, molecular thermodynamics and kinetics, heavy element chemistry, geochemistry, and surface chemistry. Remote and on-site access to the system and associated software, and visualization and data storage capabilities are available through a separate application and external peer review process.

REFERENCES

Clark, D. L., D. R. Janecky, and L.J. Lane, 2006. Science-based Cleanup of Rocky Flats." *Physics Today* **59**, 34-40.

Davis, J.A.; S.B. Yabusaki; C.I. Steefel; J.M. Zachara; G.P. Curtis; G.D. Redden; L.J. Criscenti; B.D. Honeyman 2004. Assessing Conceptual Models for Subsurface Reactive Transport of Inorganic Contaminants *EOS* 85, 449-455.
http://www.iscmem.org/Documents/Publication_Davis2004Eos.pdf).

Department of Energy, 2001. A Report to Congress on Long-Term Stewardship. Office of Environmental Management. Washington, DC.
http://www.lm.doe.gov/documents/3_pro_doc/lts_study/rpt_to_congress_vol_I.pdf

Department of Energy, 2007. Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems. DOE Office of Science, Basic Energy Sciences, Washington, DC, 186p. (http://www.sc.doe.gov/bes/reports/files/GEO_rpt.pdf)

Kersting, A. B., D. W. Efurud, D. L. Finnegan, D. J. Rokcop, D. K. Smith, and J. L. Thompson, 1999. Migration of Plutonium in Ground Water at the Nevada Test Site. *Nature* 397, 56-59.

National Research Council, 2000. Research Needs in Subsurface Science, U.S. Department of Energy's Environmental Management Science Program. National Academy Press, Washington, DC. <http://www.nap.edu/browse.html>

Riley, R. G. and J. M. Zachara, 1992. Chemical Contaminants on DOE Lands and Selection of Contaminant Mixtures for Subsurface Science Research. Department of Energy Report DOE/ER-0547-T. Office of Energy Research, Subsurface Science Program.